ISSN 2521-3113 (Online)
ISSN 1024-8714 (Print)

BMDC RECOGNIZED

BANGLADESH HEART JOURNAL

VOL. 39 NO. 2 JULY 2024

CONTENTS

Official Journal of
Bangladesh Cardiac Society

BANGLADESH HEART JOURNAL

Vol. 39, No. 2, July 2024

Published by :
Prof. M.G. Azam
Publicity Secretary
Bangladesh Cardiac Society
Karukaj Hashim Heritage (1st Floor)
21/8, Khiljee Road, Block-B, Mohammadpur
Dhaka-1207, Bangladesh
Tel: 01799925522 (Office)
E-mail: bcs@bol-online.com
Website: www.banglacardio.org

Printed by :
Asian Colour Printing
130, DIT Extension Road
Fakirerpool, Dhaka-1000
Mobile: 01835180135
E-mail: asianclr@gmail.com

BANGLADESH CARDIAC SOCIETY বাংলাদেশ কার্ডিয়াক সোসাইটি

Executive Committee 2019 - 2021

President	:	Prof. AKM Mohibullah MD, FRCP, FACC, FESC, FJCS
Vice-President	:	Prof. Mir Jamal Uddin MD, FACC, FRCP Prof. Abdul Wadud Chowdhury FCPS, MD Prof. HI Lutfur Rahman Khan MD Prof. AKM. Fazlur Rahman MD, FACC, FRCP Prof. Abu Azam FRCPE, FESC, FACC Prof. Sajal Krishna Banerjee MD, FRCP, FACC, FESC
Treasurer	:	Prof. Md. Mamunur Rashid MD, FSCAI, AFACC
Secretary General	:	Prof. Abdullah A. Shafi Majumder MD, FACC, FRCPE, FESC
Joint Secretary	:	Dr. Kajal Kumar Karmokar D-Card, FSCAI, Ph.D Prof. Md. Mahbubur Rahman D-Card, Ph.D
Organising Secretary	:	Dr. Bijoy Dutta MD, FSCAI Prof. S.M. Mostafa Kamal D-Card, FACC *(Deceased)* Dr. Md. Towhiduz Zaman MD, FACC, FSCAI Dr. S.M. Habibullah Selim D-Card, MD Dr. Quazi Abul Azad MS Dr. S.M. Quamrul Huq MD
Publicity Secretary	:	Prof. M.G. Azam MD, FSCAI
Scientific Secretary	:	Prof. Mohsin Ahmed MD, FACC, FESC, FSCAI
Social & Cultural Secretary	:	Dr. Nur Alam MD, FSCAI
Office Secretary	:	Dr. Md. Zillur Rahman MD, FACC
Secretary International Affairs	:	Dr. Suman Nazmul Hosain MS
Members	:	Prof. Afzalur Rahman MD, Ph.D, FRCP, FACC Prof. Amal Kumar Choudhury MD, FACC, FESC, FSCAI Prof. Nawazesh Farid D-Card Prof. Mohd. Zahid Hussain FCPS Prof. Muhammad Shahabuddin MD Dr. Md. Shamsul Alam D-Card, FSCAI *(Deceased)* Prof. Liakat Hossain Tapan, D-Card, MSc. Dr. Abu Mohammed Shafique, MD Dr. Mohammad Arifur Rahman, MD

Correspondence: Bangladesh Cardiac Society, Karukaj Hashim Heritage (1st Floor)
21/8, Khiljee Road, Block-B, Mohammadpur, Dhaka-1207, Bangladesh
Tel: 01799925522 (Office), E-mail: bcs@bol-online.com, Website: www.banglacardio.org

INSTRUCTION TO AUTHORS

A. Introduction

Bangladesh Heart Journal is the official journal of Bangladesh Cardiac Society, and accepts articles for publication from home and abroad. This is a biannual, peer-reviewed journal and aims to publish work of the highest quality from all sub-specialties of cardiology and cardiovascular surgery. The aim of the publication is to promote research in Bangladesh and serve as platform for dissemination of scientific information in cardiology.

B. Categories of Articles

The journal accepts original research, review articles, case reports, cardiovascular images and letters to the editor, for publication.

Original Research:

Original, in-depth research article that represents new and significant contributions to medical science. Each manuscript should be accompanied by a structured abstract of up to 250 words using the following headings: Objective, Methods, Results, and Conclusions. Three to 5 keywords to facilitate indexing should be provided in alphabetical order below the abstract. The text should be arranged in sections on INTRODUCTION, METHODS, RESULTS and DISCUSSION. The typical text length for such contributions is up to 3000 words (including title page, abstract, tables, figures, acknowledgments and key messages). Numberof references should be limited to 50.

Review Articles:

Generally review articles are by invitation only. But unsolicited reviews will be considered for publication on merit basis. Following types of articles can be submitted under this category: Newer drugs, new technologies and review of a current concept.The manuscript should not exceed 5000 words (including tables and figures). A review article should include an abstract of up to 250 words describing the need and purpose of review,methods used for locating, selecting, extracting and synthesizing data, and main conclusions. The number of references should be limited to 50.

Case Reports:

Only case reports of exceptional quality will be published in the case report format. The text should not exceed 1500 words and is arranged as introduction, case report and discussion. Include a brief abstract of about 150 words. Number of tables/figures should be limited to 3. Include up to 10 most recent references. The patient's written consent, or that of the legal guardian, to publication must be obtained.

Cardiovascular Images:

Only clinical photographs with or without accompanying skiagrams, pathological images, echocardiographic images, angiographic images etc. are considered for publication. Image should clearly identify the condition and have the classical characteristics of the clinical condition. Clinical photographs of condition which are very common, where diagnosis is obvious, or where diagnosis is not at all possible on images alone would not be considered. Photographs should be of high quality, usually 127 × 173 mm (5 × 7 in) but no larger than 203 × 254 mm (8 × 10 in). A short text of up to 250 words depicting the condition is needed. Figures should be placed exactly at a logical place in the manuscript. The submitted images should be of high resolution (>300 dpi). The following file types are acceptable: JEPG and TIFF. The number of authors should not exceed 3. The authors should ensure that images of similar nature have not been published earlier. Authors must obtain signed informed consent from the patient, or the legal guardian.

Letter to the Editor:

Letters commenting upon recent articles in Bangladesh Heart Journal are welcome.Such letters should be received within 16 weeks of the article's publication. Letters should be up to 250 words; should contain no more than 1 figure/table and upto 5 most recent references. The text need not be divided into sections. The number of authors should not exceed 3.

C. Criteria for Acceptance

All manuscripts should meet the following criteria: the material is original, study methods areappropriate, data are sound, conclusions are reasonable and supported by the data, and the information is important; the topic has general cardiology interest; and that the article is written in reasonably good English. Manuscripts which do not follow the guidelines of Bangladesh Heart Journal are likely to be sent back to authors without initiating the peer-review process. All accepted manuscripts are subject to editorial modifications to suit the language and style of Bangladesh Heart Journal and suggestions may be made to the authors by the Editorial Board to improve the scientific value of the journal.

D. Editorial Process

The Bangladesh Heart Journal commits to high ethical and scientific standards. Submitted manuscripts are considered with the understanding that they have not been published previously in print or electronic format

(except in abstract or poster form) and are not under consideration by another publication or electronic medium. Statements and opinions expressed in the articles published in the Journal are those of the authors and not necessarily of the Editor. Neither the Editor nor the Publisher guarantees, warrants, or endorses any product or service advertised in the Journal. Bangladesh Heart Journal follows the guidelines on editorial independence produced by the International Committee of Medical Journal Editors (ICMJE). All manuscripts correctly submitted to the Bangladesh Heart Journal are first reviewed by the Editors. Manuscripts are evaluated according to their scientific merit, originality, validity of the material presented and readability. Some manuscripts are returned back to the authors at this stage if the paper is deemed inappropriate for publication in the Bangladesh Heart Journal, if the paper does not meet the submission requirements, or if the paper is not deemed to have a sufficiently high priority. All papers considered suitable by the Editors for progress further in the review process, undergo peer review by at least two reviewers. If there is any gross discrepancy between the comments of two reviewers, it is sent to a third reviewer. Peer reviewers' identities are kept confidential; authors' identities are also not disclosed to the reviewers. Accepted articles are edited, without altering the meaning, to improve clarity and understanding. Decision about provisional or final acceptance is communicated within 8 weeks.

E. Cover Letter

The cover letter should outline the importance and uniqueness of the work. It should include the signed declaration from all authors on:

1. Category of manuscript (original research, review article, case report, cardiovascular image, letter to the Editor)
2. Statement that the material has not been previously published or submitted elsewhere for publication (this restriction does not apply to abstracts published in connection with scientific meetings.)
3. Transfer of copyright to the Bangladesh Heart Journal upon the acceptance of the manuscript for publication
4. All authors have reviewed the article and agree with its contents
5. Information of any conflicts of interest (of any) of the authors.
6. Sources of research support, if any, including funding, equipment, and drugs.

The cover letter should also include the mailing address, telephone and fax numbers, and e-mail address of the corresponding author.

F. Manuscript Preparation

The manuscripts should comply with the prescribed guidelines. It should be well organized and written in simple and correct English under appropriate headings. The abbreviations and acronyms should be spelled out when they occur first time.

The Introduction should address the subject of the paper. The Methods section should describe in adequate detail the laboratory or study methods followed and state the statistical procedures employed in the research. This section should also identify the ethical guidelines followed by the investigators with regard to the population, patient samples or animal specimens used. A statement should be made, where applicable, that their study conforms to widely accepted ethical principles guiding human research (such as the Declaration of Helsinki) AND also that their study has been approved by a local ethics committee.The Results section should be concise and include pertinent findings and necessary tables and figures.The Discussion should contain conclusions based on the major findings of the study, a review of the relevant literature, clinical application of the conclusions and future research implications. Following the Discussion, Acknowledgements of important contributors and funding agencies may be given.

a. Title page information

- Title. Concise and informative. Titles are often used in information-retrieval systems. Avoid abbreviations where possible.
- Author names and affiliations. Please clearly indicate the given name(s) and family name(s) of each author and check that all names are accurately spelled. Present the authors' affiliation addresses (where the actual work was done) below the names. Indicate all affiliations with a lower case superscript letter immediately after the author's name and in front of the appropriate address. Provide the e-mail address of each author.
- Corresponding author. Clearly indicate who will handle correspondence at all stages of refereeing and publication, also post-publication. Ensure that the e-mail address is given and that contact details are kept up to date by the corresponding author.

b. Abstract

A concise and factual abstract is required. The abstract should state briefly the purpose of the research, the principal results and major conclusions. An abstract is often presented separately from the article, so it must be able to stand alone. References should be avoided. Also, non-standard or uncommon abbreviations should be

avoided, but if essential they must be defined at their first mention in the abstract itself.

c. Keywords

Immediately after the abstract, provide a maximum of 5 keywords. Keywords should be the listed terms in the Medical Subject's Headings (MeSH) of the National Library of Medicine (NLM), available at https://www.nlm.nih.gov/mesh.

d. Abbreviations

Define abbreviations that are not standard in this field in a footnote to be placed on the first page of the article. Such abbreviations that are unavoidable in the abstract must be defined at their first mention there, as well as in the footnote. Ensure consistency of abbreviations throughout the article.

e. Acknowledgements

Collate acknowledgements in a separate section at the end of the article before the references. List here those individuals who provided help during the research (e.g., providing language help, writing assistance or proof reading the article, etc.).

f. Units

Follow internationally accepted rules and conventions: use the international system of units (SI). If other units are mentioned, please give their equivalent in SI. Generic rather than trade names of drugs should be used.

g. Figures and graphics

- For graphics, a digital picture of 300 dpi or higher resolution in JPEG or TIFF format should be submitted.
- Figures should be numbered consecutively according to the order in which they have been first cited in the text, if there is more than 1 figure. Each figure should be cited in the text.
- Each figure/illustration should be provided with a suitable legend that includes enough information to permit its interpretation without reference to the text.
- All photomicrographs should indicate the magnification of the prints.
- When symbols, arrows, numbers or letters are used to identify parts of the illustrations, each one should be explained clearly in the legend.

h. Tables

Tables should be placed next to the relevant text in the article.

- Number tables consecutively in accordance with their appearance in the text. Each table should be cited in the text in Arabic numerals.
- Titles should be brief and a short or abbreviated heading for each column should be given.
- Explanatory matter should be placed in footnotes and not in the heading.
- Abbreviations in each table should be explained in footnotes.
- The data presented in a table should not be repeated in the text or figure.

i. References

References should follow the standards summarized in the NLM's International Committee of Medical Journal Editors (ICMJE) Recommendations for the Conduct, Reporting, Editing and Publication of Scholarly Work in Medical Journals (ICMJE recommendations), available at: http://www.icmje.org/recommendations/. The titles of journals should be abbreviated according to the style used for MEDLINE (www.ncbi.nlm.nih.gov/nlmcatalog/journals). Journals that are not indexed should be written in full.

- References should be numbered consecutively in the order in which they are first mentioned in the text.
- References in text, tables and legends should be identified by superscript Arabic numerals at the end of the sentence outside any punctuation. If several different studies or papers are cited within one sentence, the number should be placed where it will accurately identify the correct study.
- The names of authors in the text should concur with the reference list.
- References cited only in tables or in legends to figures should be numbered in accordance with a sequence established by the first identification in the text of the particular table or illustration.
- Abstracts as references may be used; "unpublished observations" and "personal communications" may not be used as references, although references to written, not oral, communications may be inserted (in parentheses) in the text.
- Papers accepted but not yet published may be included as references by adding "In press" after the journal name. Information from manuscripts submitted but not yet accepted should be cited in the text as "unpublished observations" (in parentheses).
- In general: All authors/editors should be listed unless the number exceeds six, when you should give six followed by "et al."

Examples of correct forms of references are given below:

Articles in Journals (see also *Journal article on the Internet*)

1. *Standard journal article*

List the first six authors followed by et al.

Halpern SD, Ubel PA, Caplan AL. Solid-organ transplantation in HIV-infected patients. N Engl J Med. 2002 Jul 25;347(4):284-7.

More than six authors:

Rose ME, Huerbin MB, Melick J, Marion DW, Palmer AM, Schiding JK, et al. Regulation of interstitial excitatory amino acid concentrations after cortical contusion injury. Brain Res. 2002;935(1-2):40-6.

2. *Organization as author*

Diabetes Prevention Program Research Group. Hypertension, insulin, and proinsulin in participants with impaired glucose tolerance.Hypertension. 2002;40(5): 679-86.

3. *Both personal authors and organization as author* (List all as they appear in the byline.)

Vallancien G, Emberton M, Harving N, van Moorselaar RJ; Alf-One Study Group. Sexual dysfunction in 1,274 European men suffering from lower urinary tract symptoms. J Urol. 2003;169(6):2257-61.

4. *Volume with supplement*

Geraud G, Spierings EL, Keywood C. Tolerability and safety of frovatriptan with short- and long-term use for treatment of migraine and in comparison with sumatriptan. Headache. 2002;42Suppl 2:S93-9.

5. *Issue with supplement*

Glauser TA. Integrating clinical trial data into clinical practice.Neurology. 2002;58(12 Suppl 7):S6-12.

6. *Type of article indicated as needed*

Tor M, Turker H. International approaches to the prescription of long-term oxygen therapy [letter]. Eur Respir J. 2002;20(1):242.

Lofwall MR, Strain EC, Brooner RK, Kindbom KA, Bigelow GE. Characteristics of older methadone maintenance (MM) patients [abstract]. Drug Alcohol Depend. 2002;66Suppl 1:S105.

7. *Article published electronically ahead of the print version*

Yu WM, Hawley TS, Hawley RG, Qu CK. Immortalization of yolk sac-derived precursor cells. Blood. 2002 Nov 15;100(10):3828-31. Epub 2002 Jul 5.

Books and Other Monographs

1. *Personal author(s)*

Murray PR, Rosenthal KS, Kobayashi GS, Pfaller MA. Medical microbiology. 4th ed. St. Louis: Mosby; 2002.

2. *Editor(s), compiler(s) as author*

Gilstrap LC 3rd, Cunningham FG, VanDorsten JP, editors. Operative obstetrics. 2nd ed. New York: McGraw-Hill; 2002.

3. *Organization(s) as author*

Advanced Life Support Group. Acute medical emergencies: the practical approach. London: BMJ Books; 2001. 454 p.

4. *Chapter in a book*

Meltzer PS, Kallioniemi A, Trent JM. Chromosome alterations in human solid tumors. In: Vogelstein B, Kinzler KW, editors. The genetic basis of human cancer. New York: McGraw-Hill; 2002. p. 93-113.

5. *Conference proceedings*

Harnden P, Joffe JK, Jones WG, editors.Germ cell tumours V. Proceedings of the 5th Germ Cell Tumour Conference; 2001 Sep 13-15; Leeds, UK. New York: Springer; 2002.

6. *Dissertation or thesis*

Borkowski MM. Infant sleep and feeding: a telephone survey of Hispanic Americans [dissertation]. Mount Pleasant (MI): Central Michigan University; 2002.

Other Published Material

Newspaper article

Tynan T. Medical improvements lower homicide rate: study sees drop in assault rate. The Washington Post. 2002 Aug 12;Sect. A:2 (col. 4).

Unpublished Material

In press or Forthcoming

Tian D, Araki H, Stahl E, Bergelson J, Kreitman M. Signature of balancing selection in Arabidopsis. ProcNatlAcadSci U S A. Forthcoming 2002.

Electronic Material

1. *Journal article on the Internet*

Abood S. Quality improvement initiative in nursing homes: the ANA acts in an advisory role. Am J Nurs. 2002 Jun [cited 2002 Aug 12];102(6):[about 1 p.]. Available from: http://www.nursingworld.org/AJN/2002/june/Wawatch.htm Article

Article published electronically ahead of the print version:

Yu WM, Hawley TS, Hawley RG, Qu CK. Immortalization of yolk sac-derived precursor cells.Blood. 2002 Nov 15;100(10):3828-31. Epub 2002 Jul 5.

Article with document number in place of traditional pagination:

Williams JS, Brown SM, Conlin PR. Videos in clinical medicine.Blood-pressure measurement. N Engl J Med. 2009 Jan 29;360(5):e6. PubMed PMID: 19179309.

Article with a Digital Object Identifier (DOI):

Zhang M, Holman CD, Price SD, Sanfilippo FM, Preen DB, Bulsara MK. Comorbidity and repeat admission to hospital for adverse drug reactions in older adults: retrospective cohort study. BMJ. 2009 Jan 7;338:a2752. doi: 10.1136/bmj.a2752. PubMed PMID: 19129307; PubMed Central PMCID: PMC2615549.

2. *Monograph on the Internet*

Foley KM, Gelband H, editors. Improving palliative care for cancer [Internet]. Washington: National Academy Press; 2001 [cited 2002 Jul 9]. Available from: http://www.nap.edu/books/0309074029/html/.

3. *Homepage/Web site*

Cancer-Pain.org [Internet]. New York: Association of Cancer Online Resources, Inc.; c2000-01 [updated 2002 May 16; cited 2002 Jul 9]. Available from: http://www.cancer-pain.org/.

G. Submission Preparation Checklist

As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.

1. The submission has not been previously published elsewhere, is original and has been written by the stated authors.
2. The article is not currently being considered for publication by any other journal and will not be submitted for such review while under review by the Bangladesh Heart Journal.
3. The submission file is in Microsoft Word file format, and the figures are in JEPG or TIFF format.
4. The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end.
5. The text adheres to the stylistic and bibliographic requirements outlined in the Instruction to Authors. Make sure that the references have been written according to the ICMJE Recommendations Style.
6. Spell and grammar checks have been performed.
7. All authors have read the manuscript and agree to publish it.

H. Submission

Papers should be submitted to the Editor. Three copies of manuscript should be submitted duly signed by all authors with a copy of CD, to:

Prof. Hl Lutfur Rahman Khan

The Editor, Bangladesh Heart Journal
Professor of Cardiology
Room No. 458, Block B, Anwer Khan Medical College
House No. 17, Road No 8, Dhanmondi, Dhaka 1205
Bangladesh.

Papers can also be submitted via the email using the following address:

Email: bangladeshheartj@yahoo.com

Original Article

Frequency & Predictors of Depression in Patients of Chronic Heart Failure with Reduced Ejection Fraction (HFrEF)

A.B.M. Shafiuzzaman[1], Abdul Wadud Chowdhury[2], Md. Gaffar Amin[3], Kazi Nazrul Islam[3], ATM Mahfuzul Hoque[4], Isha Abdullah Ali[5], Basudev Kumar Kashyapi[6]

Abstract:

Background: Clinically significant depression is estimated to occur in a significant portion of chronic heart failure (CHF) patients and increases sharply with increase in heart failure severity. However, the frequency and predictors of depression in this group of patients are underreported. This study was designed to assess frequency & predictors of depression in patients of chronic heart failure with reduced ejection fraction (HFrEF).

Methods: This cross-sectional analytical study was performed in the department of Cardiology, Dhaka Medical College Hospital, Dhaka, during the period from October'2018 to Septemeber'2019. One hundred and fifty-two CHF patients with reduced ejection fraction (<40%) either admitted in the department of Cardiology or attended Cardiology OPD, Dhaka Medical College Hospital (DMCH), Dhaka who fulfilled the selection criteria were included into the study. A translated and validated Patient Health Questionnaire (PHQ-9) in Bengali was used to assess depression level in CHF patients in this study. Informed written consent was taken from each patient. Approval for the study was taken from Ethical Review Committee (ERC) of Dhaka Medical College before commencement of the study. After compiling data from all participants, statistical analyses were performed using the Statistical Package for Social Science (SPSS), version 22.0 for windows.

Results: Mean age of the patients was 58.68±9.40 years, ranging from 36 to 75 years. Male predominance was noted (72% vs 28%). Overall, frequency of depression was 56%. Among the depressed patients (n=85), majority (40%) had minimal depression while 27%, 19% and 14% had mild, moderate and severe depression. respectively. Among the different risk factors, DM and sedentary lifestyle were significantly associated with depression (p<0.05). Age >65 years, sedentary lifestyle and H/O past MI were independently associated with depression among chronic HErEF patients. Widowed patients, diabetes, hospital readmission in last 2 months before study inclusion and NYHA class III/IV were also significantly associated with depression among patients with chronic HFrEF (p<0.05).

Conclusion: More than half of the patients with chronic HFrEF had concurrent depression of varied severity. Proper care of depression along with HF may improve the survival and quality of life of these patients.

Keywords: *Depression, heart failure*

(Bangladesh Heart Journal 2024; 39(2): 74-84)

1. Junior Consultant (Cardiology), Bangabhaban Dispensary, President Office, Dhaka, Bangladesh.
2. Professor & Head of the Department, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
3. Associate Professor, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
4. Assistant Professor, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
5. Registrar and Specialist, Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka, Bangladesh.
6. Medical Officer, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.

Address of Correspondence: Dr A.B.M. Shafiuzzaman, Junior Consultant (Cardiology), Bangabhaban Dispensary, President Office, Dhaka, Bangladesh. Mobile: +8801717017368, E-mail: drshafidoc@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75692

Introduction:

Chronic Heart failure (CHF) is a prevalent debilitating disease of poor prognosis in which heart cannot fill with or eject the sufficient amount of blood that is required due to structural or functional cardiac disorder.[1] Heart failure prevails now in the form of a pandemic across the world and a serious threat to the heath and financial wellbeing of the people. It is a major cause of hospitalization, morbidity, and mortality that affects >23 million people worldwide.[2,3,4] It affects approximately 6% of people aged between 60 and 86 years. Personal, economic and health care burden of heart failure is expected to increase more in the future as life expectancy of people increases, placing further pressure on the finite health care resource.[4]

Bangladesh is passing through an epidemiological transition. Following the world trend, the burden of infectious diseases are coming down while with increased life expectancy and widespread changes of lifestyles, non-communicable diseases have been on the rise in this region. But there is a paucity of data in Indo-Asians particularly in Bangladesh on characteristics of heart failure patients. Nevertheless, from a study of Bangladesh, about one-seventh of total admitted patients in a tertiary level cardiac hospital were found to be have HF.[5]

Depression is a common psychiatric disorder characterized by the presence of low mood or loss of interests associated with several other features that are present almost daily for at least two weeks.[6] It is a common comorbidity in heart failure patients. Frequency of depression in patients with chronic heart failure ranges from 13–77.5%. Depression is 4–5 times common in heart failure patients than in the general population and it might confer a higher risk of developing heart failure and negatively affect prognosis in established heart failure.[1] Depression increases sharply with increase in heart failure severity. Depressed heart failure patients experience a more rapid loss of physical function, poorer health-related quality of life, more frequent readmissions, and higher mortality rates than non-depressed heart failure patients.[1,7] For these reasons, depression is a first-order problem that should be approached within a comprehensive care program for the patients with chronic heart failure.[8]

The main precipitating factors associated with depression in CHF patients are age, gender, educational and economic status as well as the stage and the onset of the disease.[6] Previous MI, NYHA stage 3 or 4, living without a partner, absence of joint family system, sedentary lifestyle, hospital readmission have also been associated with depression in CHF patients.[9] Shimizu et al. predicted that the presence of previous ischaemic heart disease, participation restriction and lack of satisfaction with social support increases the risk of developing depressive symptoms by 70%, and patients are likely to develop such symptoms at one year.[7]

The definite mechanism which causes depression in CHF patients is not exactly known, yet the raised levels of catecholamines, cortisol and inflammatory cytokines (IL-6, IL-1â, TNF-á) in both the diseases might somewhat explain the pathophysiology.[9,10] Four different mechanisms have been proposed for the progression of CHF in depressed patients. Firstly, hypersecretion of cortisol and sympathetic hyperactivity in response to hypothalamic stimulation; secondly, reduced parasympathetic response leading to increased chances of arrhythmias; thirdly, rise in pro-inflammatory cytokines causing inflammation, and fourthly, hypercoagulability due to defective platelet activation.[9,11] CHF is a multi-organ disorder involving skeletal, renal, neuroendocrine and immune systems along with the heart. Cytokines like TNF-á, IL-1, IL-6 and macrophage chemo-attractant protein (MCP)-1 play a significant role in its development.[12] Similarly, depression and emotional distress have also been linked to abnormal immune responses peripherally and increased expression of pro-inflammatory cytokines which profoundly effects the brain and peripheral serotonin-mediated systems.[13]

Increasing or new-onset depressive symptoms have been associated with worse outcomes in CHF patients.[7] Depression was found to be an independent risk factor for mortality in CHF and this persists independent of NYHA class.[14] Clinical depression can worsen compliance with cardiac medication regimens and also causes less adherence to other recommendations, including dietary modifications, exercise, smoking cessation and attending cardiac rehabilitation programs. The meta-analysis by Rutledge, et al. found that the presence of depression in a patient with chronic heart failure predicts worse outcomes in terms of hospital readmission rates, functional status, and walk times. This analysis also found twice the rate of death in heart failure patients with depression compared to heart failure patients without depression.[15]

Psychological interventions and pharmacological or non-pharmacological treatment of depression may lead to a substantial decrease in morbidity and perhaps in mortality among patients with heart failure.[1] Considering the fact stated above, our aim of the study was to

determine the frequency & predictors of depression in patients with heart failure with reduced ejection fraction (HFrEF) as it is vital in planning the wholesome treatment in these patients.

Methods:

This cross-sectional analytical study was conducted at the Department of Cardiology, Dhaka Medical College Hospital (DMCH), Dhaka between October, 2018 to September, 2019. The study protocol was approved by Ethical Review Committee (ERC) of Dhaka Medical College and Hospital. Patients of chronic heart failure (more than 6 months) with reduced ejection fraction (LVEF < 40%) admitted in the department of Cardiology or attended in Cardiology OPD, DMCH, within the study period, fulfilling the inclusion and exclusion criteria were included in this study by convenient purposive sampling. Study subjects having acute coronary syndrome (ST elevation MI, Non-ST elevation MI, Unstable angina), recent major surgeries, other co-morbid conditions like moderate to severe hepatic or renal impairment, malignancy, hypothyroidism, Parkinson's disease and other chronic illness etc., history of use of alcohol or other illicit/ recreational substances, prior use of anti-depressant medications, anti-epileptic or steroids (more than 6 weeks) during last 2 months, pregnancy and unwilling to be included in the study were excluded. The study subjects were assessed first by attending doctor and then was evaluated by the principal investigator. Detailed clinical history, physical examination, relevant investigations were done and required data were recorded in preformed data collection sheet. Each participant signed a consent form prior to data collection. Information on age, sex, marital status, income level and health status information like diabetes, hypertension, dyslipidemia, smoking history, sedentary lifestyle, previous MI and number of hospital readmissions, mean time since diagnoses was collected. Hospital readmission was specified for exacerbation of symptoms of CHF within last two months before study inclusion. The NYHA functional classification was done according to participants' severity of limitation. It ranges from I (no limitation of physical activity) to II (Slight limitation in physical activity; comfortable at rest, but moderate physical activity results in limitation) to III (marked limitation of physical activity; symptoms are caused by less than ordinary activities) to IV (unable to carry on any physical activity without discomfort). Enrolled patients were subsequently assessed for the presence and severity of depressive symptoms during the last two weeks from the study inclusion by using a 9-item depression screening tool, the Patient Health Questionnaire-9 (PHQ-9). The PHQ-9 consists of nine items in line with the DSM-IV criteria for major depression (i.e. Loss of interest, feeling down, sleeping problems, loss of energy, appetite change, feelings of failure, trouble concentrating, psychomotor change, suicidal ideations). Each item is scored on a scale from 0 (not at all) to 3 (nearly every day) with a total score ranging from 0 to 27. PHQ-9 scores (5-9) suggest mild depression, (10-14) suggest moderate depression, (15-19) suggest moderately severe depression and (20-27) suggest severe depression.[16] The process of assessing of depressive symptoms by this tool was evaluated and approved by the department of Psychiatry of DMCH. After compiling data from all patients, statistical analysis was done. Sociodemographic variables and other factors related to heart failure were compared in between heart failure patients with depression & without depression in order to identify the predictors of depression.

Results:

One hundred and fifty-two chronic heart failure patients with reduced ejection fraction either admitted in the department of Cardiology or attended Cardiology OPD, Dhaka Medical College Hospital (DMCH), Dhaka who fulfilled the selection criteria were included in the study.

Mean age of the patients was 58.68±9.40 years, ranging from 36 to 75 years. Majority (35.5%) of the patients belonged to 61–70 years age group, followed by 51–60 years age group (34.9%).

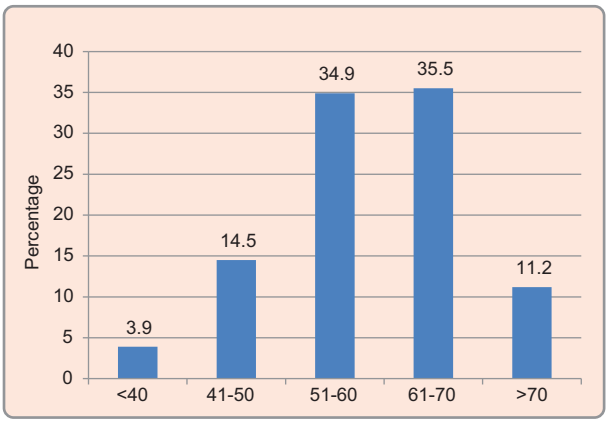

Figure 1: *Age distribution of patients (n=152)*

In our study, 72% (110) were male and 28% (42) were female. Male and female ratio was 2.6:1.

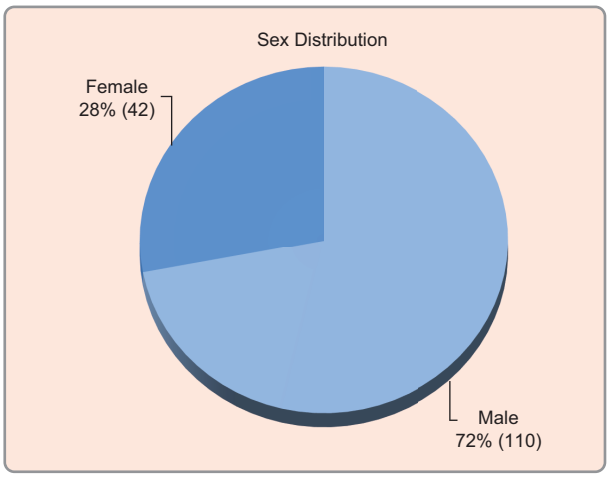

Figure 2: *Pie chart of sex distribution of patients (n=152)*

In this study, 77.6% (118) patients were married, 18.4% (28) were widowed, 2% (3) were divorced and 2% (3) were single.

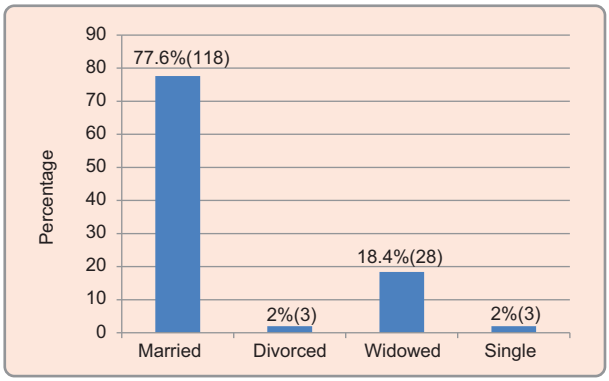

Figure 3: *Marital status of patients (n=152)*

Among study subjects, 58% (88) came from low-income group, followed by 28% (43) from lower-middle income group and 14% (21) from upper-middle income group. None belonged to high income group.

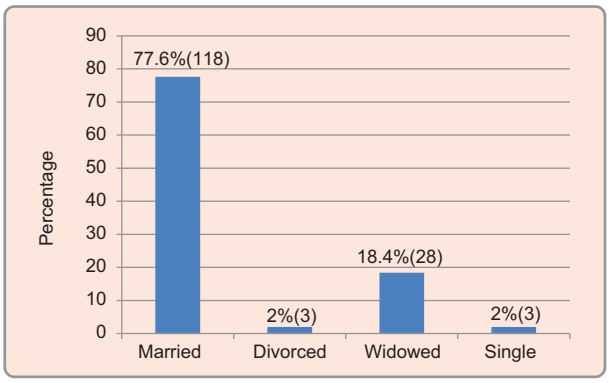

Figure 4: *Socioeconomic Status of patients (n=152)*

Among 152 patients, most commonly associated risk factors in heart failure patients were HTN (64.5%), sedentary lifestyle (64.5%) and diabetes (62.5%).

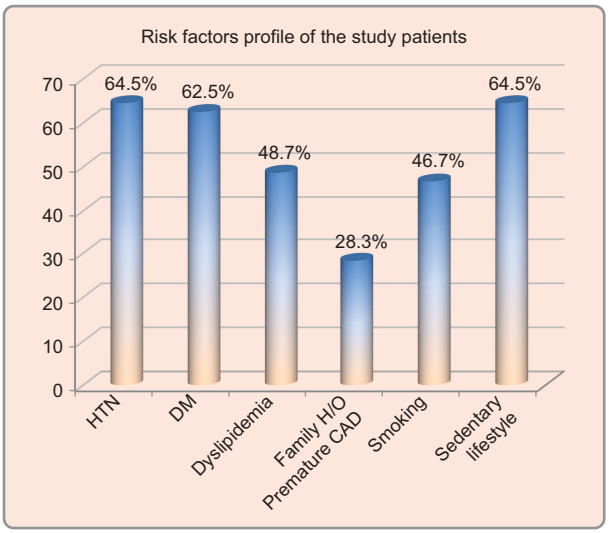

Figure 5: *Risk factors profile of the study patients (n=152)*

Among all patients, 51% (78) had past history of myocardial infarction (MI) and 49% (74) had no prior history of MI.

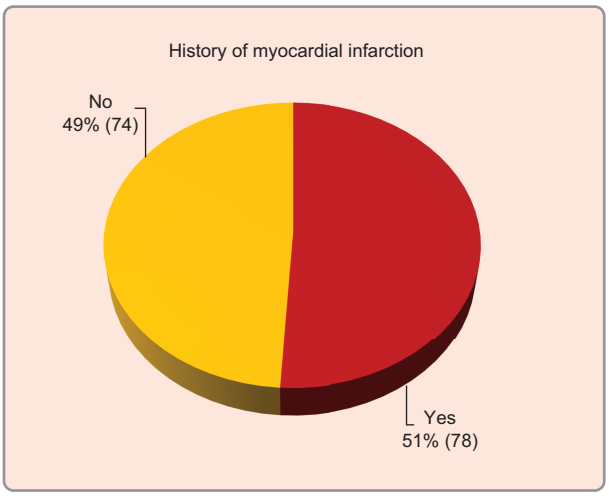

Figure 6: *Distribution of patients according to past history of myocardial infarction (MI) (n=152)*

Among all patients, 33% (50) had history of readmission in the hospital within last 2 months before study inclusion and 67% (102) had no such history.

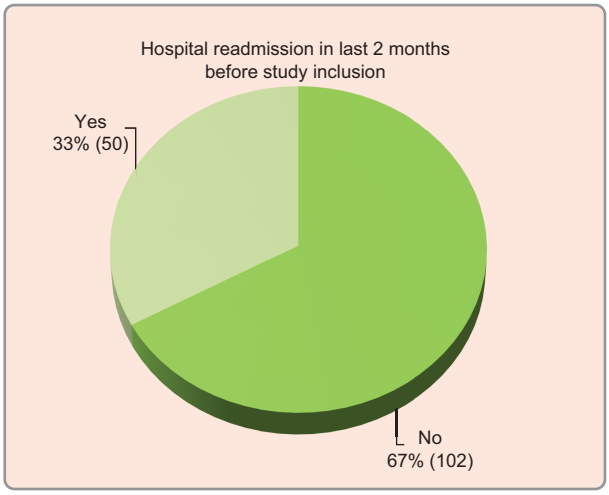

Figure 7: *Frequency of patients who was re-admitted in hospital in last 2 months before study inclusion (n=152)*

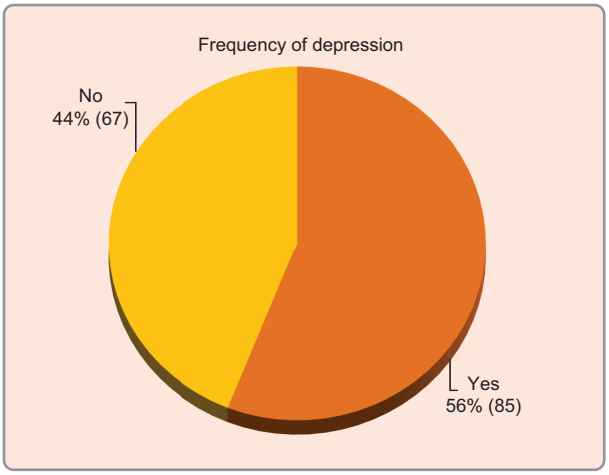

Figure 8: *Distribution of patients according to frequency of depression (n=152)*

Table I shows that among all patients, according to NYHA class of heart failure, 17.8% (27), 45.4% (69), 25.0% (38) and 11.8% (18) patients had class I, II, III and IV heart failure respectively. Mean duration of heart failure was 1.25±0.98 years, ranging from 0.5-5.0 years. Mean ejection fraction was 35.67±2.37%, ranging from 26-39%.

Table I
Characteristics of heart failure of patients (n=152)

	Frequency	Percentage
NYHA class of heart failure		
Class I	27	17.8%
Class II	69	45.4%
Class III	38	25.0%
Class IV	18	11.8%
	Mean±SD	Range
Duration of heart failure (years)	1.25±0.98	0.5 – 5.0
Ejection fraction (%)	35.67±2.37	26 – 39

Among all patients, 56% (85) had depression (PHQ-9 ≥5) of varied severity according to Patients Health Questionnaire-9 (PHQ-9). 44% (67) patients had no depression (PHQ-9 <5).

Among 85 depressed patients, 40% (34) had mild depression, while 27% (23), 19% (16) and 14% (12) had moderate, moderately severe and severe depression respectively.

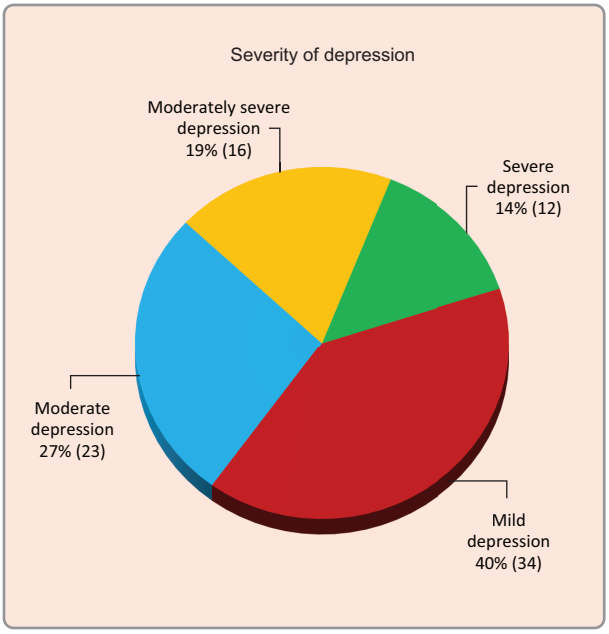

Figure 9: *Pie diagram showing distribution of depressed patients according to severity (n=85)*

In our study, patients who were depressed were significantly older than non-depressed patients (62.25±6.80 vs 54.14±10.29 years, p<0.001). Patients with age >65 years were significantly associated with depression (p<0.001). Patients who were widowed/ divorced/ single were found more depressed significantly (p<0.001). No relationship of sex and socioeconomic status with depression was noted.

Table-II

Comparison of sociodemographic profile in HFrEF patients with and without depression (n=152)

Variable	Depression		Total	P value
	Present (PHQ-9 ≥5) (n= 85)n (%)	Absent (PHQ-9 <5) (n=67) n (%)	(n=152) n (%)	
Age in years, mean±SD	62.25±6.80	54.14±10.29	58.68±9.40	* <0.001[s]
Age groups				
> 65	34 (40%)	10 (14.9%)	44 (28.9%)	**<0.001[s]
≤65	51 (60%)	57 (85.1%)	108 (71.1%)	
Sex				
Male	61 (71.8%)	49 (73.1%)	110 (72%)	**0.851[ns]
Female	24 (28.2%)	18 (26.9%)	42 (28%)	
Marital Status				
Married	55 (64.7%)	63 (94.0%)	118 (77.6%)	**<0.001[s]
Widowed/divorced/single	30 (35.3%)	4 (6.0%)	34 (22.4%)	
Socioeconomic status				
Low-income	50 (58.8%)	38 (56.7%)	88 (58%)	**0.934[ns]
Lower-Middle income	24 (28.2%)	19 (28.4%)	43 (28%)	
Upper-Middle income	11 (12.9%)	10 (14.9%)	21 (14%)	

p value determined by unpaired samples *Student's t test and **Chi-square test as appropriate.
s = Significant (p<0.05), ns = Not significant (p>0.05).
Among risk factors of IHD, diabetes mellitus (DM) and sedentary lifestyle were significantly associated with depression (P<0.001).

Table-III

Comparison of risk factors of IHD in HFrEF patients with and without depression (n=152)

Risk factors	Depression		Total	P value
	Present (PHQ-9 ≥5) (n= 85)n (%)	Absent (PHQ-9 <5) (n=67) n (%)	(n=152) n (%)	
Hypertension	58 (68.2%)	40 (59.7%)	98 (64.5%)	0.275[ns]
DM	64 (75.3%)	31 (46.3%)	95 (62.5%)	<0.001[s]
Dyslipidaemia	41 (48.2%)	33 (49.3%)	74 (48.7%)	0.901[ns]
Smoking	41 (48.2%)	30 (42.3%)	71 (46.7%)	0.671[ns]
Family H/O premature CAD	26 (30.6%)	17 (25.4%)	43 (28.2%)	0.478[ns]
Sedentary lifestyle	68 (80%)	30 (44.8%)	98 (64.5%)	<0.001[s]

p value determined by Chi-square test
s = Significant (p<0.05), ns = Not significant (p>0.05).

Majority patients had IHD as cause of heart failure accounting for 77% of the heart failure. None of the causes were significantly associated with depression (P>0.05).

Table-IV

Comparison of etiology in chronic HFrEF patients with and without depression (n=152)

Etiology	Depression		Total	P value
	Present (PHQ-9 ≥5) (n= 85)n (%)	Absent (PHQ-9 <5) (n=67) n (%)	(n=152) n (%)	
IHD	64 (75.3%)	53 (79.1%)	117 (77%)	0.580^{ns}
DCM	18 (21.1%)	11 (16.4%)	29 (19%)	0.459^{ns}
VHD	3 (3.6%)	3 (4.5%)	6 (4%)	0.766^{ns}

p value determined by Chi-square test
s = Significant (p<0.05), ns = Not significant (p>0.05).

Past history of MI and hospital readmission within last 2 months before study inclusion were significantly associated with depression (p <0.05).

Table-V

Comparison of history of MI and hospital readmission in HFrEF patients with and without depression (n=152)

Variable	Depression		Total	P value
	Present (PHQ-9 ≥5) (n= 85)n (%)	Absent (PHQ-9 <5) (n=67) n (%)	(n=152) n (%)	
Past H/O MI	55 (64.7%)	23 (34.3%)	<0.001^{s}	
Hospital readmission within last 2 monthsbefore study inclusion	36 (42.4%)	14 (20.9%)	0.005^{s}	

p value determined by Chi-square test
s = Significant (p<0.05), ns = Not significant (p>0.05).

Among class I, II, III and IV NYHA heart failure patients, 33.3%, 50.7%, 71.1% and 77.8% had depression respectively. This indicates that an increasing class of heart failure was significantly associated with increasing frequency of depression (p<0.05).

Table-VI

Comparison of NYHA class of heart failure in HFrEF patients with and without depression (n=152)

NYHA classification	Depression		Total	P value
	Present (PHQ-9 ≥5) (n= 85)n (%)	Absent (PHQ-9 <5) (n=67) n (%)	(n=152) n (%)	
Class I		9 (33.3%)	18 (66.7%)	0.004^{s}
Class II		35 (50.7%)	34 (49.3%)	
Class III		27 (71.1%)	11 (28.9%)	
Class IV		14 (77.8%)	4 (22.2%)	

p value determined by Chi-square test
s = Significant (p<0.05), ns = Not significant (p>0.05).

The multivariate analysis showed that age >65 years, sedentary lifestyle and past history of MI were independently associated with depression among HFrEF patients with Odds Ratio (OR) 5.549, 4.692, 8.451 respectively.

Table-VII

Multivariate logistic regression of different risk factors for development of depression in HFrEF patients (n=152)

Risk factors	OR	95%CI		p value
		Lower bound	Upper bound	
Age >65 years	5.549	1.115	27.607	0.036[s]
Unmarried/ widowed/ single	2.031	0.324	12.746	0.449[ns]
DM	0.335	0.094	1.202	0.094[ns]
Sedentary lifestyle	4.692	1.457	15.105	0.01[s]
H/O Past MI	8.451	4.889	13.933	0.002[s]
H/O of hospital readmission	3.975	0.483	32.72	0.199[ns]
NYHA Class III/IV HF	0.053	0.002	1.144	0.061[ns]

H/O: History of; NYHA: New York Heart Association; HF: Heart failure;
s = Significant (p<0.05), ns = Not significant (p>0.05).

Discussions:

This study included 152 patients of chronic heart failure with reduced ejection fraction (HFrEF) who had their ejection fraction <40%, to find out the frequency and predictors of depression among them.

Mean age of the participants was 58.68±9.40 years, ranging from 36 to 75 years. Majority patients belonged to age group 61–70 years (35.5%). Nearly 70% of the patients were between 51 to 70 years. This is comparable with the findings of a study conducted in BSMMU in 2016, where a mean age of 55±14 years was recorded among patients of congestive heart failure.[17] In their study majority patients were aged between 51–60 years (42.2%) with 61.8% patients falling within the age range 51–70 years. Another study conducted on heart failure patients to see the effect of albumin infusion found that 60% patients were aged between 51–70 years.[18] Rahman, et al. (2019) conducted demographic study on heart failure patients with preserved ejection fraction (HFpEF) and found a mean age of 65±10.1 years with majority falling into age group 60 to 79 years. This might be due to probability of living longer of HFpEF patients than HFrEF patients.[19]

Most of the patients were male in this study constituting 72% of the study population giving a male-female ratio of 2.6:1. Abedin, et al. (2016) found a similar proportion of male and female in their study (respectively 66.7 and 33.3%).[17] Rahman, et al. (2019) found 60% male in their study.[19] A study similar to present study conducted by Zahid, et al. (2018) found 73.5% male patients among the sample population.[9]

In this study 77.6% were married, 18.4% widowed, 2% divorced and 2% single. Although married patients were less, if widowed & divorced patients were considered married, it would give a figure of 98% which is similar to that (98%) found by Abedin and coresearchers.[17]

In this study, 58%, 28% and 14% patients belonged to low income, lower-middle income and upper-middle income group respectively. Highest proportion of patients came from low-income group which is consistent with the findings of Zahid, et al. (2018) where they found 61.2% patients were from low socio-economic group.[9] Low socioeconomic status is associated with increased incidence of heart failure worldwide.[20] Hence, socioeconomic deprivation is a powerful independent predictor of heart failure.

In this study, risk factors most commonly associated with HFrEF were hypertension and sedentary lifestyle (64.5% each), DM (62.5%), dyslipidaemia (48.7%) & smoking (46.7%). Talukder, et al. (2019) in their study found risk factors in following order: HTN (48%), smoking (40%), DM (28%), dyslipidaemia (24%).[18] Zahid et al. (2018) found that HTN (60.5%), DM (57.6%), sedentary lifestyle (53.5%) and smoking (42.9%) were common associated risk factors.[9] All these studies showed that hypertension was the most common comorbidity among heart failure patients.

The present study found 51% patients with past history of myocardial infarction and 33% patients with history of readmission in hospital within last 2 months of study inclusion. This is nearly similar to the findings of Zahid et al. (2018). They found previous history of myocardial infarction in 46.4% patients and at least 1 hospital readmission in last 2 months in 25.9% patients.[9]

In this study, majority of patients had NYHA class II heart failure (45.4%), followed in decreasing order by 25% class III, 17.8% class I and 11.8% class IV patients. This pattern is similar to that of Haworth, et al. (2005) who

found 65% class II, 26% class III, 8% class I and 1% class IV patients in an outpatient study.[21] In another study, Sherwood, et al. (2011) found 59 & 37% class II & III patients respectively.[22]

The frequency of depression has been shown to be extremely high in the present study, with 56% of the participants labeled as depressed. Zahid et al. (2018) found a nearly similar 60% cases of depression among patients with chronic heart failure in their study.[9] Previous small studies have recorded varying prevalence ranging from 9% to 60%.[23]

Presence of depression makes treatment in heart failure patients more difficult and causes increase in NYHA class, hospitalization, and mortality rate.[10,24] A previous study demonstrated how depressive symptoms developed in 22% of CHF patients within one year post-discharge (Shimizu, et al., 2014) which partly explains that depression is more common in CHF patients.[7]

In this study, the risk factors associated significantly ($p<0.05$) with depression in HFrEF patients were age >65 years, previous MI, DM, sedentary lifestyle, increasing NYHA class, living without a partner, and hospital readmission within 2 months of study inclusion. The results were in line with a similar study which found a significant relation of age, previous MI, NYHA class III or IV, living without a partner, absence of a joint family system, sedentary lifestyle, hospitalization within the past 2 months, and hospital readmission with depression.[9] Another study predicted that the presence of previous ischaemic heart disease, participation restriction, and lack of satisfaction with social support alone increases the risk of developing depressive symptoms by 70%, and patients are likely to develop such symptoms in one year.[7] But multivariate logistic regression showed that age >65 years, sedentary lifestyle and past history of MI were the most significant predictors of depression among patients.

Living without a partner and social isolation have previously been found to be associated with depression in elderly people.[25] The present study found that being single is a significant risk factor for depression in patients with HFrEF. Nonetheless, a study by Shimizu, et al. (2014) did not find the same relation to be significant.[7] Although some individuals might be depressed due to lack of support because of being single or not living with family, other individuals find it positive to live alone, which explains how depression is a subjective phase which develops when level of relationship does not meet one's desire to bond.[26]

NYHA class is another factor that was significantly associated with depression in the study participants which is comparable with the findings of a meta-analysis performed in 2006 where higher prevalence rates were associated with higher NYHA functional class.[15] Moreover, it has been demonstrated that patients with NYHA class 3 and 4 are more likely to be depressed.[27] This study is analogous as it shows this group as having moderate to severe depression rather than mild to moderate depression, and the difference is significant.

Smoking[28,29] and hypertension[27] have previously been shown to be strongly associated with depression implying reduced desire for self-care and drug compliance, but it was not a significant predictor of depression in the chronic heart failure patients in this study. Rather, DM and sedentary lifestyle were found to be significantly associated with depression in present study. This finding is similar to the study done by Zahid, et al. (2018) which showed sedentary lifestyle was demonstrated as a risk factor of depression.[9] Physically active people are more likely to have a mentally healthy life. This could positively lead them away from depression.

This study revealed that diabetes was more prevalent among depressed patients than non-depressed patients with statistical significance (75.3% vs 46.3%, p value <0.001). Previously it was shown that depression among diabetic patients culminated into heart failure within a median follow-up of 1.5 years.[30] Majority patients had IHD as cause of heart failure accounting for 77% of the heart failure. None of the causes were significantly associated with depression ($P>0.05$).

The consequences of depression cannot be overlooked. It has been found to lower the quality of life and the survival rate.[25] Adelberg, et al. (2016) have shown that all-cause mortality increases in heart failure patients with ejection fraction <35%[3], and depressed patients were at risk for significant worsening of their HF symptoms, physical and social function, decline in health status and quality of life.[31] Accordingly, studies have suggested that treatment of depression can decrease morbidity and mortality in patients of HF.[27]

Therefore, comprehensive treatment strategies should be taken to deal with depression in patients of chronic heart failure with low ejection fraction to decrease morbidity and improve quality of life among them.

Conclusion:

Depression is common among patients with chronic heart failure. In this study, about 56% patients of chronic heart failure (CHF) with reduced ejection fraction (<40%)

suffered from different degrees of depression. Age >65 years, sedentary lifestyle and H/O past MI were independently associated with depression among chronic HErEF patients. Widowed, Diabetes, hospital readmission & NYHA class III/IV were also linked with higher prevalence of depression among patients with chronic HFrEF. So, Depression screening programme should be recommended as an integral part of management of chronic HFrEF patients.

Limitations of the study:

Although the result of this study supports the hypothesis, there are some facts to be considered which might have affected the result of the current study. It was a single center study. Study population was small. Purposive sampling was done instead of random sampling. Therefore, the results of the study may not reflect the exact picture of the country. Follow up of the patients for longer duration was beyond scope. Full psychiatric evaluation of the patients could not be done who were screen-positive.

Recommendations:

Chronic heart failure patients should be screened for depression. Early detection of depression in these patients is crucial to improve a patient's quality of life. Proper counseling and management of depression should be started promptly for the better outcome of the heart failure patients.

References:

1. Khan S, Khan A, Ghaffar R & Awan ZA. Frequency of depression in patients with chronic heart failure. Journal of Ayub Medical College Abbottabad. 2012;24(2):26–29.
2. Guo Y, Lip GY & Banerjee A. Heart Failure in East Asia. Current Cardiology Reviews. 2013; 9(2):112–122
3. Adelborg K, Schmidt M, Sundbøll J, Pedersen L, Videbech P, Bøtker HE, et al. Mortality Risk Among Heart Failure Patients With Depression: A Nationwide Population-Based Cohort Study. Journal of the American Heart Association. 2016;5(9):1–8.
4. Azam STMA & Ullah M. Heart failure – How can we face this pandemic of twenty first century? Bangladesh Heart Journal. 2016;2(1):1–2.
5. Kabiruzzaman M, Malik F, Ahmed N, Badiuzzaman M, Choudhury S, Haque T, et al. Burden of Heart Failure Patients in a Tertiary Level Cardiac Hospital. Journal of Bangladesh College of Physicians and Surgeons. 2010;28(1):28–29.
6. Lefteriotis C. Depression in Heart Failure patients. Health Science Journal. 2013;7(4):349–355.
7. Shimizu Y, Suzuki M, Okumura H & Yamada S. Risk factors for onset of depression after heart failure hospitalization. Journal of Cardiology, Japanese College of Cardiology. 2014;64(1):37–42.
8. Pintor L. Heart Failure and Depression, an Often-Neglected Combination. Revista Española de Cardiología (English Edition). 2007;59(8):761–765.
9. Zahid I, Baig MA, Gilani JA, Waseem N, Ather S, Farooq AS, et al. Frequency and predictors of depression in congestive heart failure. Indian Heart Journal. 2018;70:199–S203.
10. DeJongh B, Birkeland K & Brenner M. Managing Comorbidities in Patients with Chronic Heart Failure: First, Do No Harm. American Journal of Cardiovascular Drugs. 2015;15(3):171–184.
11. Joynt KE, Whellan DJ & O'Connor CM. Why is depression bad for the failing heart? A review of the mechanistic relationship between depression and heart. Journal of Cardiac Failure. 2004;10(3):258–271.
12. Anker SD. Inflammatory mediators in chronic heart failure: an overview. Heart. 2004;90(4):464–470.
13. Pasic J, Levy WC & Sullivan MD. Cytokines in depression and heart failure. Psychosomatic Medicine. 2003;65(2):181–193.
14. Mbakwem A, Aina F & Amadi C. Depression in Patients with Heart Failure: Is Enough Being Done? Radcliffe Cardiology. 2016;2(2):110–20.
15. Rutledge T, Reis VA, Linke SE, Greenberg BH & Mills PJ. Depression in Heart Failure. A Meta-Analytic Review of Prevalence, Intervention Effects, and Associations With Clinical Outcomes. Journal of the American College of Cardiology. 2006;48(8):1527–1537.
16. Spitzer RL, Kroenke K & Williams JBW. The PHQ-9-Validity of a Brief Depression Severity Measure. Journal of General Internal Medicine. 2001;16(9):606–613.
17. Abedin MZ, Banerjee SK, Hoque H, Mahmood M, Krishna D, Samsuzzaman SM, et al. Demographic and Socio-Economic Characteristics of Patients with Congestive Heart failure Presenting to the Cardiac Emergency of Bangabandhu Sheikh Mujib Medical University. University Heart Journal. 2016;12(2):76–81.

18. Talukder A, Siraj MM, Khondokar MN, Habib SA, Salim MA, Rahman MW, et al. Outcome of Albumin Infusion in Heart Failure Patients. University Heart Journal. 2019;15(2):47–53.

19. Rahman MW, Mahmood M, Adhikary DK, Ahsan SA, Ahmed CM, Hoque H, et al. Frequency and Clinical Characteristics of Heart Failure with Preserved Ejection Fraction Patients in a Tertiary Level Hospital. University Heart Journal. 2019;15(2):63–67.

20. Hawkins NM, Jhund PS, McMurray JJV & Capewell S. 2. Heart failure and socioeconomic status: Accumulating evidence of inequality. European Journal of Heart Failure. 2012;14(2):138–146.

21. Haworth JE, Moniz-Cook E, Clark AL, Wang M, Waddington R & Cleland JGF. Prevalence and predictors of anxiety and depression in a sample of chronic heart failure patients with left ventricular systolic dysfunction. European Journal of Heart Failure. 2005;7(5):803–808.

22. Sherwood A, Blumenthal JA, Hinderliter AL, Koch GG, Adams KF, Dupree CS, et al. Worsening depressive symptoms are associated with adverse clinical outcomes in patients with heart failure. Journal of the American College of Cardiology. 2011;57(4):418–423.

23. Metra M, Gheorghiade M, Bonow RO & Dei Cas L. Postdischarge assessment after a heart failure hospitalization: The next step forward. Circulation. 2010;122(18):1782–1785.

24. Vongmany J, Hickman LD, Lewis J, Newton PJ & Phillips JL. Anxiety in chronic heart failure and the risk of increased hospitalisations and mortality: A systematic review. European Journal of Cardiovascular Nursing. 2016;15(7):478–485.

25. Djernes JK. Prevalence and predictors of depression in populations of elderly: A review. Acta Psychiatrica Scandinavica. 2006;113(5):372–387.

26. Teo AR, Choi HJ & Valenstein M. Social Relationships and Depression: Ten-Year Follow-Up from a Nationally Representative Study. PLoS ONE. 2013;8(4):1–8.

27. Gottlieb SS, Khatta M, Friedmann E, Einbinder L, Katzen S, Baker B, et al. The influence of age, gender, and race on the prevalence of depression in heart failure patients. Journal of the American College of Cardiology. 2004;43(9):1542–1549.

28. Cole MG & Dendukuri N. Risk factors for depression among elderly community subjects: A systematic review and meta-analysis. American Journal of Psychiatry. 2003;160(6):1147–1156.

29. Vink D, Aartsen MJ & Schoevers RA. Risk factors for anxiety and depression in the elderly: A review. Journal of Affective Disorders. 2008;106(1-2):29–44.

30. Wang Y, Yang H, Nolan M, Burgess J, Negishi K & Marwick TH. Association of depression with evolution of heart failure in patients with type 2 diabetes mellitus. Cardiovascular Diabetology. 2018;17(1):1–11.

31. Rumsfeld JS, Havranek E, Masoudi FA, Peterson ED, Jones P, Tooley JF. Depressive Symptoms Are the Strongest Predictors of Short-Term Declines in Health Status in Patients with Heart Failure. Journal of the American College of Cardiology. 2003;42(10):1811–1817.

Original Article

Influence of Cardiovascular Risk Factors among Patients with Covid 19 Infection and its Association with In-Hospital Outcome - A Multicentre Prospective Observational Study

MA Rahman[1], M Ahmed[2], KMR Anwar[3], J Farjana[4], MK Hasan[5], MS Mahmod[6], D Hossain[7], RM Huda[8], G Morshed[9], AK Sikder[10], S Islam[11], L Farzana[12]

Abstract:

Introduction: **The global spread of COVID-19, first identified in Wuhan, China, in December 2019, has ignited an unprecedented ongoing global pandemic. Risk stratification of these patients is crucial to optimize the use of hospital resources. Several associations with adverse outcomes in COVID-19 patients have been identified, including factors that also predispose to cardiovascular disease (CVD), such as older age, male sex, hypertension, overweight and diabetes. In this context we designed this study to observe Association of Cardiovascular risk factors with patients infected with Covid 19 and it's in-hospital outcome.**

Materials and Methods: **In this prospective observational study total 408 adult patients who were reverse transcription polymerase chain reaction (Rt-PCR) positive for COVID-19 were included. They were admitted in Sarkari Karmachari Hospital, Kuwait Bangladesh Friendship Government Hospital and Dr. Sirajul Islam Medical College between June 2020 to June 2022. Patients with severe comorbidities like Acute myocardial infarction, Stroke, Acute kidney injury, malignancy and pregnant women were excluded from the study. Appropriate informed written consent was obtained. Demographic and clinical data were correlated with outcome. The statistical analysis was carried out using the Statistical Package for Social Sciences version 22.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Qualitative variables were expressed as frequency and percentage. Quantitative variables were expressed as mean ± standard deviation and median. Test of significance was performed by unpaired t-test for quantitative variable and Chi square test for qualitative variables. In addition, multivariate logistic regression analysis of possible risk factors was done to determine the association with outcome by calculating odds ratio with 95% confidence intervals. A p value <0.05 was be considered as significant.**

(Bangladesh Heart Journal 2024; 39(2): 85-92)

1. Dr. Mohammad Arifur Rahman, Senior Consultant and Head of the Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh.
2. Professor Dr. Mohsin Ahmed, Professor, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
3. Dr. Kazi Md Rubayat Anwar, Clinical Fellow of cardiology, The Hillingdon Hospital NHS Trust, United Kingdom.
4. Dr. Jinat FarJana, Major, Classified Specialist in Medicine, Department of Cardiology, CMH, Barishal, Bangladesh.
5. Dr. Md Kamrul Hasan, Medical Officer, Kuwait Bangladesh Friendship Govt. Hospital, Dhaka, Bangladesh.
6. Dr. Md. Salim Mahmod, Associate Professor, Department of Cardiology, Dr. Sirajul Islam, Medical College, Dhaka, Bangladesh
7. Dr. Md. Delwar Hossain, Assistant Professor, Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh
8. Dr. Reaz Mahmud Huda, Assistant Professor, Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh.
9. Dr. Md. Golam Morshed, Assistant Professor, Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh.
10. Dr. Anjan Kumar Sikder, Assistant Registrar, Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh.
11. Dr. Shafiqul Islam, Medical Officer, Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh.
12. Dr. Laila Farzana, Medical Officer, Tele medicine Service, BRAC, Dhaka, Bangladesh.

Address of Correspondence: Dr. Mohammad Arifur Rahman, Senior Consultant and Head of the Department of Cardiology, Sarkari Karmachari Hospital, Dhaka, Bangladesh, email: drarif79@yahoo.com, Mobile: +8801711666030.

DOI: https://doi.org/10.3329/bhj.v39i2. 75693

Results: **The mean age of participants was 45.2±13.4 years among them 263 (64.5%) were male and 145 (35.5%)were female. According to BMI maximum male 126 (47.9%) were normal weight group whereas maximum female 63(43.4%) were obese. Considering cardiovascular risk factors among male and female Smoking were 160 (60.8%) vs. 38 (26.2%), Hypertension were 105 (39.9%) vs. 65 (44.8%), Diabetes Mellitus were 71 (27.0%) vs 55 (37.9%), Dyslipidemia were 69 (26.2%) vs. 36 (24.8%), Family history of CVD were 55 (20.9%) vs.20 (13.8%) and Clustering of risk factors (≥2 factors) were 117 (44.5%) vs. 74 (51.0%). Among the study population 81 (19.9%) needed oxygen therapy , 50 (12.3%) needed Non-invasive ventilation, 34 (8.3%) patients needed Mechanical Ventilation, Among the study subjects total 27 (6.61%) expired and maximum number of patients 15 (55.6%) were in 61-80 years age group. Regression analysis for the predictors of adverse in hospital outcome among the Cardiovascular risk factors showed Age (>60yrs) (p= 0.034), BMI (>25) (p= 0.026), Smoking (p= 0.041), Hypertension (p= 0.037) Diabetes Mellitus (p= 0.013), Dyslipidemia (p= 0.021) and Clustering of risk factors (≥2) (p= 0.012) were statistically significant contributors.**

Conclusion: **In conclusion, this study shows that Age (>60yrs), BMI (>25), Smoking, Hypertension, Diabetes Mellitus, Dyslipidemia, clustering of risk factors (≥2) have greater risk of adverse outcomes including death from COVID-19. It is recommended that individuals with cardiovascular risk factors, especially older men and women, should be focus of public health measures and must be informed regarding increased risk of death in COVID-19. It is likely that with proper preventive and therapeutic interventions the higher risk of adverse outcomes in COVIDF-19 patients with cardiovascular risk factors can be mitigated. We need to be more vigilant in controlling CVD risk factors since it not only increases the morbidity of non-communicable diseases, but also poses to and worsens the outcome of communicable diseases.**

Introduction

The global spread of COVID-19, first identified in Wuhan, China, in December 2019, has ignited an unprecedented ongoing global pandemic.[1] Although most infected individuals experience only mild symptoms that do not require hospitalization, the absolute number of patients requiring hospital admission is staggering. Risk stratification of these patients is crucial to optimize the use of hospital resources.[2] Several associations with adverse outcomes in COVID-19 patients have been identified, including factors that also predispose to cardiovascular disease (CVD), such as older age, male sex, hypertension, overweight and diabetes.[3,4] Furthermore, individuals with overt CVD appear to be affected more seriously by COVID-19 infection.[5]

By the end of 2020, the COVID-19 pandemic had led to an estimated 3 million deaths worldwide.[6] Large, population-based studies show that existing cardiovascular disease (CVD) and some individual cardiovascular risk factors (such as diabetes and hypertension) are associated with COVID-19-related deaths.[7,8,9] Other studies support associations between CVD or individual risk factors and severe COVID-19 outcomes among hospitalized patients.[10]

With a population of over 160 million, Bangladesh is one of the most densely populated (1265 per square km) countries in the world.[11] About 60% of its population is between 15 to 64 years and only 4.7% is above 65 years of age .[12] The care-home facility is virtually non-existent and the extended family structure combines the aged with the young in the same household, Because of economic prosperity, the country has been experiencing an increasing trend of unplanned urbanization, and currently, more than 32% of people live in urban areas. Bangladesh is also undergoing nutrition and epidemiologic transition with a higher burden of non-communicable diseases (NCDs). A recent meta-analysis has shown that overall prevalence for metabolic syndrome (a cluster of health problems including high blood pressure, abdominal fat, high triglycerides, high blood sugar, and low HDL cholesterol) is higher in Bangladesh compared to the estimated world prevalence (30% versus 20 25%).[13] Besides, approximately 34% of adults are overweight and NCDs account for 67% of deaths in Bangladesh.[14] In this context we designed this study to observe Association of Cardiovascular risk factors with patients infected with Covid 19 and it's in-hospital outcome.

Materials and Methods:

In this prospective observational study total 408 adult patients who were reverse transcription polymerase chain reaction (Rt-PCR) positive for COVID-19 were included. They were admitted in Sarkari Karmachari Hospital, Kuwait Bangladesh Friendship Government Hospital and Dr. Sirajul Islam Medical College between June 2020 to

June 2022. Patients with severe comorbidities like Acute myocardial infarction, Stroke, Acute kidney injury, malignancy and pregnant women were excluded from the study. Appropriate consent was obtained from every patient or from legal guardian by reading out the written informed consent according the revised Declaration of Helsinki. We collected demographic data (age, sex, occupation, education), clinical data (symptoms on admission, comorbidities) and correlated them with outcome. The statistical analysis was carried out using the Statistical Package for Social Sciences version 22.0 for Windows (SPSS Inc., Chicago, Illinois, USA). Qualitative variables such as fever, cough etc. were expressed as frequency and percentage. Quantitative variables like age, durations, etc. were expressed as mean ± standard deviation and median. Test of significance was performed by unpaired t-test for quantitative variable and Chi square test for qualitative variables compared separately in different clinical presentation. In addition, multivariate logistic regression analysis of possible risk factors was done to determine the association with outcome by calculating odds ratio with 95% confidence intervals. A p value <0.05 was be considered as significant.

Results:

The mean age of participants was 45.2±13.4 years among them 263 (64.5%)were male and 145 (35.5%)were female. Maximum number of male 82 (31.2%) were in 61-80 years group and maximum female 44 (33.3%) were in 41-60 years group. Among both group 165 (62.7%) male and 62 (42.8%) female were service holder. Considering education status among study population maximum number male 91 (34.6%) were graduated and maximum number of female 38 (26.2%) were XII class passed. According to BMI maximum male 126 (47.9%) were normal weight group whereas maximum female 63(43.4%) were obese **(**Table I**).**

It has been observed among the study population presenting complaints were 355 (87%) Fever, 352 (86.3) Dry cough, 163 (40%) tiredness, 176 (43.1%) Bodyache, 32 (7.8%) Diarrhea, 116(28.4%) Headache, 49 (12%) Loss of taste, 66 (16.2%) Loss of smell, 214 (52.5%) Shortness of breath, 60 (14.7%) Chest pain. Elderly patients presented with most of the complaints (Table II).

Table-I

Distribution of the study population according to age, sex, occupation, literacy and BMI

	Male 263 (64.5%)	Female 145 (35.5%)
Age group		
<21	22 (8.4%)	10 (6.9%)
21-40	52 (19.8%)	40 (43.5%)
41-60	73 (27.8%)	44 (33.3%)
61-80	82 (31.2%)	29 (20%)
>80	34 (12.9%)	22 (15.2%)
Occupation		
Service	165 (62.7%)	62 (42.8%)
Business	57 (21.7%)	16 (11.0%)
Farmer	11 (4.2%)	1 (0.7%)
Housewife	0 (0.0%)	49 (33.8%)
Doctor	4(1.5%)	16 (11.0%)
Others	26 (9.9%)	1 (0.7%)
Education level		
Nil	4 (1.5%)	8 (5.5%)
V	4 (1.5%)	16 (11%)
X	33 (12.5%)	24 (16.6%)
XII	76 (28.9%)	38 (26.2%)
Graduate	91 (34.6%)	27 (%)
Masters	55 (20.9%)	32 (22.1%)
BMI		
<18.5	20 (7.6%)	4 (2.8%)
18.5-24.9	126(47.9%)	49(33.8 %)
25-29.9	92 (35 %)	63(43.4%)
>30	25 (9.5 %)	29 (20 %)

Table-II

Distribution of study population according to presenting sign, symptoms.

	Age group					Total
	<21	21-40	41-60	61-80	>80	
Fever	28	78	93	107	49	355 (87%)
	7.9%	22.0%	26.2%	30.1%	13.8%	
Dry cough	25	79	91	110	47	352 (86.3)
	7.1%	22.4%	25.9%	31.2%	13.4%	
tiredness	16	37	33	53	24	163 (40%)
	9.8%	22.7%	20.2%	32.5%	14.7%	
Bodyache	16	42	37	57	24	176 (43.1%)
	9.1%	23.9%	21.0%	32.4%	13.6%	
Diarrhoea	3	5	5	16	3	32 (7.8%)
	9.4%	15.6%	15.6%	50.0%	9.4%	
Headache	10	29	21	35	21	116 (28.4%)
	8.6%	25.0%	18.1%	30.2%	18.1%	
Loss of taste	1	10	11	20	7	49 (12%)
	2.0%	20.4%	22.4%	40.8%	14.3%	
Loss of smell	3	15	15	22	11	66 (16.2%)
	4.5%	22.7%	22.7%	33.3%	16.7%	
Shortness of breath	14	49	57	65	29	214 (52.5%)
	6.5%	22.9%	26.6%	30.4%	13.6%	
Chest pain	4	11	17	15	13	60 (14.7%)
	6.7%	18.3%	28.3%	25.0%	21.7%	
	7.8%	22.5%	25.0%	30.9%	13.7%	

Table-III

Distribution of study population according to Cardiovascular risk factors.

	Risk factors	
Smoking	160 (60.8%)	38 (26.2%)
Hypertension	105 (39.9%)	65 (44.8%)
Diabetes Mellitus	71 (27.0%)	55 (37.9%)
Dyslipidemia	69 (26.2%)	36 (24.8%)
Family history of CVD	55 (20.9%)	20 (13.8%)
Clustering of risk factors	117 (44.5%)	74 (51.0%)

Considering cardiovascular risk factors among male and female Smoking were 160 (60.8%) vs. 38 (26.2%), Hypertension were 105 (39.9%) vs. 65 (44.8%), Diabetes Mellitus were 71 (27.0%) vs 55 (37.9%), Dyslipidemia were 69 (26.2%) vs. 36 (24.8%), Family history of CVD were 55 (20.9%) vs.20 (13.8%) and Clustering of risk factors (≥2 factors) were 117 (44.5%) vs. 74 (51.0%) (Table III).

Among the study population 81 (19.9%) needed oxygen therapy and maximum number of patients 34 (42.0%) were in 61-80 years age group, 50 (12.3%) needed Non-invasive ventilation and maximum number of patients 19 (38.0%) were in 61-80 years age group, 34 (8.3%) patients needed Mechanical Ventilation and maximum number of patients 18 (52.9%)were in 61-80 years age

Table-IV

Distribution of study subjects according to Oxygen delivery system and death.

		Age group					Total
	<21	21-40	41-60	61-80	>80		
Oxygen therapy	Count	7	19	12	34	9	81 (19.9%)
	% within Oxygen therapy	8.6%	23.5%	14.8%	42.0%	11.1%	
Non-invasive ventilation	Count	3	3	13	19	12	50 (12.3%)
	% within Non-invasive ventilation	6.0%	6.0%	26.0%	38.0%	24.0%	
Mechanical Ventilation	Count	0	3	3	18	10	34 (8.3%)
	% within Mechanical Ventilator	0.0%	8.8%	8.8%	52.9%	29.4%	
Expired	Count	0	2	2	15	8	27 (6.61%)
	% within Expired	0.0%	7.4%	7.4%	55.6%	29.6%	

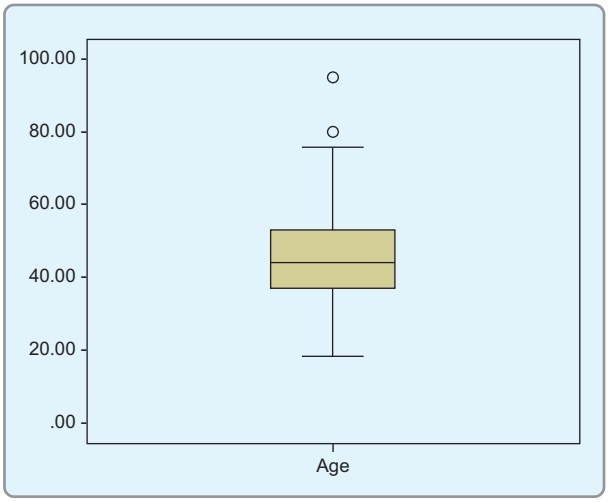

Figure 1: *Box whisker plot showing age distribution of Expired patients*

Table-V

Regression analysis showing influences of Cardiovascular risk factors on outcome.

Expired	B	Std.Error	Wald	Sig.	Exp(B)	95% CI for Exp(B)	
						Lower Bound	Upper Bound
Age (>60yrs)	.101	1.229	.007	0.034	1.106	.199	2.310
BMI (>25)	.081	1.189	.005	0.026	1.085	.105	3.155
Male gender	.231	.779	.076	0.129	1.001	.217	4.610
Smoking	.037	.758	.002	0.041	1.064	.218	4.255
Hypertension	.103	2.243	.122	0.037	1.157	.126	7.047
Diabetes Mellitus	.210	.797	.038	0.013	1.279	.163	3.714
Dyslipidemia	.134	.945	.020	0.021	1.025	.137	5.579
Clustering of risk factors(≥2)	.043	2.216	.069	0.012	1.792	.123	3.916
Comorbidities (2)	.071	.755	.009	0.225	.932	.212	4.091

group (Table IV). Among the study subjects total 27 (6.61%) expired and maximum number of patients 15 (55.6%) were in 61-80 years age group (Figure 1).

Regression analysis for the predictors of adverse in hospital outcome among the Cardiovascular risk factors showed Age (>60yrs) (p= 0.034), BMI (>25) (p= 0.026), Smoking (p= 0.041), Hypertension (p= 0.037) Diabetes Mellitus (p= 0.013), Dyslipidemia (p= 0.021) and Clustering of risk factors (≥2) (p= 0.012) were statistically significant contributors.

Discussion:

The mean age of participants was 45.2±13.4 years among them 263 (64.5%)were male and 145 (35.5%)were female. Maximum number of male 82 (31.2%) were in 61-80 years group and maximum female 44 (33.3%) were in 41-60 years group. According to other studies mean age of participants was 41.7±16.3 years where 63% were male and 37% female.[15]

The mean age of the cohort was 46±18 years, 54% were less than 50 years and about half lived in large family households (>5 persons). Prevalence of low educational status was higher in women while tobacco use was more in men. Comorbidities were present in 28.6% with hypertension (17.8%) and diabetes (16.6%) being the most common. Other comorbidities were chronic pulmonary disease, tuberculosis, coronary heart disease and neurological disease.[16]

Among both group 165 (62.7%) male and 62 (42.8%) female were service holder. Considering education status among study population maximum number male 91 (34.6%) were graduated and maximum number of female 38 (26.2%) were XII class passed. According to

BMI maximum male 126 (47.9%) were normal weight group whereas maximum female 63(43.4%) were obese.

It has been observed among the study population presenting complaints were 355 (87%) Fever, 352 (86.3) Dry cough, 163 (40%) tiredness, 176 (43.1%) Bodyache, 32 (7.8%) Diarrhea, 116(28.4%) Headache, 49 (12%) Loss of taste, 66 (16.2%) Loss of smell, 214 (52.5%) Shortness of breath, 60 (14.7%) Chest pain. Elderly patients presented with most of the complaints. Some study showed Patients got admitted predominantly with fever (69%), cough (54%), breathlessness (41%), fatigue (40%), anorexia (26%) and diarrhea (19%). Less frequent symptoms included chest pain, sore throat, headache and bodyache, nasal congestion, anosmia, nausea, vomiting.[15]

Considering cardiovascular risk factors among male and female Smoking were 160 (60.8%) vs. 38 (26.2%), Hypertension were 105 (39.9%) vs. 65 (44.8%), Diabetes Mellitus were 71 (27.0%) vs 55 (37.9%), Dyslipidemia were 69 (26.2%) vs. 36 (24.8%), Family history of CVD were 55 (20.9%) vs.20 (13.8%) and Clustering of risk factors (≥2 factors) were 117 (44.5%) vs. 74 (51.0%). Other study showed Total 51 patients (51.0%) had comorbidities. Hypertension (21%), diabetes mellitus (16%), heart diseases (8%) and renal diseases (8%) were frequent Thirteen out of hundred patients had history of smoking.[15]

Risk factors, clinical findings and outcomes in patients with hypertension, diabetes and smoking/tobacco use, Hematological and biochemical parameters did not show significant inter-group differences. Patients with known hypertension were older and had higher prevalence of diabetes, cardiovascular disease, hypothyroidism and smoking/tobacco.[17]

Among the study population 81 (19.9%) needed oxygen therapy and maximum number of patients 34 (42.0%) were in 61-80 years age group, 50 (12.3%) needed Non-invasive ventilation and maximum number of patients 19 (38.0%) were in 61-80 years age group, 34 (8.3%) patients needed Mechanical Ventilation and maximum number of patients 18 (52.9%)were in 61-80 years age group. Among the study subjects total 27 (6.61%) expired and maximum number of patients 15 (55.6%) were in 61-80 years age group.

Regression analysis for the predictors of adverse in hospital outcome among the Cardiovascular risk factors showed Age (>60yrs) (p= 0.034), BMI (>25) (p= 0.026), Smoking (p= 0.041), Hypertension (p= 0.037) Diabetes Mellitus (p= 0.013), Dyslipidemia (p= 0.021) and Clustering of risk factors (≥2) (p= 0.012) were statistically significant contributors.

Other study showed regarding the comorbidity status, hypertension, heart disease and renal disease were significantly (p<0.001) associated with death. Other comorbidities were not significantly (p>0.05) associated with death. Multivariate logistic regression analysis revealed that only smoking and renal disease were independently and significantly (p<0.05) associated, having OR = 9.95 (95% CI 1.73- 57.12) and OR = 9.43 (95% CI 1.12 -79.23) respectively.[15]

Previous meta-analyses including studies from India have identified diabetes as equally important as hypertension for adverse COVID-19 related outcomes.[11,12] In the present study the unadjusted OR for diabetes and deaths were 1.88 (CI 1.46–2.43), however, the risk significantly attenuated after age and sex adjustment to OR 1.16 (CI 0.89–1.52) which is different from the previous studies.[17]

Another study showed in patients admitted to the ICU, we found a trend towards increased mortality, with an ICU mortality of 27.2%, 29.1%, 40.1% for patients with 0, 1 and ≥2 CVD-risk factors (p=0.055). In Cox regression analysis, a 5-year age increase was associated with an HR 1.37, 95% CI 1.31 to 1.45) for mortality, while there was no significant association with sex (HR 1.02, 95% CI 0.81 to 1.28). The presence of two or more cardiovascular risk factors was significantly associated with overall mortality (HR 1.52, 95% CI 1.15 to 2.02), but not with ICU admission or ICU mortality. After additional adjustment for smoking, obesity and the combined use of beta-blockers and platelet aggregation inhibitors the presence of two or more risk factors remained associated with mortality (HR 1.38, 95% CI 1.02 to 1.86), while there was no increased risk in the group with 1 CVD risk factor (HR 1.01, 95% CI 0.73 to 1.39).[16]

Oxygen requirement, non-invasive as well as invasive ventilation were more in older age-groups (40–59 and 60 years) with graded escalation. Deaths were significantly higher in age-group 40–59 (7.1%) and 60 (15.0%) when compared to <40 years (2.1%). Women were less literate and had lower prevalence of hypertension, diabetes and tobacco use. Oxygen requirement was significantly more in women while requirement of non-invasive or invasive ventilation were not different. Hematological and biochemical parameters were not significantly different and are not shown. Number of in hospital deaths were significantly more in men (n = 282, 8.3%) as compared to women (n = 58, 4.6%) (Fig 2) with univariate OR 1.88, (95% CI 1.41–3.51).[17]

We also performed age-sex adjusted and multivariate analyses to determine association of various cardiovascular risk factors with COVID-19 related in-hospital mortality and other outcomes. Age 60 years vs <40 years emerged as the most important risk factor with significantly greater deaths on univariate, sex-adjusted and multivariate analyses. In age-group 40–59 years also deaths were significantly higher than <40 y on univariate and multivariate analyses. On univariate analyses, male sex, hypertension diabetes and tobacco were associated with significantly more deaths. There was moderate attenuation of significance with age and sex adjusted analyses, but hypertension and tobacco use continued to be significant. Following multivariate analyses significance of all the risk factors completely attenuated (Fig 3). Analyses of secondary outcomes show that in patients age 60 years as well in age-group 40–59 years, compared with <40 years, the need for invasive ventilation as well as non-invasive ventilation were higher.[17]

Conclusion:

In conclusion, this study shows that Age (>60yrs), BMI (>25), Smoking, Hypertension, Diabetes Mellitus, Dyslipidemia, Clustering of risk factors (≥2) have greater risk of adverse outcomes including death from COVID-19. It is recommended that individuals with cardiovascular risk factors, especially older men and women, should be focus of public health measures and must be informed regarding increased risk of death in COVID-19. Moreover, these high risk individuals must aggressively follow all non-pharmacological physical measures for prevention. Clinicians are advised to seek early evidence of deterioration of pulmonary function and signs of cardiovascular and extra pulmonary manifestation of acute COVID-19 in these patients and provide optimum management. It is likely that with proper preventive and therapeutic interventions the higher risk of adverse outcomes in COVID-19 patients with cardiovascular risk factors can be mitigated. Mechanistic studies investigating how CVD risk factors disproportionately affect COVID-19 patients compared with other infectious diseases are warranted. We need to be more vigilant in controlling CVD risk factors since it not only increases the morbidity of non-communicable diseases, but also poses to and worsens the outcome of communicable diseases.

Conflict of interests

The authors declare that there is no conflict of interests.

References:

1 World Health Organization. Coronavirus disease 2019 (COVID-19), situation report 92.

2 Lipsitch M, Swerdlow DL, Finelli L. Defining the epidemiology of Covid-19 — studies needed. N Engl J Med Overseas Ed 2020;382:1194–6.

3 Wilkins JT, Ning H, Berry J, et al. Lifetime risk and years lived free of total cardiovascular disease. JAMA 2012;308:1795–801.

4 Zhou F, Yu T, Du R, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020.

5 Zheng Y-Y, Ma Y-T, Zhang J-Y, et al. COVID-19 and the cardiovascular system. Nat Rev Cardiol 2020;17:259–60.

6. World Health Organization. The true death toll of COVID-19: estimating global excess mortality; 2021 [cited 2022 18/10/2022]. Available from: https://www.who.int/data/stories/the-true-death-toll-ofcovid- 19-estimating-global-excess-mortality.

7. Williamson EJ, Walker AJ, Bhaskaran K, et al. Factors associated with COVID-19-related death using OpenSAFELY. Nature. 2020;584(7821):430–436.

8. Strongman H, Carreira H, De Stavola BL, Bhaskaran K, Leon DA. Factors associated with excess all-cause mortality in the first wave of the COVID-19 pandemic in the UK: a time series analysis using the Clinical Practice Research Datalink. PLoS Med. 2022;19(1): e1003870.

9. Barron E, Bakhai C, Kar P, et al. Associations of type 1 and type 2 diabetes with COVID-19-related mortality in England: a wholepopulation study. Lancet Diabetes Endocrinol. 2020;8(10):813–822.

10. Pepera G, Tribali MS, Batalik L, Petrov I, Papathanasiou J. Epidemiology, risk factors and prognosis of cardiovascular disease in the Coronavirus Disease 2019 (COVID-19) pandemic era: a systematic review. Rev Cardiovasc Med. 2022;23(1):28.

11. Assessing Risk Factors for Severe COVID-19 Illness | CDC. (2020) Available at: https://www.cdc.gov/coronavirus/2019-ncov/covid-data/investigations-discovery/assessingrisk-factors.html [Accessed July 14, 2020]

12. National Report Volume-04: Socio economic and Demographic Report. (2011) Available at: http://www.bbs.gov.bd/site/page/47856ad0-7e1c-4aab-bd78-892733bc06eb/Population-&- Housing [Accessed July 14, 2020]

13. Chowdhury MZI, Anik AM, Farhana Z, Bristi PD, Abu Al Mamun BM, Uddin MJ, Fatema J, Akter T, Tani TA, Rahman M, et al. Prevalence of metabolic syndrome in Bangladesh: A systematic review and meta-analysis of the studies. BMC Public Health (2018) 18:308. doi:10.1186/s12889-018-5209-z

14. Mitra DK, Mistry SK, Afsana K, Rahman M. Demographic, Socio-economic and Lifestyle Determinants of Under- And Over-nutrition among Bangladeshi Adult Population: Results from a large cross-sectional study. J Epidemiol Glob Health (2018) 8:134–142. doi:10.2991/j.jegh.2018.03.002

15. SGM Mowlaa, KAK Azadb, A Kabirc, S Biswasd, MR Islame, GC Banikf, MMH Khang, KMI Rohanh, MA Alami, Clinical Profile of 100 Confirmed COVID-19 Patients Admitted in Dhaka Medical College Hospital Dhaka, Bangladesh. Journal of Bangladesh College of Physicians and Surgeons (July 2020) Vol. 38, COVID-19 (Supplement Issue)

16. Didier Collard, Nick S Nurmohamed, Yannick Kaiser, Laurens F Reeskamp , Tom Dormans, Hazra Moeniralam, Suat Simsek, Renee Douma, Annet Eerens, Auke C Reidinga, Paul W G Elbers, Martijn Beudel, Liffert Vogt, Erik S G Stroes, Bert-Jan H van den Born. Cardiovascular risk factors and COVID-19 outcomes in hospitalised patients: a prospective cohort study.BMJ Open 2021;11:e045482. doi:10.1136/bmjopen-2020-045482

17. Arvind K. SharmaID, Vaseem Naheed BaigID, Sonali SharmaID, Gaurav Dalela, Raja Babu Panwar, Vishwa Mohan KatochID, Rajeev GuptaI, Cardiovascular risk factors and outcomes in COVID-19: A hospital-based study in India. PLOS Global Public Health 2022; 2(4): e0000234. https://doi.org/ 10.1371/journal.pgph.0000234

Association of Fragmented QRS Complex with Short Term Outcome in Patients with Acute ST-Elevation Myocardial Infarction

Basudev Kumar Kashyapi[1], Abdul Wadud Chowdhury[2], Md. Gaffar Amin[3], Kazi Nazrul Islam[3], ATM Mahfuzul Hoque[4], A.B.M. Riaz Kawsar[5], Isha Abdullah Ali[6], A.B.M. Shafiuzzaman[7], Khandakar Aisha Siddika[8]

Abstract:

Background: Acute ST-elevated myocardial infarction is a life-threatening condition. Presence of fragmented QRS (fQRS) after acute STEMI is associated with alteration of myocardial activation due to myocardial scar and myocardial fibrosis. Previous studies have suggested that fQRS in acute STEMI is associated with increased mortality, morbidity, sudden cardiac death and recurrent adverse cardiovascular events. The study was designed to assess the association of fQRS complex with short-term outcome (in hospital and 30 days follow up) in patients with acute ST elevation myocardial infarction.

Methods: This prospective cohort study was conducted in the Department of Cardiology, Dhaka Medical College Hospital among the STEMI patients who were thrombolysed. All patients underwent serial ECG at admission, within first 12 hours, at 24 hours and at 48 hours for detecting the presence of fQRS complex. Patients showing fQRS involving infarct territory within 48 h of admission were included in the "fQRS group" and those who did not develop fQRS within 48 h of admission were included in the "without fQRS" group. 114 patients had fQRS complex and 104 patients were without fQRS in their ECG. In-hospital outcomes such as: death, heart failure, significant arrhythmias (VT, VF AF, SVT, 2° AV block, CHB), cardiogenic shock were recorded. Among the study patients, sixteen patients were lost to follow up in 30 days of index hospitalization. Finally, 202 patients were tracked for follow up regarding death or re hospitalization information by personal contact or over telephone. Statistical analysis was performed using the statistical package for social science (SPSS) 21.0 software for windows.

Results: Appearance of fQRS complex occurred at admission, within first 12 hours, 24 hours and 48 hours in 53.5%, 23.7%, 14.9% and 7.9% cases respectively. During index hospitalization, development of cardiogenic shock (27.19% vs 11.54%), heart failure (23.68% vs 9.62%) and significant arrhythmias were significantly higher in fQRS group (42.10% vs 11.53%, p<0.05). Although mean duration of hospitalization was similar in both groups (p>0.05), but in-hospital mortality was higher in fQRS group (11.40% vs 3.85%, p<0.05). Rate of re-hospitalization was significantly higher in patients with fQRS complex (21.69% vs 7.29% p<0.05). Overall mortality within 30 days of index hospitalization follow-up also differs significantly in presence of fQRS complex (19.81% vs 5.2%; p =0.006).

Conclusion: Presence of fQRS complex is associated with adverse short-term outcome in patients with acute ST elevation myocardial infarction. Hence, these patients need more aggressive and early invasive treatment to reduce morbidity and mortality.

Keywords: *Fragmented QRS, short term outcome, STEMI*

(Bangladesh Heart Journal 2024; 39(2): 93-101)

1. Medical Officer, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh
2. Professor & Head of the Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
3. Associate Professor, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
4. Assistant Professor, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh
5. Assistant Professor, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh
6. Registrar and Specialist, Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka, Bangladesh
7. Junior Consultant (Cardiology), Bangabhaban Dispensary, President Office, Dhaka, Bangladesh
8. Junior Consultant, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh

Address of Correspondence: Dr. Basudev Kumar Kashyapi, Medical Officer, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh Mobile: +8801715054987, E-mail: basurmc@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75781

Introduction:

Coronary artery disease is major cause of mortality globally and this health problem is reaching pandemic in developed as well as in developing countries.[1] According to an estimate by World Health Organization (WHO) in 2012, about one third of all deaths globally were attributed to CVD, and 7.4 million of those results from ischaemic heart disease.[2] Despite decreasing mortality trends of coronary artery disease (CAD) in many developed countries, increasing number is noticed in developing countries.[3] The ST-segment elevation myocardial infarction (STEMI) is a critical and acute disease that is life threatening to patients. The STEMI patients always have a higher incidence rate of in-hospital mortality and in-hospital adverse cardiovascular events.[4] Despites major advances in cardiac imaging techniques, the standard 12-lead electrocardiogram (ECG) continues to be the most used tool for the diagnosis, early risk stratification, triage and determination of appropriate therapies in patients with acute STEMI. Recent studies have shown that some of the newer ECG parameters can also be used to determine if patients are at higher risk. The most important of these new ECG parameters are fragmented QRS (fQRS) and QRS distortion.[5] Das, et al., (2006) defined fQRS as the QRS complex with the presence of an additional R wave (R') or notching in the nadir of the R wave or the S wave, or the presence of >1 R' (fragmentation) in 2 contagious leads, corresponding to a major coronary artery territory.[6] Data suggest that fQRS occurs in different populations such as coronary artery disease, cardiomyopathies, arrhythmogenic right ventricular cardiomyopathy, Brugada syndrome, congenital heart disease, and long QT syndrome.[7] fQRS occurrence varies from 34% to 60% in patients with acute coronary syndrome (ACS) and usually appears within 48 hours.[8] It is not related to the type of myocardial infarction (MI) [ST-elevation MI (STEMI) or non-ST elevation MI (NSTEMI)].[9] Moreover, several reported that QRS fragmentations on surface ECG have been associated with larger infarcted area as well as with increased mortality, morbidity, sudden cardiac death and recurrent adverse cardiovascular events.[8,10,11] According to a study, cardiac fibrosis was the main causative mechanism for fQRS. Additionally, fQRS may represent altered ventricular depolarization, which can be derived from mechanisms such as non-homogeneous activation of ischemic ventricles in the setting of STEMI.[12]

QRS fragmentation has been identified as a marker of myocardial depolarization abnormalities and has been linked to poor long-term outcome in patients with ischemic as well as non-ischemic heart disease.[10] Kothi, et al., (2015) in their study found that, patients with fQRS had higher CK-MB levels on admission, low left ventricular ejection fraction compared to fQRS negative group.[11] In one study, patients with fQRS complexes on lead V4 -V6 in first acute anterior STEMI was associated with left ventricular apical thrombus formation.[13] fQRS predicts short-term and long- term mortality and major cardiac events and thus is helpful in risk stratification in patients with STEMI.[9] Therefore, the aim of present study was to assess the short-term outcome of fQRS complex in patients with acute STEMI.

Methods:

This prospective cohort study was conducted at the Department of Cardiology, Dhaka Medical College Hospital (DMCH), Dhaka between October, 2018 to September, 2019. The study protocol was approved by Ethical Review Committee (ERC) of Dhaka Medical College and Hospital. All the newly diagnosed acute STEMI patients admitted in the Department of Cardiology, DMCH within the study period who were thrombolysed and fulfilling the inclusion and exclusion criteria were included in this study by convenient purposive sampling Study subjects who came with late presentation after symptom of onset (>12 h), had contraindication for thrombolysis, who were not thrombolysed, had history of prior MI /PCI /CABG, significant primary valvular or congenital heart disease, having fQRS in previous ECG, bundle branch block on ECG (LBBB or RBBB), dependent on permanent pacemaker pacing, having other comorbidities such as chronic kidney disease, chronic liver disease, malignancy and unwilling to participate in the study were excluded. The study subjects were assessed first by attending doctor and then was evaluated by the principal investigator. Detailed history, physical examination and 12 lead standard surface ECG were done. Written consent was taken from the patient or accompanying attendant. All the subjects were evaluated for demographic profile (age, sex); and risk factors for coronary artery disease like diabetes, hypertension, dyslipidemia, smoking and family history of premature coronary artery disease. After thrombolysis, all patients were closely monitored in the coronary care unit. All patients underwent serial ECG at admission, within first 12 hours, at 24 hours and at 48 hours for detecting the presence of fQRS complex. Patients who showed fQRS involving infarct territory within 48 hours of admission were included in the "fQRS" group. Patients who did not develop fQRS within 48 hours of admission were included in the "without QRS" group. In-hospital

outcomes such as death, significant arrhythmias (VT, VF, AF, SVT, 2° AV block, CHB), heart failure, cardiogenic shock and outcome within 30 days of index hospitalization like death and re-hospitalization were recorded. All the information were recorded properly in the preformed data collection sheet and kept confidential. After compiling data from all patients, statistical analysis was done.

Results:

In this study, 114 patients had fQRS complex and 104 patients had no fQRS in their ECG. 16 patients were lost to follow up in 30 days of index hospitalization. So, finally at 30 days of index hospitalization, 202 patients were tracked & included in the study. Among them, 106 patients belonged to 'fQRS' group and 96 patients belonged to 'without fQRS' group.

Fig.1 shows that majority (43.1 %) of patients belonged to 50 - 59 years age group. The least number (3.2 %) of patients belonged to < 40-year age group.

In our study, patients with fQRS complex were significantly older (≥50 years) than patients without fQRS group (59.04±9.74 vs 55.76±8.99 years, p=0.01). Males were more prone to have fQRS after acute STEMI than females (85.96 vs 14.04, p= 0.005). The findings are depicted in Table I.

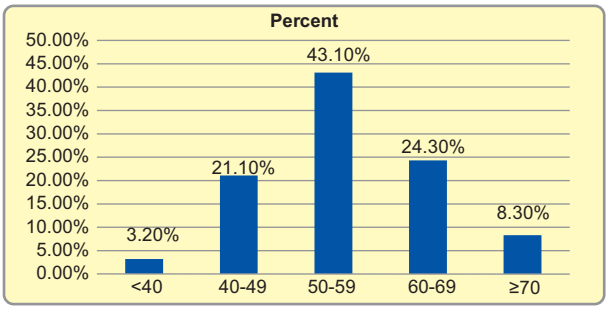

Figure 1: *Age distribution of study patients. (n=218)*

Figure 2 shows that, according to territory of STEMI, majority of acute STEMI was anterior (49.08%) followed by inferior (47.71%) and lateral (3.21%). Majority patients with fragmented QRS had inferior MI (54.39%) whereas majority of patients without fragmented QRS had anterior MI (55.77%).

In our study, 52.3% patients had fragmented QRS complex and 47.7% were without fragmented QRS complex.

Table-I

Demographic characteristics of acute STEMI patients with and without fQRS (n=218)

Parameter		With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
Age (in years)(Mean±SD)		59.04±9.74	55.76±8.99	57.43±9.40	[a]0.01[s]
Age group					
≥50 years		97(85.09%)	68(65.38%)	165(75.69%)	
<50 years		17(14.91%)	36(34.62%)	53(25.31%)	[b]0.001[s]
Sex	Male	98(85.96%)	73(70.19%)	171(78.44%)	[b]0.005[s]
	Female	16(14.04%)	31(29.81%)	47(21.56%)	

[a]p-value is determined by independent sample t-test. [b]p-value is determined by Chi-square test.
s= Significant

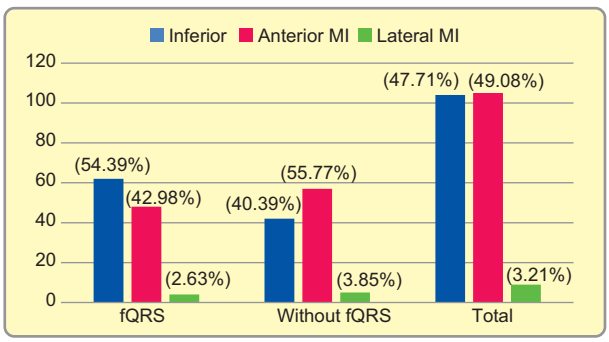

Figure 2: *Territory of STEMI among study patients (n=218)*

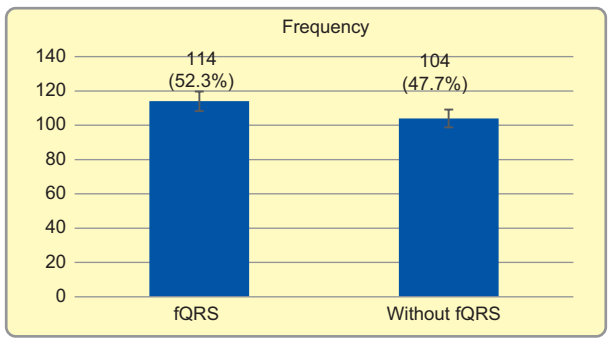

Figure 3: *Distribution of fQRS complex among the study patients. (n=218)*

Majority (53.5%) of patients developed fragmented QRS complex at admission, 23.7% within 12 hours of admission, 14.9% at 24 hours and 7.9% at 48 hours of admission.

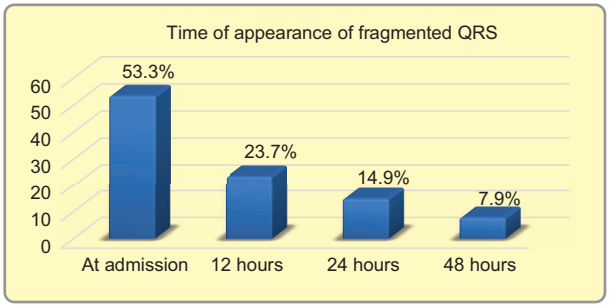

Figure 4: *Time of appearance of fragmented QRS among study patients (n=218)*

Among 218 patients, majority had a history of HTN (62.84%) followed by dyslipidemia (61.93%) and DM (37.61%); all of the risk factors had no statistically significant difference in distribution between the two groups (p value >0.05).

On admission, mean systolic BP and diastolic BP were significantly higher in patients with fQRS group (128.33±32.35 vs 117.12±22.94; p=0.004) and (84.12±17.23 vs 73.46±12.68; p<0.001) compared to without fQRS group. Similarly irregular pulse was significantly higher in fQRS group (9.65% vs 1.92%; p=0.016).

Table IV shows that, 27.19 % patients developed cardiogenic shock in fQRS group, 23.68% of fQRS patients developed heart failure which was statistically significant. Total 27.52% patients developed different types of arrhythmias which were more in fQRS group. Among the arrhythmias, VT (16.67% vs 4.81%) and AF (9.65% vs 1.92%) were statistically significant in fQRS group.

In this study, patients with fragmented QRS had significantly higher (11.40%) mortality rate compared to those without fragmented QRS (3.85%), (p= 0.016). However, duration of hospital stay was similar in both groups.

Table VI shows that, total 30 days mortality in fragmented QRS group was significantly higher compared to those without fragmented QRS (19.81% vs 5.2%, p=0.006). Re-hospitalization within 30 days of index hospitalization was also higher (21.69%) among patients with fragmented QRS compared to without fragmented QRS group (7.29%). (p=0.013).

Multivariate logistic regression analysis was done to see the overall combined effects of determinants of short-term adverse outcome among acute STEMI patients. Age e”50 years and fQRS were found to retain the significance as an independent risk factor with the OR of 3.64 and 4.18 respectively.

Table-II

Distribution of risk factors among acute STEMI patients with and without fQRS. (n=218)

Parameter	With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
Smoking				0.100^{ns}
Current	44(38.59%)	26(25%)	70(32.11%)	
Past	32(28.07%)	36(34.62%)	68(31.19%)	
Never	38(33.33%)	42(40.38%)	80(36.7%)	
HTN	75(65.79%)	62(59.62%)	137(62.84%)	0.346^{ns}
DM	41(35.96%)	41(39.42%)	82(37.61%)	0.599^{ns}
Dyslipidaemia	75(65.79%)	60(57.69%)	135(61.93%)	0.219^{ns}
Family history of premature CAD	25(21.93%)	16(15.38%)	41(18.81%)	0.217^{ns}

(p-value is determined by Chi-square test)
ns= Not significant

Table-III

Clinical characteristics of acute STEMI patients with and without fQRS on admission (n=218)

Parameter	With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
Systolic BP (mmHg) (Mean±SD)	128.33±32.35	117.12±22.94	122.98±28.73	[a]0.004[s]
Diastolic BP (mmHg) (Mean±SD)	84.12±17.23	73.46±12.68	79.04±16.11	[a]<0.001[s]
Pulse				[b]0. 016[s]
Regular	103(90.35%)	102(98.07%)	205(94.04%)	
Irregular	11(9.65%)	2(1.92%)	13(5.96%)	

[a]p-value is determined by independent sample t-test.
[b] p-value is determined by Chi-square test.
S=Significant

Table-IV

In-hospital short term outcome in acute STEMI patients with and without fQRS (n=218)

Parameter	With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
Cardiogenic shock	31(27.19%)	12(11.54%)	43(19.72%)	0.004[s]
Heart failure	27(23.68%)	10(9.62%)	37(16.97%)	0.006[s]
Complete heart block	12(10.53%)	5(4.81%)	17(7.80%)	0.116[ns]
Significant arrhythmias	48 (42.10%)	12 (11.53%)	60 (27.52%)	<0.001[s]
VT	19(16.67%)	5(4.81%)	23(10.55%)	0.001[s]
VF	6(5.26%)	2(1.92%)	8(3.67%)	0.342[ns]
SVT	12(10.53%)	4(3.85%)	16(7.34%)	0.1[ns]
AV block	10(8.77%)	3(2.89%)	16(7.34%)	0.122[ns]
AF	11(9.65%)	2(1.92%)	14(6.42%)	0.034[s]

p-value is determined by Chi-square test
s=Significant
ns=Not significant

Table-V

Duration of hospital stay and in hospital mortality of acute STEMI patients with and without fQRS (n=218)

Parameter	With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
Hospital duration (Mean±SD) in days	5.44±1.62	5.37±1.26	5.4±1.46	[a]0.709[ns]
In-hospital mortality	13(11.40%)	3(3.85%)	16(7.34%)	[b]0.016[s]

[a]p-value is determined by independent sample t-test.
[b]p-value is determined by Chi-square test.
s=Significant, ns=Not significant

Table-VI

Outcome within 30 days of index hospitalization among acute STEMI patients with and without fQRS (n=202)

Parameter	With fQRS (n=114) No. (%)	Without fQRS (n=104) No. (%)	Total (n=218) No. (%)	p value
30 days mortality	21(19.81%)	5(5.2%)	26(12.62%)	0.006[s]
Re-hospitalization	23(21.69%)	7(7.29%)	30(14.85%)	0.013[s]

p-value is determined by Chi-square test
s=Significant

Table-VII

Multivariate logistic regression analysis to detect independent predictors of short-term adverse outcome among acute STEMI patients (n=218)

Variable of interest	OR	95% CI		p value
		Lower bound	Upper bound	
Age ≥50 years	3.64	1.23	9.39	0.03[s]
Male	2.03	0.25	7.05	0.28[ns]
fQRS	4.18	1.15	12.17	0.03[s]

s=Significant
ns=Not significant

Discussions:

This prospective cohort study was performed in the Department of Cardiology, Dhaka Medical College Hospital, Dhaka during the period from October 2018 to September 2019. The general objective of the study was to find out the association of fragmented QRS (fQRS) complex with short term outcome in patients with acute STEMI. Two hundred and eighteen hospitalized patients having first acute STEMI and who were thrombolysed were included in this study after fulfilling the inclusion and exclusion criteria. Then they were divided into two groups, patients with fQRS group and patients without fQRS group based on the appearance of fQRS within 48 hours of admission in surface ECG. Among them sixteen patients were lost to follow up within 30 days of index hospitalization. Finally, 202 patients were tracked within 30 days of index hospitalization and included in the study

In this study, among the 218 patients, the mean age of total patients was 57.43±9.40 (ranges 35-81) years. The mean age of patients with fQRS group was 59.04±9.74 and patients without fQRS was 55.76±8.99 years. Tanriverdi, et al., (2015) also found that mean age of the patients was 63.2 ± 11.9 years.[5] Attachaipanich and Krittayaphong, (2019) in their study found that the mean age of the patients was 58.31±10.53 years.[14]

In our study, males were predominant 171 (78.44%). Male and female ratio was 3.64:1. Sex distribution between 'fragmented QRS' group and 'without fragmented QRS' group was statistically significant (p-value 0.005). Attachaipanich and Krittayaphong, (2019) found 76.1% males out of 452 patients in their study on fragmented QRS as a predictor of in-hospital life-threatening arrhythmic complications in STEMI patients.[14]

In this study, 114 (52.3%) patients had fQRS and 104 (47.7%) patients had no fQRS in surface ECG. Majority of the patients developed fQRS at admission (53.5%). Umapathy, et al., (2018) found around 61.5% of study subjects had fQRS in surface ECG, of which 42.2% developed at admission.[9] But Attachaipanich and Krittayaphong (2019) found only 21.2% STEMI patients had fragmented QRS complex in their study.[14] In many studies, fQRS rates have been reported to be between 28 and 54%.[8,11,15,16] The reasons of fQRS rates distribution over such a wide range may be due to the differences between studies regarding treatment methods used, periods of time in which fQRS were evaluated, and variability in the ranges of ûlters adopted in ECG imaging.

In this study, 49.08% had anterior wall, 47.71% had inferior wall and 3.21% had lateral wall involvement.

Majority of patients with fragmented QRS had inferior MI (54.39%) whereas, majority patients without fragmented QRS had anterior MI (55.77%). Difference in distribution of site of infarction between these two groups was statistically not significant (p value 0.117). In the study of Attachaipanich and Krittayaphong, (2019), distribution of inferior wall MI, anterior wall MI, and lateral wall MI among study subjects was 51%, 49% and 14.6% respectively.[14] Xia and Feng, (2018); Lorgis, et al., (2013) reported that fQRS was most often detected by inferior ECG leads (57%) with no significant differences between fQRS group and without fQRS group.[4,17]

In this study, mean systolic BP and diastolic BP of all patients with acute STEMI was 122.98±28.73 and 79.04±16.11 mm Hg respectively with 94.04% regular pulse: all of which was statistically significant between patients with and without fragmented QRS complex (p<0.05). Xia and Feng, (2018) found significantly higher hemodynamic instability rates in the f-QRS group (41%) compared to the patients without fragmented QRS group (25%).[4]

In our study, 63.3% patients were smoker and about 18.81% had a family history of CAD; both of which had no statistical significance between two groups (p >0.05). The majority had a history of HTN (62.84%) followed by dyslipidemia (61.93%) and DM (37.61%); all of which had no statistically significant difference in distribution between with and without fragmented QRS (p>0.05). Kothi, et al., (2015) also found no statistical significance regarding smoking, hypertension, diabetes, family history of CAD.[11] Several other studies also noted similar findings (Cho, et al., 2019 and Umapathy, et al., 2018)[9,15]

In this study, 19.72% patients developed cardiogenic shock and 16.97% had heart failure (p <0.05). Around 7.80% had complete heart block which was statistically not significant. 27.52% patients had developed different types of arrhythmias, of which significant arrhythmias were predominant in patients with fQRS group. VT was present in 16.67% of study subjects followed by SVT (10.53%), AF (9.65%), AV block (8.77%) and VF (5.26%). Distribution of different types of arrhythmias was statistically significant between two groups (p-value < 0.001). Erdinler et al., (2014) found 8.3% patients had VT, 12% had VF, 8.3% had cardiogenic shock in fQRS patients compared to patients without fQRS group.[18] These findings are consistent with previously reported findings.[19,20,21,22,23] This relatively high incidence of in hospital life threatening arrhythmias in STEMI patients with fQRS was significantly associated with increased in hospital mortality highlighting the clinical importance of this condition.[14,25]

In this study, mean duration of hospital stays between patients with and without fQRS was 5.44±1.62 days vs 5.37±1.26 days which was statistically almost similar (p-value 0.709). The study of Attachaipanich and Krittayaphong, (2019) also found no significant difference in median length of hospital stay between the fQRS and without fQRS groups (5 days [IQR: 3–9] vs. 5 days [IQR: 3–8], respectively; p = 0.821).[14]

In our study, total in-hospital mortality was 16 (7.34%) whereas patients with fQRS had higher (11.40%) mortality rate compared to patients without-fQRS group (3.85%). The distribution of in-hospital mortality between these two groups was statistically significant p <0.05. Erdinler et al., (2014) also found significantly higher (6.5%) in-hospital mortality among patients with fQRS.[18]

Total 16 (7.34%) patients were lost to follow up within 30 days of index hospitalization period. Total death within 30 days of index hospitalization follow-up period was 26 (12.62%). Among these subjects, 21(19.81%) patients had mortality in fQRS group compared to 5(5.2%) patients in without fQRS group. Re-hospitalization within the above-mentioned period was also higher among patients with fQRS group compared to without fQRS group (21.69% vs 7.29%). Distribution of both death and re-hospitalization between two groups was statistically significant (p <0.05). Xia and Feng, (2018) found 14% mortality of patients with fQRS group compared to 6% in patients without fQRS group after acute STEMI which was statistically significant (p-value 0.010).[4] Almost all other studies found that acute STEMI patients with fragmented QRS always have a higher incidence of in-hospital mortality and in-hospital adverse cardiovascular events. [5,14,24,26]

The mechanism of the association between fQRS and mortality in STEMI has not been fully described in the literature. fQRS has been shown to be associated with multivessel involvement, the presence of a myocardial scar, and left ventricular dysfunction, all of which indicate poor prognosis in STEMI patients.[27] fQRS has also been shown to be associated with ventricular arrhythmias, which could be a potential factor that drives the association between f-QRS and mortality.[8,28] Our study suggests that there were significantly more adverse cardiac events in patients with fQRS group compared to patients without fQRS group. Multiple-factor logistic regression analysis to determine the independent predictors suggests that age ≥50 years and fQRS are independent predictors of adverse short-term outcome in patients with acute STEMI.

Conclusion:

The assessment of fQRS by surface ECG is a simple, widely available and non-invasive modality that maybe useful for identifying patients with higher cardiac risk. This study demonstrated that patients with fragmented QRS complex following acute ST segment elevated myocardial infraction were associated with higher in hospital adverse outcome as well as increased mortality and re hospitalization during 30 days follow-up. Hence, fQRS after STEMI can help us in risk stratification and planning intensive treatment of a sub group of patients to reduce morbidity and mortality.

Limitations of the study:

Although the result of this study supports the hypothesis, there are some facts to be considered which might have affected the result of the current study. It was a single center study. Study population was small. Purposive sampling was done instead of random sampling. Therefore, the results of the study may not reflect the exact picture of the country. Follow up of the patients for longer duration was beyond scope.

Recommendations:

Further prospective study with larger sample and longer follow up period is recommended. Patients with acute STEMI should be screened for fQRS. Early detection of fQRS in patients with acute STEMI should alert us to plan for aggressive treatment for these group of patients.

References:

1. Chaturvedi V and Bhargava B. Health care delivery for coronary heart disease in India—Where are we headed? The American heart hospital journal. 2007;5(1):32–37.
2. WHO, 2017. Cardio-Vascular Diseases. Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds) [Accessed August 28, 2019].
3. Bhatnagar P, Wickramasinghe K, Williams J, Rayner M and Townsend N. The epidemiology of cardiovascular disease in the UK 2014. Heart. 2015;101(15):1182–1189.
4. Xia W and Feng XY. Fragmented QRS (fQRS) Complex Predicts Adverse Cardiac Events of ST-Segment Elevation Myocardial Infarction Patients Undergoing Percutaneous Coronary Intervention and Thrombolysis. Medical Science Monitor. 2018;24:4634–4640.
5. Tanriverdi Z, Dursun H, Simsek MA, Unal B, Kozan O and Kaya D. The Predictive Value of Fragmented QRS and QRS Distortion for High-Risk Patients with STEMI and for the Reperfusion Success. Annals of Noninvasive Electrocardiology. 2015;20(6):578–585.
6. Das MK and Zipes DP. Fragmented QRS: A predictor of mortality and sudden cardiac death. Heart Rhythm. 2009;6(3):S8–S14.
7. Pietrasik G and Zarêba W. QRS fragmentation/ :Diagnostic and prognostic significance. Via Medica. 2012;19(2):114–121.
8. Das MK and El Masry H. Fragmented QRS and other depolarization abnormalities as a predictor of mortality and sudden cardiac death. Current opinion in cardiology. 2010;25(1):59–64.
9. Umapathy S, Yadav R, Goswami Kewal C, Karthikeyan G, Parakh N and Bahl VK. Prognostic significance of fragmented QRS in patients with ST-elevation myocardial infarction undergoing revascularization. Indian Heart Journal. 2018;70(3):S126–S132.
10. Das MK, Michael MA, Suradi H, Peng J, Sinha A, Shen C, et al. Usefulness of Fragmented QRS on a 12-Lead Electrocardiogram in Acute Coronary Syndrome for Predicting Mortality. American Journal of Cardiology. 2009;104(1):1631–1637.
11. Kothi ZS, Mateen Athar A, Yenkanchi AP, Siddiqua A and Hussaini SM. The Usefulness of Fragmented QRS in Predicting the Successful Reperfusion by using non-Invasive Criteria of Reperfusion in STEMI after Thrombolytic Therapy. International Journal of Contemporary Medical Research. 2015;3(10):2393–915.
12. Chatterjee S and Changawala N. Fragmented QRS complex: A novel marker of cardiovascular disease. Clinical Cardiology. 2010;33(2):68–71.
13. Baysal E, Burak C, Yaylak B, Altintaº B, Öztürk Ö, Çiftçi H, et al. Relationship between fragmented QRS complexes in leads V4-V6 and left ventricular apical thrombus formation in patients presenting with first acute anterior myocardial infarction. Turk Kardiyoloji Dernegi Arsivi. 2017;45(3):219-226.
14. Attachaipanich T.and Krittayaphong R. Fragmented QRS as a predictor of in-hospital life-threatening arrhythmic complications in ST-elevation myocardial infarction patients. Annals of Noninvasive Electrocardiology. 2019;24(1):1–8.

15. Cho HJ, Yoon JY, Kim N, Jang SY, Bae MH, Lee JH, et al. Predictive value of a fragmented QRS complex in diagnosing patients with myocardial ischemia. Clinical Cardiology. 2019;42(3):379–384.

16. Ari H, Cetinkaya S, Ari S, Koca V and Bozat T. The prognostic significance of a fragmented QRS complex after primary percutaneous coronary intervention. Heart and vessels. 2012;27(1):20–28.

17. Lorgis L, Jourda F, Hachet O, Zeller M, Gudjoncik A, Dentan G, et al. Prognostic value of fragmented QRS on a 12-lead ECG in patients with acute myocardial infarction. Heart & lung/ : the journal of critical care. 2013;42(5):326–331.

18. Erdinler Ý. The relationship between fragmentation on electrocardiography and in-hospital prognosis of patients with acute myocardial infarction. Medical Science Monitor. 2014;20:913–919.

19. Priori SG, Blomstrom-Lundqvist C, Mazzanti A, Blom N, Borggrefe M, Camm J, et al. 2015 ESC Guidelines for the management of patients with ventricular arrhythmias and the prevention of sudden cardiac death: The Task Force for the Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death of the Europe. European heart journal. 2015:36(4):2793–2867.

20. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: The Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). European Heart Journal. 2017;39(2):119-177.

21. Stavileci B, Cimci M, Ikitimur B, Barman HA, Ozcan S, Ataoglu E, et al. Significance and usefulness of narrow fragmented QRS complex on 12-lead electrocardiogram in acute ST-segment elevation myocardial infarction for prediction of early mortality and morbidity. Annals of noninvasive electrocardiology,/ the official journal of the International Society for Holter and Noninvasive Electrocardiology. 2014;19(4):338–344.

22. Zhang R, Chen S, Zhao Q, Sun M, Yu B and Hou J. Fragmented QRS complex is a prognostic marker of microvascular reperfusion and changes in LV function occur in patients with ST elevation myocardial infarction who underwent primary percutaneous coronary intervention. Experimental and therapeutic medicine. 2017;13(6):3231–3238.

23. Akgul O, Uyarel H, Pusuroglu H, Surgit O, Turen S, Erturk M, et al. Predictive value of a fragmented QRS complex in patients undergoing primary angioplasty for ST elevation myocardial infarction. Annals of noninvasive electrocardiology: the official journal of the International Society for Holter and Noninvasive Electrocardiology. 2015;20(3):263–272.

24. Morita H, Kusano KF, Miura D, Nagase S, Nakamura K, Morita ST, et al. Fragmented QRS as a marker of conduction abnormality and a predictor of prognosis of Brugada syndrome. Circulation. 2008;118(17):1697–1704.

25. Sandau KE, Funk M, Auerbach A, Barsness GW, Blum K, Cvach M, et al. Update to Practice Standards for Electrocardiographic Monitoring in Hospital Settings: A Scientific Statement From the American Heart Association. Circulation. 2017;136(19):e273–e344.

26. Das MK, Saha C, Masry H, Peng J, Dandamudi G, Mahenthiran J, et al. Fragmented QRS on a 12-lead ECG: A predictor of mortality and cardiac events in patients with coronary artery disease. Heart Rhythm. 2007;4(11):1385–1392.

27. Das MK, Suradi H, Maskoun W, Michael MA, Shen C, Peng J, et al. Fragmented wide QRS on a 12-lead ECG: a sign of myocardial scar and poor prognosis. Circulation, Arrhythmia and electrophysiology. 2008;1(4):258–268.

28. Kanjanahattakij N, Rattanawong P, Riangwiwat T, Prasitlumkum N, Limpruttidham N, Chongsathidkiet P, et al. Fragmented QRS and mortality in patients undergoing percutaneous intervention for ST-elevation myocardial infarction: Systematic review and meta-analysis. Annals of Noninvasive Electrocardiology. 2018;23(6):1–7.

Original Article

A Single Center Study on Demographic Profile of Patients Undergoing Coronary Angiogram

Md. Abdul Kader Akanda[1], Abeeda Tasnim Reza[2], Md. Muhtasim Akanda[3]

Abstract:

Background: The aim of this study was to observe demographic profile of patients undergoing coronary angiogram (CAG) in a single center.

Method: The data was derived from a prospective observational study to observe the demographic profile of patients undergoing coronary angiogram for 2 years. A total of 176 patients undergoing coronary angiogram were randomly selected and enrolled from 2018 to 2019 in an urban cardiac hospital of Bangladesh. The study population were divided into two groups with group 1 consisting of patients with normal coronaries (n=45) and group 2 consisting of patients having coronary artery disease (CAD) (n=131). Age, sex, risk factors & investigation findings were noted and compared between two groups.

Results: Most of the patients (120) belonged between 41-60 years age group. This age group had the maximum patients with abnormal CAG & normal CAG. Most of the study populations were male (73.9%). Among the female study population (26.1%), most of them had normal coronaries rather than CAD (52% vs 48%). Most of the study population with abnormal CAGs had normal body mass index (BMI). Those having CAD had higher percentage of risk factors in comparison to those having normal coronaries. Among all the risk factors, there were significant difference in respect of diabetes & smoking between the two groups (p=0.007 & <0.001, respectively). Most of the CAD patients had presence of 2 or more risk factors. Dx: Significant difference was noted among the 2 group in respect of random blood sugar & serum creatinine level. Echo: , TVD, DVD, SVD, LM, Right dominant

Conclusions: Higher percentage of patients undergoing coronary angiogram had abnormal coronaries.

Key words: *demographic profile, coronary angiogram, normal coronaries, coronary artery disease*

(Bangladesh Heart Journal 2024; 39(2): 102-107)

Introduction:

Coronary artery disease (CAD) is the leading cause of death worldwide. Over three quarters of these deaths occur in low and middle income countries[1]. Another data showed that than 4.5 million deaths occurring in the developing world due to CAD[2]. In Bangladesh, according to WHO, the CAD accounted for 75.1 deaths per 100000 populations in the year 2019[3].

In the recent days, there is a certain shift of demographic profile in patients undergoing coronary angiograms to evaluate coronary arteries. More young age group and female patients are undergoing CAGs. CAD also tends to occur earlier in patients more cardiovascular risk factors and involve the coronary tree with more aggressive lesions[4]. Differences were observed in clinical presentations, risk factors and angiographic profile of patients with CAD worldwide[5]. The incidence of cardiac disease in patients having chest pain referred to cardiologist, may be as low as 11–27%[6].

There is lack of data regarding the demographic profile of patients undergoing coronary angiogram in

1. Professor, President, Heart Failure Research Foundation
2. Associate Consultant, Department of Clinical & Interventional Cardiology, Evercare Hospital Dhaka
3. Intern, Green life Medical College & Hospital

Address of Correspondence: Md. Abdul Kader Akanda, Professor, President, Heart Failure Research Foundation, Mobile: 01714445962, E-mail: abeeda.tasnim.rez@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75786

Bangladesh. Thus, this study has been designed to define the regional demographic indicators, main cardiovascular risk factors in Bangladeshi population.

Methods:

Study Population:
The data was derived from a prospective observational study to observe the demographic profile of patients undergoing coronary angiogram for 2 years. A total of 176 patients undergoing coronary angiogram were randomly selected and enrolled from 2018 to 2019 in an urban cardiac hospital of Bangladesh. The study population were divided into two groups with group 1 consisting of patients with normal (n=45) and group 2 consisting of patients having coronary artery disease (CAD) (n=131). Age, sex, risk factors & investigation findings were noted and compared between two groups.

Data collection
Data was collected on patient's demography (age, sex, BMI), risk factors for cardiovascular diseases (CVD) such as diabetes, hypertension, dyslipidemia, family history of IHD & smoking. Clinical diagnosis were recorded. All baseline investigations were done including ECG (Electrocardiogram) & echocardiography following hospital admission. For each study subject, angiographic severity was assessed by number of vessel involvement.

Patient groups
The study population were divided into two groups with group 1 consisting of patients with normal (n=45) and group 2 consisting of patients having coronary artery disease (CAD) (n=131). Both groups were compared.

Study ethics
The study protocol was reviewed and approved by ethical review committee. Informed written consent was obtained from each patient.

Statistical analysis
All data were analyzed with SPSS statistical software version 16.0 (Chicago, Illinois, USA). Continuous variables (age, blood pressure data, and heart rate) were expressed as mean ± standard deviation. The comparison of continuous variables between two groups was performed using the t-test. Categorical variables were expressed as number (n) with regard to percentage (%). The comparison of categorical variables between group 1 & 2 was performed using the chi-square test. $p < 0.05$ was considered statistically significant.

Results:
Demographic & Clinical profile:

In Table I, clinical characteristics of study population with normal & abnormal coronaries are shown. Patients with CAD were older than the normal coronary group. Most of the study populations were male (73.9%). Among the female study population (26.1%), most of them had normal coronaries rather than CAD (52% vs 48%). Most of the study population with abnormal CAGs had normal body mass index (BMI). Those having CAD had higher percentage of risk factors in comparison to those having normal coronaries (Table II, Figure 1). Among all the risk factors, there were significant difference in respect of diabetes & smoking between the two groups (p=0.007 & <0.001, respectively). Most of the CAD patients had presence of 2 or more risk factors (Table III).). Most of the normal & abnormal CAG groups were diagnosed as stable coronary artery disease (Table IV). In CAD patients, next higher percentage belonged to Non ST-ACS patients. Significant difference was noted among the 2 group in respect of random blood sugar & serum creatinine level (Table V). Most of the population of both groups had normal LV systolic function (Table VI).

Angiographic Findings:

Table 7 shows angiographic findings. Most of the patient had right dominance. Among the CAD group, most

Table-I
Demographic profile of patients undergoing coronary angiogram (n=176)

Variables	Coronary angiogram			p-value
	Normal (n=45)	Abnormal (n=131)	Total (n=176)	
Age group (years)	No. (%)	No. (%)	No. (%)	
20-40	7(15.6%)	14(10.7%)	21(11.9%)	
41-60	36(80.0%)	84(64.1%)	120(68.2%)	
61-80	2(4.4%)	33(25.2%)	35(19.9%)	
Mean±SD	48.27±8.43	54.21±9.96	52.69±9.92	<0.001*
Range (min-max)	(30-70)	(29-76)	(29-76)	
Sex				
Female	24(53.3%)	22(16.8%)	46(26.1%)	<0.001*
Male	21(46.7%)	109(83.2%)	130(73.9%)	
BMI (kg/m^2)				
Underweight (<18.5)	0(0.0%)	4(3.1%)	4(2.3%)	0.075
Normal (18.5-24.9)	17(37.8%)	71(54.2%)	88(50.0%)	
Overweight (25.0-29.9)	24(53.3%)	43(32.8%)	67(38.1%)	
Obese (>30.0)	4(8.9%)	13(9.9%)	17(9.7%)	

Table-II

Association of risk factors between normal and abnormal coronary angiogram findings (n=176)

Variables	Coronary angiogram			p-value
	Normal findings (n=45) No. (%)	Abnormal findings (n=131) No. (%)	Total (n=176)	
DM	16(35.6%)	77(58.8%)	93(52.8%)	0.007*
Hypertension	37(82.2%)	95(72.5%)	132(75.0%)	0.195
Smoking	6(13.3%)	63(48.1%)	69(39.2%)	<0.001*
Dyslipidemia	8(17.8%)	34(26.0%)	42(23.9%)	0.267
Family history	15(33.3%)	40(30.5%)	55(31.3%)	0.727

patients had LAD involvement, followed by RCA & then LCX/OM (Figure 2). 14 patients had LM involvement. Most of the patients had double vessel disease, followed by TVD & then SVD (Figure 3).

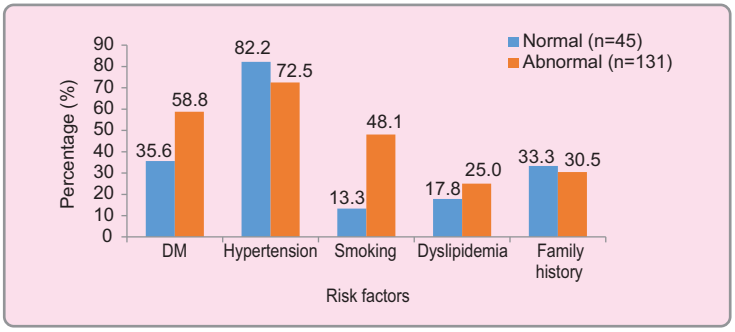

Figure 1: *Bar diagram showing the association of risk factors between normal and abnormal coronary angiogram findings (n=176)*

Table-III

Number of risk factors relation with normal and abnormal coronary angiogram findings (n=176)

Number of risk factors	Coronary angiogram		Total (n=176) No. (%)	p-value
	Normal findings (n=45) No. (%)	Abnormal findings (n=131) No. (%)		
0	0(0.0%	6(4.6%	6(3.4%	0.004*
1	18(40.0%	22(16.8%	40(22.7%	
2	17(37.8%	50(38.2%	67(38.1%	
3	10(22.2%	28(21.4%	38(21.6%	
4	0(0.0%	21(16.0%	21(11.9%	
5	0(0.0%	4(3.1%	4(2.3%	
Total	45(100.0%	131(100.0%	176(100.0%	

Tabl-IV

Comparison of Clinical Diagnosis between normal and abnormal coronary angiogram findings (n=176)

Variables	Coronary angiogram	
	Normal findings (n=45)	Abnormal findings (n=131)
Stable Coronary Artery Disease	35 (77.77%)	61(46.6%)
Old MI	0	22(16.8%)
Acute & Recent MI	0	14(10.7%)
Non ST-ACS	7(15.55%)	34(25.9%)
HCM	2(4.44%)	0
DCM	1(2.24%)	0

Table-V

Comparison of laboratory investigations between normal and abnormal coronary angiogram findings (n=176)

Variables	Coronary angiogram		p-value
	Normal findings (n=45) Mean±SD	Abnormal findings (n=131) Mean±SD	
Hb	12.66±1.62	13.20±1.68	0.061
RBS	6.77±2.27	8.46±3.87	0.006*
Serum creatinine	91.26±19.05	105.32±31.40	0.005*
Uric acid	280.98±128.30	272.16±113.19	0.749
SGPT	45.03±45.18	42.34±24.94	0.668
TC	165.21±35.04	171.69±52.51	0.502
HDL	40.27±7.43	38.58±9.98	0.370
LDL	96.73±38.87	94.92±39.87	0.819
TG	186.61±83.72	202.62±140.54	0.536

Table-VI

Comparison of Left ventricular Function on Echocardiography between normal and abnormal coronary angiogram findings (n=176)

Variables	Coronary angiogram	
	Normal findings (n=45)	Abnormal findings (n=131)
LVEF >50%	42(93.3%)	84(64.1%)
LVEF ≤50%	3(6.7%)	47(35.9%)

Table-VII

Comparison of coronary dominance between normal and abnormal coronary angiogram findings (n=176)

Variables	Coronary angiogram	
	Normal findings (n=45)	Abnormal findings (n=131)
Right Dominant	37(82.2%)	116(88.5%)
Left Dominant	7(15.6%)	14(10.7%)
Co Dominant	1(2.2%)	1(0.8%)

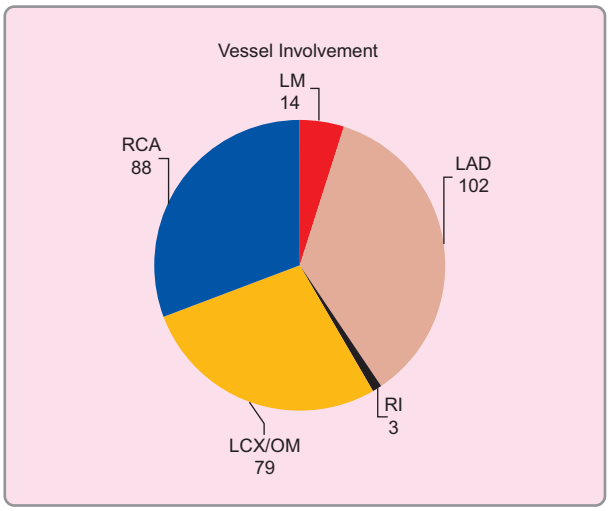

Figure 2: *Pie Diagram of involvement of vessels in abnormal coronary angiogram group (n=131)*

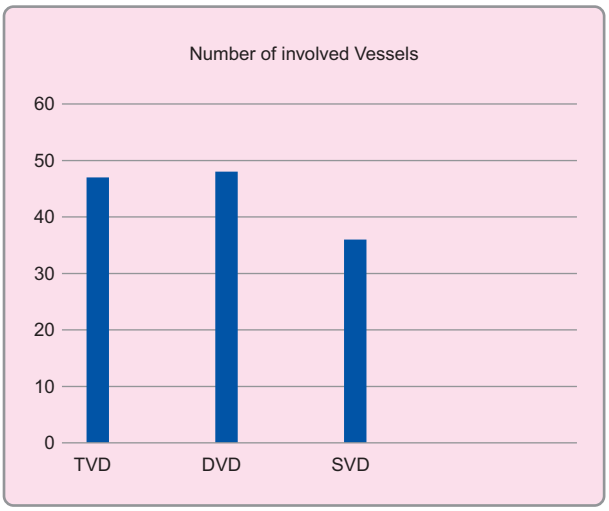

Figure 3: *Bar Diagram of involvement of number of involved vessels in abnormal coronary angiogram group (n=131)*

Discussion:

In this study, we compared demographic, clinical & angiographic characteristics of patients undergoing coronary angiogram to evaluate coronaries.

The percentage of normal coronaries & abnormal coronaries were 25.6% & 74.4% respectively. This findings are consistent with other similar study[7].

The mean age was 48.27±8.43 vs 54.21±9.96 years in normal coronary vs abnormal coronary group indicating elderly people had more occurrence of CAD (Mean age 52.69±9.92). The age of the most patients were 41 years or more. A similar study showed that most of the study population were 33-83 years with a mean (SD) of 55.5 ± 10.4 years which was similar to our study[7].

Majority of the patients were male (73.9% vs 26.18%) respectively indicating a male to female preponderance. This is consistent with other studies done in south-east regions[8, 9]. In the normal coronary group, most were female (53.3% vs 46.7%).

Most of the study population with abnormal CAGs had normal body mass index (BMI), whereas those with normal CAGs were overweight. Studies have shown that obesity had been shown as an independent risk factor for the early incidence of CAD[10].

The most prevalent risk factor among the study population was HTN (82.2% vs 72.5%). Diabetes was the second most prevalent risk factor, followed by smoking, positive family history of CAD & Dyslipidemia. Among all the risk factors, there were significant difference in respect of diabetes & smoking between the two groups (p=0.007 & <0.001, respectively). Most of the CAD patients had presence of 2 or more risk factors (Table 3). A similar study revealed that the highest prevalence was that of hypertension (55.3%), followed by dyslipidemia (42.7%) and T2DM (29%). All com-parisons proved statistically significant. *P*-value d" 0.005[7].

Most of the normal & abnormal CAG groups were diagnosed as stable coronary artery disease (77.77% vs 46.6%). In CAD patients, next higher percentage belonged to Non ST-ACS patients, followed by old MI & acute/Recent MI.

Significant difference was noted among the 2 group in respect of random blood sugar & serum creatinine level. Most of the population of both groups had normal LV systolic function. 3(6.7%) patients with LV systolic dysfunction had normal findings in CAG.

Most of the patient had right dominance. Among the CAD group, most patients had LAD involvement (77.9%), followed by RCA (67.17%) & then LCX/OM (60.3%). 14 patients (10.7%) had LM involvement. Most of the patients had double vessel disease (36.64%), followed by TVD (35.88%) & then SVD (27.48%). In a study done in India showed that SVD was the most common angiographic pattern (50.3%); LAD was the most common vessel involved (65.9%); and majority of the lesions were proximally located (35.8%)[9]. LMCA disease was seen in 4.2% patients, all of whom had multi vessel CAD. This picture indicates more severe CAD is prevalent in Bangladeshi population in comparison to Srinagar, India.

Study limitations:

The major limitation of the study is that this is a single center study with a relatively small number of patients; a multicenter study with larger study cohort may be required to give a better estimate of study parameters.

Conclusions:

The demographic, clinical & angiographic variables were compared in a study population undergoing coronary angiogram. This study showed that CAD is prevalent among older age group, male sex & those having 2 or more coronary risk factors. The angiographic findings also suggest that severity of CAD with multiple vessel involvement was more in the study population having abnormal coronaries.

References:

1. Naghavi M, Wang H, Lozano R, et al. Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990– 2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. 2015;385:117–171.
2. GBD 2015 Mortality and Causes of Death Col-laborators. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet 2016; 388: 1459-1544.
3. WHO 2019.Bangladesh (who.int)
4. Mohammad AM, Jehangeer HI and Shaikhow SK. Prevalence and risk factors of premature coronary artery disease in patients undergoing coronary angiography in Kurdistan, Iraq. BMC Cardiovasc Disord 2015; 15: 155.
5. Beig JR, Shah TR, Hafeez I, Dar MI, Rather HA, Tramboo NA, Lone AA and Rather FA. Clinico-angiographic profile and procedural outcomes in

patients undergoing percutaneous coronary interventions: the srinagar registry. Indian Heart J 2017; 69: 589-596.

6. Kroenke K, Mangelsdorff AD. Common symptoms in am-bulatory care: incidence, evaluation, therapy, and out-come. Am J Med 1989;86:262-6.

7. Mohammad AM, Rashad HH, Habeeb QS, Rashad BH, Saeed SY. Demographic, clinical and angiographic profile of coronary artery disease in kurdistan region of Iraq. American Journal of Cardiovascular Disease. 2021 ;11(1):39-45. PMID: 33815918; PMCID: PMC8012293.

8. 23. Bhatt P, Parikh P, Patel A, Mehta JL, Parikh K (2015) Unique aspects of coronary artery disease in Indian women. *Cardiovasc Drugs Ther.* 29(4): 369–376

9. 24. Beig JR, Shah TR, Hafeez I, Dar MI, Rather HA, Tramboo NA et al (2017) Clinico-angiographic profile and procedural outcomes in patients undergoing percutaneous coronary interventions: the Srinagar registry.
Indian Heart J. 69:589–596.

10. Formentini FS, Zaina Nagano FE, Lopes Neto FDN, Adam EL, Fortes FS, Silva LFD. Coronary artery disease and body mass index: What is the relationship? Clin Nutr ESPEN. 2019 Dec;34:87-93. doi: 10.1016/j.clnesp.2019.08.008. Epub 2019 Sep 14. Erratum in: Clin Nutr ESPEN. 2021 Apr;42:419. PMID: 31677718.

Original Article

Demographics, Clinical Characteristics and In-Hospital Outcome of Coronavirus Disease 2019 (COVID-19) Patients With or Without Diabetes Mellitus

Fazila-Tun-Nesa Malik[1], Md. Kalimuddin[2], Mir Ishraquzzaman[3], Ashok Dutta[4], Smita Kanungo[5], Md. Habibur Rahman[4], Nazmun Laila[5], Md. Shamim Chowdhury[6], Mohammad Abdullah Al Mamun[7], Sohel Reza Choudhury[8].

Abstract:

Introduction: Diabetes Mellitus (DM) is one of the important co-morbidity that may negatively influence the clinical outcome of the coronavirus disease 2019 (COVID-19) if it co-exists. There is a paucity of data regarding the characteristics and outcomes of COVID-19 diabetic patients in comparison to non-diabetic patients. Thus, we aimed to compare demographics and clinical characteristics, and in-hospital outcome in COVID-19 positive patients with or without DM.

Method: This prospective observational study included all consecutive confirmed symptomatic and asymptomatic COVID-19 positive patients from March 8th 2020 to July 7th 2023 at the National Heart Foundation Hospital & Research Institute of Bangladesh. Patients were divided into two groups based on whether they had diabetes: Group I- patients with DM and group II- patients without DM. Baseline and clinical characteristics & in-hospital outcome of patients in both groups were assessed for comparison.

Result: This study included a total of 2506 confirmed COVID-19 positive patients. Of them 1003 (40%) patients had DM (Group-I) & 1503 (60%) were without DM (Group-II). Diabetic COVID-19 positive patients were older (56.87 ±11.84 years vs 45.92 ± 16.91 years; p=0.001) and had more co-morbidities (p= 0.001) than patients without DM. Only 4.2% healthcare personnel had DM. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease (90.4% vs 65.7%; p=0.001); hypertension (84.3% vs 41.4%; p=0.001); chronic kidney disease (47.7% vs 29.8%;p=0.001); smoking (37.8% vs 25.9%; p=0.001); dyslipidemia (37.2% vs 17.4%;p=0.001); and chronic obstructive pulmonary disease/bronchial asthma (7.5% vs 4.3%; p=0.001). Most of the patients with DM (G-I) were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in Group-II patients. Diabetic patients had more severe form of COVID-19 disease {(moderate: 3.5% vs 1.4%; p=0.001), (severe: 9.5% vs 4.1%; p=0.001), and (critical ill: 1.3% vs 0.4%; p=0.01)}.Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) and most of the non-diabetic patients were treated either in home isolation or in institutional isolation (70.4% vs 48.0%; p=0.001). COVID-19 patients with DM had worse outcome than patients without DM (mortality rate- 6.1% vs 2.6%; p=0.001).

Conclusion: COVID-19 diabetic patients were usually older, have more comorbidities, a higher probability of hospitalization, increased risk of severe/critical COVID-19 and associated with higher mortality rate as compared with patients without DM.

Key Ward: *COVID-19, demographics, clinical features, DM, in-hospital outcome*

(Bangladesh Heart Journal 2024; 39(2): 108-116)

1. Professor & Head, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
2. Associate Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
3. Consultant, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
4. Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
5. Assistant Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
6. Registrar, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
7. Associate Professor, Department of Cardiology, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.
8. Professor & Head, Department of Epidemiology & Research, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.

Address of Correspondence: Fazila-Tun-Nesa MaliK, Professor & Head, National Heart Foundation Hospital & Research Institute, Mirpur, Dhaka.Mobile: 01711338292, E-mail: drkalimp@yahoo.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75789

Introduction:

In the 21st century, within two decades three CoVs of the genera â-CoV, namely severe acute respiratory syndrome coronavirus (SARS-CoV), Middle East respiratory syndrome coronavirus (MERS-CoV), and coronavirus disease 2019 (COVID-19) emerged as significant public health concerns[1]. In November 2002, SARS-CoV was first found in Foshan (China), in April 2012, the first case of MERS-CoV was reported in Jordan[1] and in December 2019, COVID-19 was first reported in Wuhan (China), which became the most dangerous contagious infectious disease of the century and emerged as pandemic. Both hyperglycaemia and a history of type 2 diabetes were independent predictors of mortality and morbidity not only in patients with SARS-Cov[2] but also in patients with MERS-CoV.[3] Emerging data showed that DM was associated with 5.3%-58.0% of patients with COVID-19[4]. COVID-19 patients with newly diagnosed diabetes had the highest risk of all-cause mortality compared with COVID-19 patients with known diabetes, hyperglycaemia and normal glucose[5]. DM as a comorbidity in COVID-19 patients significantly increased the risk of poor outcomes such as COVID-19 disease severity, respiratory failure, ICU admission, longer duration of ventilator dependence, increased length of hospital stay, and mortality compared to those patients without the disease[6]. Evolving data showed that SARS-CoV-2 may lead to direct pancreatic harm, which could aggravate hyperglycemia and potentially cause the establishment of diabetes in formerly non-diabetic individuals[7]. SARS-CoV-2 may cause pleiotropic changes in glucose homeostasis, which could exacerbate the pathophysiology of pre-existing diabetes or result in new disease processes[7]. Coexistence of DM and COVID-19 is an unholy situation where in one disease entity tends to compliment the other[8]. Our main objective was to determine and compare demographics and clinical characteristics, and in-hospital outcome in COVID-19 positive patients with or without DM.

Materials and methods

Study design, setting, and population

This prospective observational study was carried-out in the non-COVID tertiary cardiac care hospital (National Heart Foundation Hospital & Research Institute, Dhaka, Bangladesh) from March 08, 2020 to July 07, 2023. All admitted patients, who subsequently got diagnosed as COVID positive and health care personnel of this hospital, who become COVID positive were included in this study. Both symptomatic and asymptomatic patients were included in this study. The study was approved by the Ethics Review Committee of National Heart Foundation Hospital & Research Institute (N.H.F.H. & R.I./4-14/7/AD-1105) and written informed consent was obtained from all patients or patient's attendance.

Definition and variables

DM was defined as fasting plasma glucose e"126 mg/dL (7.0 mmol/L), 2-h plasma glucose e"200 mg/dL (11.1 mmol/L) during an oral glucose tolerance test, glycosylated hemoglobin A1C e"6.5% (48 mmol/mol), or random plasma glucose e"200 mg/dL (11.1 mmol/L), according to the American Diabetes Association: Standards of Medical Care in Diabetes-2019 [9]. We studied all confirmed symptomatic and asymptomatic COVID-19 patients. Baseline variables, comorbidities, clinical presentation, treatment, and severity of COVID-19 were analysed. Baseline information included gender, age, risk factors and co-morbidities (hypertension, smoking, dyslipidemia, obesity, cardiovascular disease, chronic obstructive pulmonary disease /bronchial asthma (COPD/BA), chronic kidney disease). The degree of severity of COVID-19 were classified as mild, moderate, severe, and critical ill[10,11].

Statistical analysis

Descriptive statistics were used to characterize the study population. Continuous variables are described using the mean and standard deviation (SD), and compared using unpaired student's't' test. Discrete variables were expressed as frequency rates and percentage. Categorical variables between groups were compared using the chi-square test or Fisher's exact test. A p value <0.05 was considered statistically significant. All analyses were performed using SPSS statistical software version 16.0 (SPSS Inc., Chicago, IL, USA).

Results:

During this period a total of 2506 patients were included. Of whom 1003 (40%) patients were in Group-I (with DM) & 1503 (80%) were in Group-II (without DM). The mean age of the patients in Group-I was 56.87 ±11.84 years and in Group-II was 45.92 ± 16.91 years. Male were predominant in both groups (68.8% vs 31.2% and 66.1% vs 33.9%). Only 4.2% healthcare personnel had DM. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease (90.4% vs 65.7%; p=0.001); hypertension (84.3% vs 41.4%; p=0.001); chronic kidney disease (47.7% vs 29.8%;p=0.001); smoking (37.8% vs 25.9%; p=0.001); dyslipidemia (37.2% vs 17.4%;p=0.001); and chronic obstructive pulmonary disease/bronchial asthma (7.5% vs 4.3%; p=0.001). Baseline characteristics of COVID-19 patients with and without DM are presented in Table 1. Most of the patients with DM had multiple comorbidities (Figure 1).

Table-I

Baseline characteristics of patients with COVID-19 with and without DM (n-2506)

Variables	Group-I Diabetes (n=1003) Mean±SD/f(%)	Group-II Non-diabetes (n=1503) Mean±SD/f(%)	P value
Age (Mean±SD) year	56.87 ±11.84	45.92 ± 16.91	0.001#
Gender			
Male	690(68.8%)	(66.1%)	0.16*
Female	313(31.2%)	509(33.9%)	0.16*
Patient category			
HCP	42(4.2%)	409(27.2%)	0.001*
Non-HCP	961(95.8%)	1094(72.8%)	0.001*
Risk factors & comorbidities			
HTN	846(84.3%)	622(41.4%)	0.001*
Smoking	379(37.8%)	390(25.9%)	0.001*
Dyslipidemia	373(37.2%)	262(17.4%)	0.001*
Cardiovascular disease	907(90.4%)	988(65.7%)	0.001*
COPD/BA	75(7.5%)	64(4.3%)	0.001*
Obesity	330(32.9%)	469(31.2%)	0.37*
CKD	478(47.7%)	448(29.8%)	0.001*
Number of comorbidities	0.001*		
<4	539(53.7%)	1208(80.4%)	
≥4	464(46.3%)	295(19.6%)	
Diagnosis	0.001*		
COVID-19 only	92(9.2%)	457(30.4%)	
COVID-19 with heart Disease	911(90.8%)	1046(69.6%)	

COVID-19: coronavirus disease 2019; DM: diabetes mellitus; HCP: healthcare personnel; non-HCP: non-healthcare personnel; SD: standard deviation; HTN: hypertension; COPD: chronic obstructive pulmonary disease; BA: Bronchial asthma; CKD: chronic kidney disease. *Chi square test was done to find out the significance; #Student's 't' test was done to find out the significance.

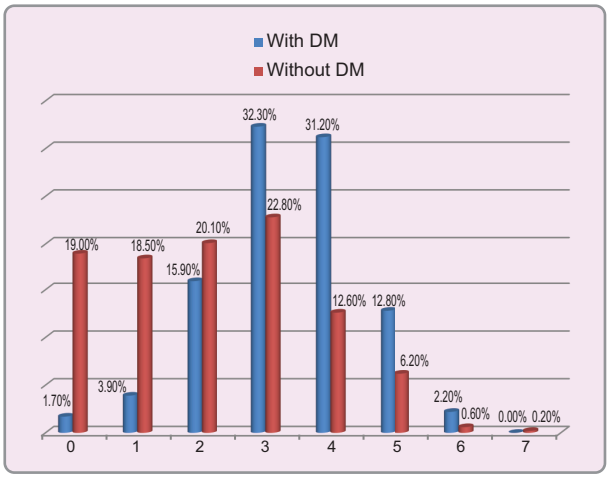

Figure 1: *Bar diagram showing number of comorbidities among patients with COVID-19 positive with (n=1003) or without DM (n=1503)*

COVID-19: coronavirus disease 2019; DM: diabetes mellitus.

Most of the patients with DM (G-I) were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in Group-II patients. Clinical presentations of COVID-19 patients with or without DM are outlined further in Table II.

Patients were treated either in hospital or in isolation. Oxygen therapy (low flow, high flow) was given when required. Prone positioning was advised for all patients. Treatment outline is given in Table 3. Most of the patients with and without DM received ivermectin (381 [38.0%] & 523 [34.8%] respectively). Three patients (0.3%) with DM and one patient (0.1%) without DM received hydroxy-chloroquine. Only 20 (2.0%) patients with DM & 25 (1.7%) patients without DM received favipiravir (1600 mg on day 1 followed by 600 mg 12 hourly from day 2 to day 10).

Remdesivir (200 mg IV infusion [within 30 min-2 hours] on day 1 followed by 100 mg infusion within [30 min to 2 hours] from day 2 to day 5) was required for most of the patients with DM than non-diabetic patients (6.3% vs 3.3%; p=0.001).

Regarding antibiotic therapy, 535 (53.3%) diabetic patients & 723 (48.1%) non-diabetic patients were treated with a single antibiotic and 196 (19.5%) diabetic patients & 162 (10.8%) non-diabetic patients were given double antibiotic therapy (p=0.001).The antibiotics used generally covered common pathogens. The antibiotics used were doxycycline, azythromycin, cephalosporins, fluoroquinolones, carbapenems and â-lactamase inhibitors. Intravenous (IV) antibiotic therapy (39.1% vs 22.0%; p=0.001) and double antibiotics (19.5% vs 10.8%; p=0.001) were given more in patients with DM than without DM. Most of the patients were received either ivermectin plus azithromycin or ivermectin plus doxycycline combination. The duration of antibiotic treatment was 5–10 days. Steroid therapy with methylprednisolone and dexamethasone for 3–7 days was received mostly diabetic patients (7.6% vs 4.1%; p=0.001). Low molecular weight heparin was used in most of the patients with DM than patients without DM (89.2% vs 62.9%; p=0.001) followed by rivaroxaban (10 mg once daily for 1 month). We administered vitamin C, vitamin D_3 and zinc to most of the patients.

Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) and most of the non-diabetic patients were treated either in home isolation or in institutional isolation (70.4% vs 48.0%; p=0.001). In patients with DM-mild disease was 63.2% (634), moderate disease was 3.5% (35); severe disease was 9.5% (95) and critical ill was 1.3% (13). In patients without DM-mild disease was 60.8% (914), moderate disease was 1.4% (21); severe disease was 4.1% (62) and critical ill was 0.4% (6) (Table 4). Patients with DM had higher mortality rate than non-diabetic patients (6.1% vs 2.6%; p=0.18).

Table-II

Clinical presentation of COVID-19 patients with or without DM (n=2506)

Variables	Group-I Patients with DM (n=1003) f(%)	Group-II Patients without DM (n=1503)f(%)	P value*
Clinical presentation			
Symptomatic	777(77.5%)	1003(66.7%)	
Asymptomatic	226(22.5%)	500(33.3%)	0.001
Duration of symptoms	3.46±3.5 days	3.27±4.2 days	0.036
Fever	532(53.0%)	753(50.1%)	0.14
Cough	339(33.8%)	519(34.5%)	0.7
Sore throat	29(2.9%)	180(12.0%)	0.001
Shortness of breath	449(44.8%)	460(30.6%)	0.001
Diarrhea	12(1.2%)	81(5.4%)	0.001
Anosmia	38(3.8%)	160(10.6%)	0.001
Fatigue	272(27.1%)	433(28.8%)	0.35
Headache	88(8.8%)	248(16.5%)	0.001
Bodyache	189(18.8%)	317(21.1%)	0.17
Anorexia	66(6.6%)	111(7.4%)	0.44
Nausea	31(3.1%)	72(4.8%)	0.036
Vomiting	30(3.0%)	73(4.9%)	0.021
Abdominal pain	13(1.3%)	38(2.5%)	0.032
Numbness	20(2.0%)	32(2.1%)	0.816
Dizziness	115(11.5%)	146(9.7%)	0.16
Generalized itching	24(2.4%)	38(2.5%)	0.831

COVID-19: coronavirus disease 2019; DM: diabetes mellitus.*Chi square test was done to find out the significance.

Table-III

Distribution of treatment of patients with COVID-19 with and without DM (n=2506)

Variables	Group-I Patients with DM (n=1003)f (%)	Group-II Patients without DM (n=1503)f (%)	P value*
Antibiotics			
IV	392 (39.1%)	331 (22.0%)	0.001
Oral + IV	64 (6.4%)	43 (2.9%)	
Oral	274(27.3%)	511 (34.0%)	
Not received	273 (27.2%)	618 (41.1%)	
Antibiotics			
Single	535 (53.3%)	723 (48.1%)	0.001
Double	196 (19.5%)	162 (10.8%)	
Not received	272 (27.1%)	618 (41.1%)	
Steroids	76(7.6%)	61(4.1%)	0.001
Favipiravir	20(2.0%)	25 (1,7%)	0.54
Remdesivir	63(6.3%)	49(3.3%)	0.001
Ivermectin	381 (38.0%)	523(34.8%)	0.1
Hydroxy-chloroquine	3(0.3%)	1(0.1%)	0.15
Enoxaparine	895 (89.2%)	945 (62.9%)	0.001
Rivaroxaban	897 (89.45)	956 (63.6%)	0.001

COVID-19: coronavirus disease 2019; DM: diabetes mellitus; IV: intravenous.
*Chi square test was done to find out the significance.

Table-IV

In-Hospital outcome of patients with COVID-19 with and without DM (n=2506)

Variables	Group-I Patients with DM (n=1003)f (%)	Group-II Patients without DM (n=1503)f (%)	P value*
Hospitalization	522 (52.0%)	445 (29.6%)	0.001
Home isolation	481 (48.0%)	1058 (70.4%)	0.001
Disease severity			0.001
Asymptomatic	226(22.5%)	500(33.3%)	0.001
Mild	634(63.2%)	914(60.8%)	0.22
Moderate	35(3.5%)	21(1.4%)	0.001
Severe	95(9.5%)	62(4.1%)	0.001
Critical ill	13(1.3%)	6(0.4%)	0.01
Mortality	61 (6.1%)	39 (2.6%)	0.001

COVID-19: coronavirus disease 2019; DM: diabetes mellitus. *Chi square test was done to find out the significance.

Discussion

Important findings of this study are: 1) Around 40.0% patients had DM; 2) Diabetic patients are usually older and had more comorbidity; 3) Diabetic patients had an increased severity, a higher probability of hospitalization; 4) Diabetic patients with COVID-19 had worse prognosis as compared with non-diabetic patients.

Several mechanisms have been postulated that can contribute to increased susceptibility to COVID-19 infection in diabetic patients[6]: (1) impaired neutrophil recruitment, (2) impaired macrophage activity, (3) impaired interferon gamma production and release from natural killer cells, (4) impairment of antigen presentation resulting in a dysregulated immune response, cytokine

storm and systemic inflammation[12], and (5) increased angiotensin converting enzyme-2 (ACE-2) expression, a surface receptor expressed by epithelial cells of the lung, intestine, kidney and blood vessels causing vasodilation, and hypotension[13].

It was found that hyperglycemia directly enhanced replication of SARSCoV-2, and glycolysis sustains replication of SARS-CoV-2 through the generation of ROS in mitochondria and activation of hypoxia-inducible factor 1á[14]. DM-induced imbalance of the immune response can enhance the chance of dysregulation of immune modulators[4]. Immunological dysregulation in diabetic patients is also considered a risk factor for SARS-CoV-2 infection and is also responsible for disease severity[14,15]. In the context of a preexisting pro-thrombotic hypercoagulable state exacerbated by the presence of DM, hyper-activation of the coagulation cascade in COVID-19 may result in severe thromboembolic outcomes and eventual mortality[16,17].

Emerging data from different countries reported that DM was associated with 5.3%-58.0% of patients with COVID-19 [4]. These variable prevalence rates may be due to inclusion of hospitalized vs non-hospitalized patients, different geographical area, different prevalence rate of COVID-19 and different prevalence rate of DM among study population. A report of the Chinese Center for Disease Control and Prevention (China CDC), which included both hospitalized and non-hospitalized individuals, showed a lower prevalence of diabetes (5.3%) among 44,672 confirmed COVID-19 cases through February 11, 2020[18].COVID-19 patients with DM were more frequently associated with severe or critical disease conditions varying from 14% to 32% in areas[19]. A retrospective study from China showed a 9.7% prevalence of DM, which is equivalent to China's overall diabetes mellitus incidences[5]. A meta-analysis including two studies from US and one study from France reported 11.2% prevalence of DM[20]. Another two single center studies from Italy included hospitalized patients showed 8.9% - 14.9% prevalence of diabetes[21,22]. Prevalence rates were even higher inUS patients hospitalized with COVID-19, ranging from22.6 to 37.2%[23-28]. The nationwide report from the National Institute of Health of Italy showed a diabetes prevalence of 29.8% among 3857 COVID-19 patients (median age 82 years) who deceased through July 9, 2020[29].

In our study, Out of 2506 patients, 40% patients (1003) were diabetic & 60% patients (1503) were non-diabetic. Diabetic patients were older (56.87 ±11.84 years vs 45.92±16.91; p=0.001) than non-diabetic patients. Diabetic patients (G-I) had more risk factors and comorbidities than non-diabetic patients (G-II): cardiovascular disease; hypertension; chronic kidney disease; smoking; dyslipidemia and chronic obstructive pulmonary disease/bronchial asthma. Most of the patients with DM were symptomatic (77.5% vs 66.7%; p=0.001). Shortness of breath was significantly higher in diabetic patients (44.8% vs 30.6%; p=0.001). Sore throat (12.0% vs 2.9%; p=0.001), diarrhea (5.4% vs 1.2%; 0.001), anosmia (10.6% vs 3.8%; p=0.001), and headache (16.5% vs 8.8%; p=0.001) were significantly higher in non-diabetic patients. Diabetic patients had more severe form of COVID-19 disease {(moderate: 3.5% vs 1.4%; p=0.001), (severe: 9.5% vs 4.1%; p=0.001), and (critical ill: 1.3% vs 0.4%; p=0.01)} than non-diabetic patients. Most of the diabetic patients were hospitalized (52.0% vs 29.6%; p=0.001) COVID-19 patients with DM had worse outcome than patients without DM (mortality rate- 6.1% vs 2.6%; p=0.001).

A nationwide, comparative, retrospective, cohort study included 10,881 hospitalized COVID-19 patients involving 37 hospital sites from around the Philippines[6]. A subgroup analysis was performed comparing the outcomes of patients diagnosed with DM (n = 2191) versus patients without DM (n = 8690). Patients with DM comprised 20.1% of the entire cohort. Diabetic patients were older than non-diabetic patients (median age 61 vs 48 years; p<0.001).More than 50% of the diabetic population were more than 60 years old (n = 1218, 55.6%). Hypertension (74.99% vs 23.06%; p <0.001), smoking (14.6% vs 8.1%; p<0.001)), chronic respiratory disease (13.5% vs 3.6%; p<0.001), and chronic cardiac disease (8.4% vs 4.9%; p<0.0001) were the predominant comorbidities in diabetic than non-diabetic patients. The presence of DM among COVID-19 patients significantly increased the risk respiratory failure, duration of ventilator dependence, severe/ critical COVID-19, ICU admission, and length of hospital stay than non-diabetic patients.Fever, cough, dyspnea, diarrhea and fatigue were observed significantly more in diabetic than non-diabetic patients. Patients with DM had a significantly higher in-hospital mortality rate (26.4% vs 12.9%; $p < 0.001$) compared to those without DM. The adjusted OR for mortality was significantly higher among those in the DM group by 1.46 (95% CI 1.28–1.68; $p < 0.001$)

A retrospective cross-sectional study[30], which was conducted in England included 232 hospitalized COVID-19 patients. Of them 37.5% were having DM. The mean age of the diabetic and non-diabetic patients was 71.4 ± 13.1 years and 69.9 ± 17.1 years, respectively. In diabetic

group, male were predominant (43.4% vs 27.6%) and in non-diabetic group female were predominant (72.4% vs 56.6%). Heart disease was the most common comorbidity in DM patients (77.8%) and hypertension was the most common comorbidity in non-diabetic patients (64.7%). COVID-19 patients with diabetes were more likely to stay longer in hospital than the patients without diabetes (14.4 ± 9.6 days vs 9.8 ± 17.1 days). Patients with diabetic ketoacidosis (DKA) were more likely to survive compared to patients without DKA (87.1% vs 50.6%). In contrast to other studies, this study found no difference in mortalities based on the diabetes status, control or complications. Even mortality rate was higher among non-diabetic patients (55.1% vs 44.9%).

Guo et al.[31] analyzed 174 consecutive patients confirmed with COVID-19 and compared the clinical presentation of COVID-19 between diabetic (with or without comorbidities) and non-diabetic patients. Of them 21.2% patients were diabetic. The median age of the diabetic and non-diabetic patients was 61 {interquartile range (IQR)-55-69} years and 58 (IQR-47-66) years, respectively. In diabetic group, male were predominant (54.1% vs 40.9%) and in non-diabetic group female were predominant (59.1% vs 45.9%). Patients with diabetes had more cardiovascular disease (32.4% vs 14.6%) compared to patients without diabetes. This Chinese study provided some remarkable data. First, in diabetic patients the infection appears to present initially with milder symptoms. Thus, fever was less frequent, which could delay initial diagnosis. Second, more severe pneumonia (more severe pathological changes and higher CT imaging score) were detected by chest CT-scans in patients with DM. Third, diabetic patients (especially those without comorbidity) had more pronounced biological abnormalities, including elevated inflammatory biomarkers [eg. C-reactive protein (CRP), serum ferritin, erythrocyte sedimentation rate (ESR) and interleukin 6 (IL6)], elevated tissue enzymes [eg. lactate dehydrogenase (LDH)], and clotting abnormalities (eg. elevated D-dimer, fibrinogen). The above mentioned abnormalities are related to severe multi-organ damage and to a propensity to thromboembolic events, as well as to the “cytokine storm” described as an aggravating factor of COVID-19 [32]. Fourth, after excluding patients with comorbidities other than diabetes to avoid the impact of other comorbidities on the results showed patients with diabetes were older (61 [IQR, 57-69] vs 32 [IQR, 30-37]), had more nausea and vomiting (16.7% vs 0%) and higher mortality (16.7% vs 0%) compared to patients without diabetes.

Finally, lymphopenia, frequently reported as marker of poor prognosis

[33-35], was more frequent and more severe in diabetic patients. The mortality rate was higher in diabetic patients (10.8% vs 3.6%).

In another two-center retrospective study[36] based in China showed 9.8% (153) patients had DM. One sex- and age-matched COVID-19 patient without diabetes was randomly selected for each patient with diabetes. Five striking observations of this comparative study between diabetic and nondiabetic COVID-19 patients were (1) greater severity of COVID-19 symptoms (e.g., fever, cough, fatigue, and dyspnea) in diabetic patients, (2) increased frequency of other comorbidities in people with diabetes (e.g., hypertension, cardiovascular disease, and cerebrovascular disease), (3) increased necessity of external oxygen supply

in the form of invasive or noninvasive ventilation, (4) a higher proportion of intensive care unit admission (17.6% vs. 7.8%) and more fatal cases (20.3% vs. 10.5%) in diabetic patients, (5) Age ≥70 years and hypertension were independent risk factors for in-hospital death of patients with diabetes.

Limitation

Our study has several limitations. Firstly, study conducted in non-COVID-dedicated cardiac hospital. Secondly, the duration, type of DM, and history of diabetic emergencies were not determined. Thirdly, hemoglobin A1c test was not done for all patients. Fourthly, the diabetic treatment regimen was not evaluated.

Finally, Chest CT was not done for all patients.

Conclusion

COVID-19 diabetic patients were usually older, have more comorbidities, a higher probability of hospitalization, increased risk of severe/critical COVID-19 and associated with higher mortality rate as compared with patients without DM. Therefore, DM might could be considered as a risk factor for the poor outcome of SARS-CoV-2 pneumonia, and in case of rapid deterioration, more intensive attention should be paid to patients with diabetes.

Acknowledgement

We would like to thank Mrs Rehana Akter and Mr. Rasel Hasan, National Heart Foundation Hospital & Research Institute, for their sincere hard work in collecting and tabulating the data.

References

1. Zhu Z, Lian X, Su X, Wu W, Marraro GA, Zeng Y. From SARS and MERS to COVID-19: a brief summary and comparison of severe acute respiratory infections caused by three highly pathogenic human coronaviruses. Respir Res, 2020; 21: 224.
2. Yang JK, Feng Y, Yuan MY, et al. Plasma glucose levels and diabetes are independent predictors for mortality and morbidity in patients with SARS. Diabetic Med. 2006;23(6):623-628.
3. Zumla A, Hui DS, Perlman S. Middle East respiratory syndrome. Lancet. 2015;386(9997):995-1007.
4. Sen S, Chakraborty R, Kalita P, Pathak MP. Diabetes mellitus and COVID-19: Understanding the association in light of current evidence. World J Clin Cases, 2021; 9(28):8327-8339.
5. Li H, Tian S, Chen T, Cui Z, Shi N, Zhong X, Qiu K, Zhang J, Zeng T, Chen L, Zheng J. Newly diagnosed diabetes is associated with a higher risk of mortalitythan known diabetes in hospitalized patients with COVID-19.Diabetes Obes Metab. 2020;22:1897-1906.
6. Espiritu AI, Chiu HHC, Sy MCC, 2, Anlacan VMM, The Philippine CORONA Study Group, Jamora RDG. The outcomes of patients with diabetes mellitus in The Philippine CORONA Study. Scientific Reports, 2021;11:24436.
7. Sharma P, Behl T, Sharma N, Singh S, Grewal AS, Albarrati A, Albratty M, Meraya AM, Bungau S. COVID-19 and diabetes: Association intensify risk factors for morbidity and mortaliy. Biomedicine & Pharmacotherapy, 2022;151:113089.
8. Pal R, Bhadada SK. COVID-19 and diabetes mellitus: An unholy interaction of two pandemics. Diabetes & Metabolic Syndrome: Clinical Research & Reviews, 2020;14:513e517
9. American Diabetes Association. 2. Classification and diagnosis of diabetes: Standards of Medical Care in Diabetesd2019. Diabetes Care 2019;42(Suppl.1):S13-S28.
10. Zu ZY, Jiang MD, Xu PP, Chen W, Ni QQ, Lu GM, Zhang LJ: Coronavirus disease 2019 (COVID-19): a perspective from China. Radiology, 2020, 296:E15-25.
11. Yue H, Bai X, Wang J, et al.: Clinical characteristics of coronavirus disease 2019 in Gansu province, China. Ann Palliat Med, 2020, 9:1404-1412.
12. Muniyappa R, Gubbi S. COVID-19 pandemic, coronaviruses, and diabetes mellitus. Am. J. Physiol. -Endocrinol. Metab, 2020;318:E736–E741.
13. Kuba K, Imai Y, Rao S, Jiang C, Penninger JM. Lessons from SARS: control of acute lung failure by the SARS receptorACE2. J. Mol. Med, 2006;84:814–820.
14. Lin X, Xu Y, Pan X, Xu J, Ding Y, Sun X, Song X, Ren Y, Shan PF. Global, regional, and national burden and trend of diabetes in 195 countries and territories: an analysis from 1990 to 2025. Sci Rep, 2020;10:14790.
15. Kulcsar KA, Coleman CM, Beck SE, Frieman MB. Comorbid diabetes results in immune dysregulation and enhanced disease severity following MERS-CoV infection. JCI Insight, 2019; 4.
16. Dunn EJ, Grant PJ. Type 2 diabetes: an atherothrombotic syndrome, Curr. Mol. Med, 2005;5:323–332, https://doi.org/10.2174/1566524053766059.
17. Hussain A, Bhowmik B, do Vale MNC. COVID-19 and diabetes: Knowledge in progress, Diabetes Res Clin. Pr, 2020;162:108142.
18. Novel Coronavirus Pneumonia Emergency Response Epidemiology Team (2020) Vital surveillances: the epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)-China. China CDC Weekly. https :// weekl y.china cdc.cn/en/article/id/ e5394 6e2-c6c4-41e9-9a9b-fea8d b1a8f 51. Accessed 26 June 2020
19. Singh AK, Gupta R, Ghosh A, Misra A. Diabetes in COVID-19: Prevalence, pathophysiology, prognosis and practical considerations. Diabetes Metab Syndr, 2020;14:303-310.
20. Kumar A, Arora A, Sharma P et al. Is diabetes mellitus associated with mortality and severity of COVID-19? A meta-analysis. Diabetes Metab Syndr, 2020;14:535-545.
21. Fadini GP, Morieri ML, Longato E, Avogaro A. Prevalence and impact of diabetes among people infected with SARS-CoV-2. J Endocrinol Investig, 2020;43:867-869.
22. Ciceri F, Castagna A, Rovere-Querini P et al. Early predictors of clinical outcomes of COVID-19 outbreak in Milan, Italy. Clin Immunol, 2020;217:108509.

23. Petrilli CM, Jones SA, Yang J et al. Factors associated with hospital admission and critical illness among 5279 people with coronavirus disease 2019 in New York City: prospective cohortstudy. BMJ, 2020;369:m1966.

24. Richardson S, Hirsch JS, Narasimhan M et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized witH COVID-19 in the New York City area. JAMA, 2020;323:2052-2059.

25. Cummings MJ, Baldwin MR, Abrams D et al. Epidemiology, clinical course, and outcomes of critically ill adults with COVID-19 in New York City: a prospective cohort study. Lancet, 2020;395:1763-1770.

26. Argenziano MG, Bruce SL, Slater CL et al. Characterization and clinical course of 1000 patients with coronavirus disease 2019 in New York: retrospective case series. BMJ, 2020;369:m1996.

27. Myers LC, Parodi SM, Escobar GJ, Liu VX. Characteristics of hospitalized adults with COVID-19 in an integrated health care system in California. JAMA, 2020;323:2195–2198.

28. Garg S, Kim L, Whitaker M et al. Hospitalization rates andcharacteristics of patients hospitalized with laboratory-confirmedcoronavirus disease 2019—COVID-NET, 14 states, March 1–30,2020. MMWR Morb Mortal Wkly Rep, 2020;69:458-464.

29. SARS-CoV-2 Surveillance Group (2020) Characteristics of SARS-CoV-2 patients dying in Italy. Report based on available data on July 9th, 2020. https ://www.epice ntro.iss.it/en/ coron aviru s/bolle ttino /Repor t-COVID -2019_9_july_2020.pdf. Accessed 26 June 2020

30. Alkundi A, Mahmoud I, Musa A, Naveed S, Alshawwaf M. Clinical characteristics and outcomes of COVID-19 hospitalized patients with diabetes in the United Kingdom: A retrospective single centre study. Diabetes Research and Clinical Practice, 2020;165:108263.

31. Guo W, Li M, Dong Y, Zhou H, Zhang Z, Tian C, Qin R, Wang H, Shen Y, Du K, Zhao L. Diabetes is a risk factor for the progression and prognosis of COVID 19. Diabetes/metabolism research and reviews. 2020;36(7):e3319.

32. Ye Q, Wang B, Mao J. The pathogenesis and treatment of the “Cytokine Storm” in COVID-19. J Infect, 2020; 80(6): 607-613.

33. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel Coronavirus in Wuhan, China. Lancet 2020;395:497-506.

34. Zhang JJ, Dong X, Cao YY, Yuan YD, Yang YB, Yan YQ, et al. Clinical characteristics of 140 patients infected with SARS-CoV-2 in Wuhan, China. Allergy 2020;75(7):1730-1741.

35. Zhou F, Yu T, Du R, Fan G, Liu Y, Liu Z, et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. Lancet 2020;395:1054-1062.

36. Shi Q, Zhang X, Jiang F, Zhang X, Hu N, Bimu C, Feng J, Yan S, Guan Y, Xu D, He G, Chen C, Xiong X, Liu L, Li H, Tao J, Peng Z, Wang W. Clinical Characteristics and Risk Factors for Mortality of COVID-19 Patients With Diabetes in Wuhan, China: A Two-Center, Retrospective Study Diabetes Care 2020;43:1382-1391.

Original Article

Frequency and Pattern of Anomalous Origin of Coronary Artery in Bangladeshi Population: Coronary Angiogram Based Single Center Study

AFM Azim Anwar, Masud Rana, Md. Nazmul Hashan, Md. Khurshid Alam, Srizon Roy Tirtho, Sanjida Anjum Mumu, Md. Fakhrul Islam Khaled, Chaudhury Meshkat Ahmed

Abstract:

Background: Anomalous origin of coronary artery (AOCA) has been traditionally described by coronary angiography or autopsy. However the actual prevalence of such abnormalities is unknown in general Bangladeshi population. Beside conventional coronary angiogram(CAG), CT CAG and Multi-detector computed tomography (MDCT) offers higher possibility to visualize AOCA non-invasively. The purpose of this study was to report the prevalence AOCA in Bangladeshi population by using conventional CAG.

Methodology: This was a single center, cross sectional, observational study, done in department of Cardiology, BSMMU over 1 year period. Sample size was 1167. Samples were taken following inclusion and exclusion criteria. Descriptive statistical analysis was done by using SPSS v29.0

Results: 1.3% population had AOCA. Commonest (0.6%) was 'absent Left main (LM) with separate origin of Left Anterior Descending (LAD) and Left Circumflex (LCX) artery. Second commonest (0.45%) was 'Right Coronary Artery (RCA) arising from left sinus'. 0.17% had RCA highup origin, and 0.08% had RCA origin from posterior sinus.

Discussion: Among AOCA, RCA origin from left sinus, is potentially dangerious, due to high risk of sudden cardiac death (SCD) and surgical complications. Other varities of AOCA are mostly benign, but it may cause difficulties in cannulation during coronary angiography and coronary artery bypass surgery.

Conclusion: Although coronary artery anomalies are rare, they may cause difficulties during coronary interventions or cardiac surgery and may occasionally result in sudden cardiac death. So, optimum precaution to findout the AOCA is needed during conventional CAG, and if suspicion, CT CAG and MDCT should also be used.

Keywords: *Anomalous Origin of Coronary Artery, AOCA, SCD, Coronary Artery Anomalies*

(Bangladesh Heart Journal 2024; 39(2): 117-120)

Introduction:

AOCA is quite rare congenital disorder that can have a variety of clinical presentations. The prevalence of such anomalies among the adult population has been found to vary in different studies. On average, it's around 1%. In angiographic studies, the incidence ranges from 0.6% to 5.64%, while in autopsy series, it's around 0.3%.[1,2] Coronary artery anomalies (CAA) are mostly harmless and don't cause any symptoms in most patients. However, in some cases, they can cause various clinical issues such as angina, dyspnea, syncope, acute coronary syndrome, heart failure, ventricular arrhythmias, and even sudden cardiac death (SCD). Interestingly, CAAs are

Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh

Address of Correspondence: AFM Azim Anwar, Dept of Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU). Cell: +8801781258505, E-mail: azimbinanwar@gmail.com ORCID ID: 0000-0002-2489-5000,

DOI: https://doi.org/10.3329/bhj.v39i2. 75792

actually the second most common cause of SCD in young individuals, after hypertrophic cardiomyopathy [3-7]. Regarding the classification and nomenclature of CAAs, there has been some inconsistency in this area, but the proposal made by Angelini et al. is the one that is most commonly followed. According to this classification, a coronary artery pattern is considered normal if it is seen in more than 1% of the general population. Anything seen in less than 1% of the general population is considered an anomaly. The CAAs are grouped into four subtypes, which are anomalies of origin and course, intrinsic anomalies of coronaries, anomalies of termination, and anomalous anastomotic vessels [8-12]. The challenges posed by CAAs are significant, as they can make diagnostic and therapeutic procedures such as angiography or angioplasty more difficult and time-consuming due to the need for special catheters and maneuvers. Additionally, the lack of knowledge about these anomalies can result in accidental damage to the vessels during cardiac surgery. While much is known about this condition, there is no significant data on anomalous origin of coronary artery in Bangladeshi population.

Methodology:

This cross sectional observational study was conducted in department of cardiology, BSMMU, from January 2022 to December 2022. Study duration was one year, sample size was 1167. Patients admitted and underwent coronary angiogram on department of cardiology, BSMMU, were screened and included in the study as per inclusion and exclusion criteria, by consecutive sampling method. Data were collected in semi structured questionnaire by personal interview. Total 1200 people were included in the study, 33 patients denied to participate in the study. So, statistical analysis was done on 1167 patients. Baseline clinical data including cardiac symptoms (chest pain, palpitation, dyspnea, syncope), cardiovascular risk factors (DM, Hypertension , Dyslipidemia, Obesity, Smoking, Hypothyroidism, CKD, Connective Tissue Disease) , laboratory investigations (ECG, serum troponin-I, ejection fraction, regional wall motion abnormality, coronary angiogram) were recorded in data sheet. Coronary angiogram was done using both femoral and radial route after confirming proper indication and aseptic precaution. Data was analyzed using IBM SPSS 29.0. Descriptive analysis was reported as frequency and percentage.

Results:

Total number of study population was 1167. Among them, male 1039 (89%), female 128 (11%). 37 patients were below 40 years (4%), 1130 patients were above 40 years (96%). 1010 (86%) patients had family history of cardiovascular disease, 157 patients (14%) had no such family history.

Chest pain was the leading symptom (77%), exertional dyspnea in 33% and exertional palpitation in 22% population.

67% population were diabetic, 43% were hypertensive, 40% dyslipidemic, 33% overweight, 7% smoker. 33% had ST elevation MI (STEMI), 35% had non ST elevation MI (NSTMI), 32% had chronic coronary syndrome.

1120 (96%) coronary angiogram (CAG) was done via right femoral route, 47 (4%) CAG was done via right radial route.

Among 1167, 15 patients (1.3%) had anomalous origin of coronary artery. The commonest presentation was, 'absent left main and separate origin of left anterior descending (LAD) and Left circumflex (LCX) artery, in 7 patients (0.60%). The second commonest presentation was 'Right Coronary Artery (RCA) arising from left sinus' in 5 patients (0.45%). 2 patients (0.17%) had RCA highup origin, 1 patient (0.08%) had RCA origin from posterior sinus.

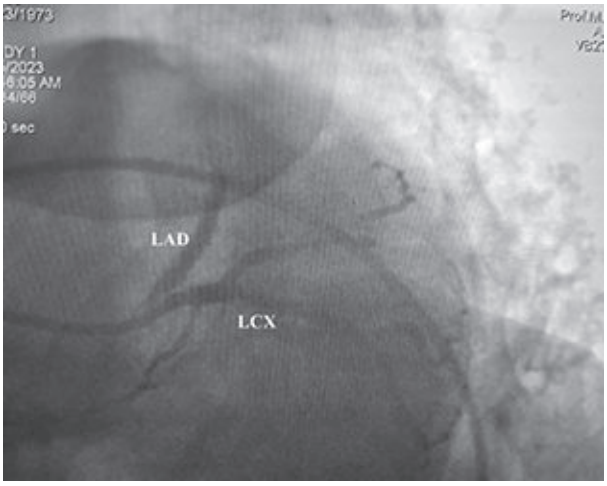

Figure 1: *LAD & LCX separate origin*

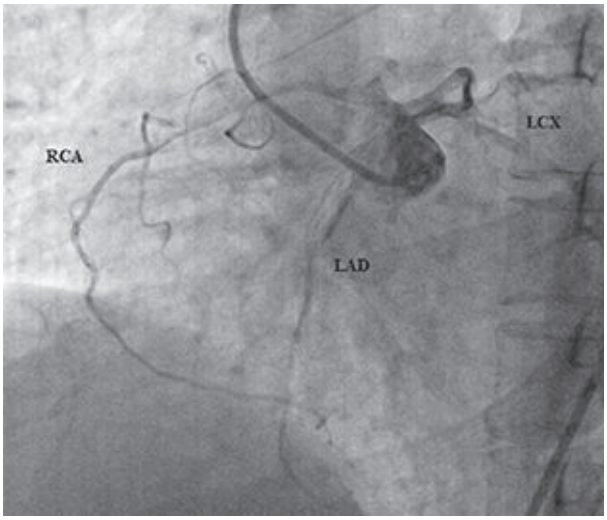

Figure 2: *RCA origin from left sinus*

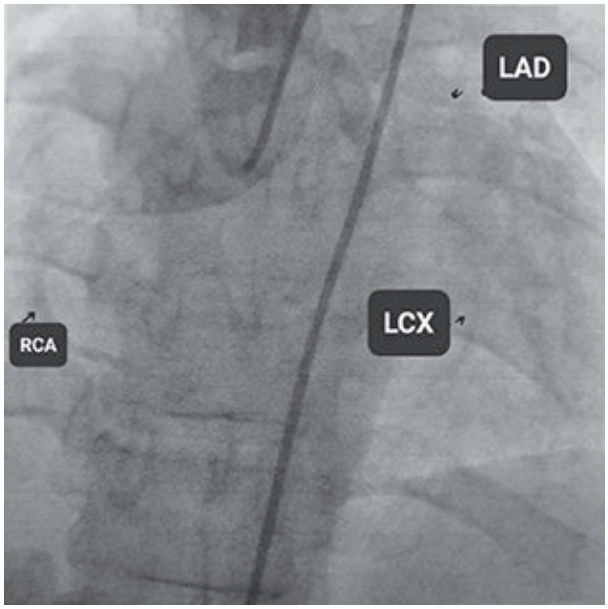

Figure 3: *RCA high up origin*

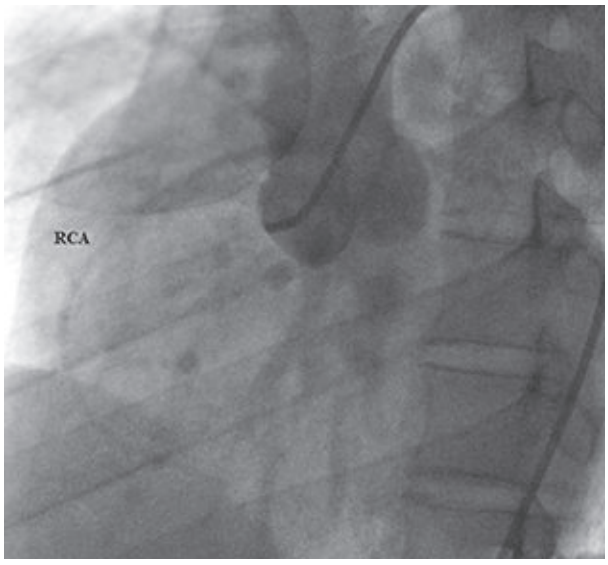

Figure 4: *RCA origin from posterior sinus*

Discussion:

The prevalence of coronary artery anomalies in our study was 1.30%. In the largest study (*n*=26,595) conducted by the Cleveland Clinic Foundation in North America in 1990, the incidence was 1.37% (*n* =1,686). The findings in our study are similar to those described in the literature. To the best of our knowledge, this is the largest study to investigate the prevalence of anomalous origin of coronary artery in the Bangladeshi population.

The etiology of coronary anomalies is uncertain. There is no definite inheritance pattern and no sex predominance. In a previous study, the most frequent coronary anomaly was separate origin of the LAD and LCX.[13] In our population, separate origin of LAD & LCX was also the most common coronary anomaly (0.60%).

The second commonest was RCA origin from left sinus (0.45%), which correlates appropriately with the literatures.[3] This is a clinically significant anomaly because of it's interarterial course between the pulmonary artery and the aorta and the compression of the RCA ostium may induce myocardial ischemia or sudden death. Anomalous origins of coronary arteries, where the artery crosses over to the opposite sinus, show four patterns: (1) an anterior course anterior to the pulmonary trunk or the right ventricular outflow tract, (2) an interarterial course between the pulmonary artery and the aorta, (3) a septal course through the interventricular septum, and (4) a retroaortic course posteriorly between the aortic root and the left atrium.[14] Of these, the interarterial course is clinically malignant because it is strongly associated with sudden death, myocardial ischemia, congestive heart failure, and endocarditis. The exact pathophysiological mechanisms of myocardial ischemia have not been determined. The assumed mechanism of sudden death is ostial closure between the aorta and pulmonary artery and the squeezing of the ostium during exercise, with sudden interference in coronary arterial flow.[15] In such cases, complicated cardiac surgery or interventions are needed. To evaluate the risk posed by a coronary anomaly, it is very important to discriminate an interarterial course from other courses. Conventional CAG is usually unable to provide information on the complex anatomy of coronary anomalies. ECG-gated MDCT is not only a noninvasive diagnostic tool but also a precise instrument for delineating the exact origin and course of coronary anomalies using 3D reconstruction.

In our study, 2 patients (0.17%) had RCA high up origin, literatures suggest that, high up origin of RCA is found in 20% cases.[11] A coronary anomaly with a high takeoff or ectopic origin refers to a left or right coronary ostium, which arises more than 0.5 cm above the sinotubular junction rather than at the aortic sinus. This is a hemodynamically benign coronary anomaly and usually considered a normal variant, but it may cause difficulties in cannulation during coronary angiography and coronary artery bypass surgery.

RCA origin from posterior sinus is extremely rare in literetures. In our study, only one patient had a RCA origin

from posterior sinus. This type of origin is frequently associated with *exercise-related sudden death.*

Conclusion:

The prevalence of anomalous origin of coronary artery in this study was similar to that of previous studies. Anomalous origin coronary artery are rare. However, as some types of coronary anomalies are clinically significant and sometimes life threatening, it important to detect it by conventional angiographic images, which can aid the physician in treatment planning. However, CT CAG, ECG-gated 3D MDCT etc. can be used to provide accurate angiographic information on the origin, course, and termination of coronary anomalies, which cannot be visualized with conventional coronary angiography.

Author Contributions: All authors participated in idea generation, data collection, data processing, manuscript preparation, revising and drafting.

Acknowledgement:

Cathlab staff and operators.

Conflict of Interest: The authors have none to declare.

Data & Materials: Available from the corresponding author, on reasonable request.

References:

1. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. Yamanaka O, Hobbs RE. (1990). *Cathet Cardiovasc Diagn*, *21*, 28–40.
2. Cieslinski, G., Rapprich, B., & Kober, G. (1993). Coronary anomalies: incidence and importance. *Clinical Cardiology*, *16*(10), 711–715. doi:10.1002/clc.4960161005
3. Lee, J., Choe, Y. H., Kim, H.-J., & Park, J. E. (2003). Magnetic resonance imaging demonstration of anomalous origin of the right coronary artery from the left coronary sinus associated with acute myocardial infarction. *Journal of Computer Assisted Tomography*, *27*(2), 289–291. doi:10.1097/00004728-200303000-00032
4. Aydinlar, A., Çiçek, D., Sentürk, T., Gemici, K., Serdar, O. A., Kazazoglu, A. R., … Cordan, J. (2005). Primary congenital anomalies of the coronary arteries: A coronary arteriographic study in western turkey: A coronary arteriographic study in western turkey. *International Heart Journal*, *46*(1), 97–103. doi:10.1536/ihj.46.97
5. Cheitlin, M. D., De Castro, C. M., & McAllister, H. A. (1974). Sudden death as a complication of anomalous left coronary origin from the anterior sinus of Valsalva, A not-so-minor congenital anomaly: A not-so-minor congenital anomaly. *Circulation*, *50*(4), 780–787. doi:10.1161/01.cir.50.4.780
6. Anomalous origin of either the right or left main coronary artery from the aorta with subsequent coursing between aorta and pulmonary trunk: analysis of 32 necropsy cases. Kragel AH, Roberts WC. (1988). *Am J Cardiol*, *62*, 771–777.
7. Chaitman, B. R., Lespérance, J., Saltiel, J., & Bourassa, M. G. (1976). Clinical, angiographic, and hemodynamic findings in patients with anomalous origin of the coronary arteries. *Circulation*, *53*(1), 122–131. doi:10.1161/01.cir.53.1.122
8. Angelini, P., Velasco, J. A., & Flamm, S. (2002). Coronary anomalies: incidence, pathophysiology, and clinical relevance: Incidence, pathophysiology, and clinical relevance. *Circulation*, *105*(20), 2449–2454. doi:10.1161/01.cir.0000016175.49835.57
9. Endovascular therapy for congenital coronary artery anomalies in adults. Rigatelli G, Cardaioli P. (2008). *J Cardiovasc Med (Hagerstown)*, *9*, 113–121.
10. Garg, N., Tewari, S., Kapoor, A., Gupta, D. K., & Sinha, N. (2000). Primary congenital anomalies of the coronary arteries: a coronary: arteriographic study. *International Journal of Cardiology*, *74*(1), 39–46. doi:10.1016/s0167-5273(00)00243-6
11. Mahowald, J. M., Blieden, L. C., Coe, J. I., & Edwards, J. E. (1986). Ectopic origin of a coronary artery from the aorta. Sudden death in 3 of 23 patients. *Chest*, *89*(5), 668–672. doi:10.1378/chest.89.5.668
12. Normal and anomalous coronary arteries: definitions and classification. Angelini P. (1989). *Am Heart J*, *117*, 418–434.
13. Sohrabi, B., Habibzadeh, A., & Abbasov, E. (2012). The incidence and pattern of coronary artery anomalies in the north-west of Iran: A coronary arteriographic study. *Korean Circulation Journal*, *42*(11), 753. doi:10.4070/kcj.2012.42.11.753
14. Basso, C., Maron, B. J., Corrado, D., & Thiene, G. (2000). Clinical profile of congenital coronary artery anomalies with origin from the wrong aortic sinus leading to sudden death in young competitive athletes. *Journal of the American College of Cardiology*, *35*(6), 1493–1501. doi:10.1016/s0735-1097(00)00566-0
15. Benson, P. A., & Lack, A. R. (1968). Anomalous aortic origin of left coronary artery. *Arch Pathol*, *86*(2), 214–216.

Original Article

Serum Albumin and Its Influence on Immediate Outcomes in Children with Congenital Heart Disease Undergoing Cardiac Surgery

K M Enayet[1], Mohd. Zahid Hussain[2], Md. Tariqul Islam[3] , Tahmina Karim[4], Tasmin Akhtar Jahan[5], Porimal Kumar Das[6], Faizul Haque Ponir[7], Mostafizur Rahman Bhuiyan[8]

Abstract:

Background:Hypoalbuminemia is associated with morbidity and mortality in critically ill children and is a well-recognized predictor of general surgical risk. It frequently occurs in patients with congenital heart disease (CHD). Moreover, cardiopulmonary bypass (CPB)-induces an inflammatory response, and the overall surgical stress can affect albumin concentration greatly

Objective: To estimate pre-operative, per-operative and post-operative serum albumin level and to see its influence on immediate outcomes in children with congenital heart disease undergoing cardiac surgery with cardiopulmonary bypass

Methods: This cross-sectional observational study was conducted in Paediatric cardiology department, BSMMU in a view to find out the influence of pre-operative, per-operative and post-operative serum albumin level on immediate outcomes in children with congenital heart disease undergoing cardiac surgery with cardiopulmonary bypass(CPB).The study included total 48 patients of CHD who underwent CPB. Patients were selected according to inclusion and exclusion criteria.

Result: Mean pre-operative serum albumin was 3.5±0.9 mg/dl whereas per-operative and post-operative serum albumin was 3.3±0.7mg/dl and 3.1±0.7 mg/dl respectively.CPB time was a bit higher in study population (98.4± 29.1min) where as other outcome parameters were within normal range. Duration of hospital stay was 12.2±3.1days. 22 patient (45.8%) developed valvular regurgitation and 6 patient (12.5%) developed pericardial effusion in post-operative echocardiography. Infection was evident by positive blood culture in 7 patients (14.8%). Pre, per and post-operative hypoalbuminaemia was associated with poor outcome after CPB.

Conclusion: Pre, per and post-operative hypo-albuminaemia is a prudent indicator for speculating poor immediate outcome following CPB in children with CHD.

Keywords : *Serum albumin , congenital heart disease, cardiac surgery*

(Bangladesh Heart Journal 2024; 39(2): 121-126)

1. Medical Officer, Khulna Medical College Hospital, Khulna.
2. Professor of Paediatic Cardiology (Former), BSMMU, Dhaka.
3. Chairman , Department of Paediatric Cardiology, BSMMU, Dhaka.
4. Associate professor, Paediatric Cardiology, BSMMU, Dhaka.
5. Medical Officer (Deputed In BSMMU), Dhaka.
6. Junior Consultant (Paediatrics), Upzila Health Complex, Kotalipara, Gopaljanj, Dhaka.
7. Junior Consultant (Paediatrics), Mugda Medical College Hospital, Dhaka.
8. Medical Officer, BSMMU, Dhaka.

Address of Correspondence: Dr. K M Enayet, Medical Officer, Khulna Medical College Hospital, Mobile: 01717-044776, E-mail: enayetsoton@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75794

Introduction:

Albumin is the most abundant protein in plasma, constituting approximately two-thirds of total plasma protein which is the greatest contributor to plasma colloid oncotic pressure and is responsible for the transport and binding of many plasma molecules. Serum albumin has been extensively used as a biomarker for predicting morbidity and mortality in patients undergoing high-risk surgery.[1] It is not the result of a reduction in albumin synthesis alone, but a multi-faceted phenomenon involving several processes, such as chronic inflammation, recurrent infections, hepatic failure, renal dysfunction, altered gastrointestinal function, increased right-sided heart pressures, dilution from fluid overload, and medications can influence serum albumin concentration.[2] Such states are frequently encountered in patients with long-standing congenital heart disease(CHD).[3]

A recent study found that perioperative hypoalbuminemia is common in the pediatric cardiac patients.[4] In other studies, hypoalbuminemia is associated with acute kidney injury and death in children undergoing repair of cyanotic heart disease and with poor outcome after pediatric heart transplantation.[5, 6] The study is thus aimed to quantify serum albumin concentration in children with different congenital heart defects and evaluate its behavior in response to metabolic stress associated with cardiac surgery and also to assess the correlation between hypoalbuminemia and post-operative outcome.

Materials and Methods:

This across-sectional study was conducted in the Department of Paediatric Cardiology, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. Purposive sampling technique was adopted. Total 48 Patient below 18 years of age with CHD diagnosed in Paediatric cardiology department, BSMMU and undergoing Cardiac surgery with CPB in Cardiac surgery department, BSMMU were included in this study. Patients with preexisting renal failure, cardiac failure, liver dysfunction, immune or central nervous system dysfunction, local or systemic infection or inflammation or on immune-suppressive/anti-inflammatory therapy/ albumin replacement, history of infective endocarditis were excluded from the study.

Echocardiography was done by G&E Echo machine ModelVividS70N. Patients were checked in supine and lateral positions. Pediatric probe 5MHz and 6MHz was used. Serum albumin and serum creatinine concentration was measured before surgery in the ward. Serum albumin measurement was Done by Atellica CH analyzer of SIEMENS Healthineers. Serum creatinine measurement was Done by Atellica CH analyzer of SIEMENS Healthineers.

The blood samples were obtained from a peripheral vein at rest with other routine tests and the measurements was obtained from the research lab of the Biochemistry department, BSMMU. During cardiac surgery Cardiopulmonary bypass time and aortic cross clamp time was recorded. Again blood sample was sent for per-operative serum albumin. In post-operative ICU clinical signs were noted. Post-operative echo-cardiography was done within 24 hours of surgery to evaluate pericardial effusion, left ventricular function (ejection fraction and fractional shortening), right ventricular function (TAPSE), and any form of valvular regurgitation.48 hours after cardiac surgery post-operative serum albumin and serum creatinine level was measured. Duration of mechanical ventilation, Post-operative mortality and post-operative length of ICU stay was also evaluated. The pre, per and postoperative serum albumin concentration was compared with normal values in references.Then pre-operative, per-operative and post-operative serum albumin level was compared with immediate outcomes

Statistical Methods:

Computer based statistical analysis were carried out with appropriate techniques and systems. All data were recorded systematically in preformed data collection form (questionnaire). Continuous data were expressed as mean and standard deviation and qualitative data were expressed as frequency distribution and percentage. Statistical analysis was performed by using window based computer software devised with Statistical Packages for Social Sciences (SPSS-22) (SPSS Inc, Chicago, IL, USA). Comparison between two means of quantitative data were analyzed byunpaired two sample t test or student's t test and comparison between qualitative data was done by Chi-square test. For all statistical tests, p value <0.05 was considered as statistically significant.

Results:

Table-I

Socio-demographic and anthropometric data of Study Subject (n=48)

Variable	Mean±SD*
Age (month)	82.12±41.45
Weight(kg)	16.8±5.5
Height (cm)	108.3±16.3
BSA(m2)	0.69±0.16
Social Status (According to monthly income in taka)	
Lower (<20000)	58.33% (28)
Middle (20000-40000)	31.25% (15)
Upper (>40000)	10.41% (5)
Urban area (%)	52.3% (25)

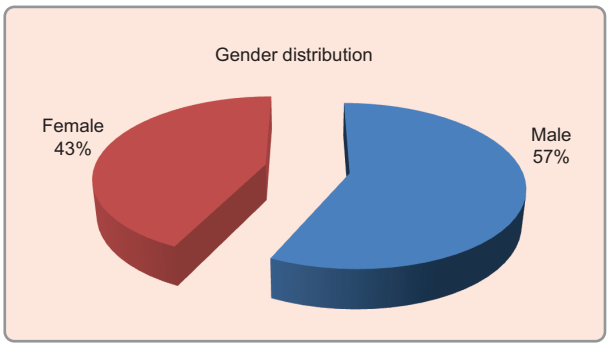

Figure-1: *Pie chart showed gender distribution among the study subjects. 57% of them were male and 43% were female*

.

Table-II

Clinical presentation on admission in study subject (n=48)

Clinical presentation	Percentage(n)*
H/O Recurrent RTI	60.4%(29)
Feeding difficulty	41.6%(20)
Dyspnoea	38.4%(19)
Cyanosis	38.4%(19)

*Data was expressed as Frequency and percentage

Table-III

Clinical examination findings on admission in study subject (n=48)

Variable	Mean±SD*
Heart rate (Beat/min)	97.1±9.4
SPO2 (%)	90.3±9.7

*Data was expressed as mean±SD

Table-IV

Serum albumin in study subject (n=48)

Serum Albumin (gm/dl)	Mean±SD
Pre-operative	3.5±0.9
Per-operative	3.3±0.7
Post-operative	3.1±0.7

*Data was expressed as mean±SD,

Table-IV

Per-operative and post-operative outcome in study subject (n=48)

Variable	Mean±SD*
S. Creatinine (mg/dl)	0.84±0.38
CPB time (min)	98.4± 29.1
ACC time (min)	82.5±45
Duration of MV (hr)	44.6±17.1
ICU stay length(hr)	53.04±32.2
Hospital stay (hr)	12.2±3.1
Echocardiographic findings	
TAPSE (mm)	17.2±3.1
EF	55.8±7.84
FS	29.1±3.2
Pericardial effusion (%)	12.5%(n=6)
Valvular regurgitation (%)	45.8%(22)
Infection (%)	14.8%(n=7)
Death (%)	6.25%(n=3)

*Quantitative data was expressed as Mean±SD and qualitative data was expressed as frequency and percentage

Table-V

Comparison of per-operative and post-operative quantitative outcome between pre-operative hpyoalbuminaemia and normal albumin group

Variable	Hypoalbu-minaemia Group (n=6)	*Normal Albumin group (n=42)*	P value**
S.creatinine(mg/dl)	0.94±0.6	0.49±0.3	0.0013
CPB time(min)	136.4± 39.1	86.4± 22.6	<0.0001
ACC time(min)	94.2±18.4	80.9±23.7	0.08
Duration of MV(hr)	77.6±17.1	38.4±21.4	<0.0001
Length of HS(day)	16.2±2.6	9.1.2±3.4	<0.0001
ICU stay length(hr)	98±18.3	42.6±16.8	<0.0001
TAPSE(mm)	14.4±2.9	18.1±3.2	0.01
EF(%)	47.2±8.4	60.4±6.25	<0.0001
FS(%)	24.3±4.5	32.1±3.6	<0.0001

*Data was expressed as Mean±SD

Unpaired t test was done as a test of significance .**P value <0.05 was considered statistically significant

This table shows comparison of per-operative and post-operative quantitative outcome between hyoalbuminaemia group (n=10) and normal albumin group (n=38) based on per-operative serum albumin level. All the comparison was statistically significant.

Table-VI

Comparison of per-operative and post-operative quantitative outcome between post-operative hpyoalbuminaemia and normal albumin group

Variable	Hypoalbu-minaemia Group (n=13)	*Normal Albumin group (n=35)*	P value**
S.creatinine(mg/dl)	1.12±0.7	0.62±0.45	0.005
CPB time(min)	144.6± 30.1	85.9± 25.4	<0.0001
ACC time(min)	104.6±13.2	74.3±21.9	<0.0001
Duration of MV(hr)	86.4±16.6	32.5±11.2	<0.0001
Length of HS(day)	20.2±2.4	8.6±2.8	<0.0001
ICU stay length(hr)	105.6±16.3	38.5±12.7	<0.0001
TAPSE(mm)	13.1±2.9	16.4±3.5	0.004
EF(%)	46.3±5.4	62.2±6.8	<0.0001
FS(%)	24.6±3.2	33.1±3.4	<0.0001

*Data was expressed as Mean±SD
Unpaired t test was done as a test of significance
**P value <0.05 was considered statistically significant

This table shows comparison of per-operative and post-operative quantitative outcome between hyoalbuminaemia group (n=13) and normal albumin group (n=35) based on post-operative serum albumin level. All the comparison was statistically significant.

Table-VII

Comparison of per-operative and post-operative qualitative outcome between pre-operative hpyoalbuminaemia and normal albumin group

Outcome	Hypoalbu-minaemia Group (n=6)	*Normal Albumin group (n=42)*	P value**
Pericardial effusion	3(50%)	3(7.1%)	0.02
Valvular regurgitation	6(100%)	16(38%)	0.12
Infection	4(66.6%)	3(7.1%)	0.004

*Data was expressed as frequency and percentage
Chi-square test was done as a test of significance
**P value <0.05 was considered statistically significant

This table shows comparison of per-operative and post-operative qualitative outcome between hyoalbuminaemia group (n=6) and normal albumin group (n=42) based on pre-operative serum albumin level. All the comparison was statistically significant except valvular regurgitation.

Table-VIII

Comparison of per-operative and post-operative qualitative outcome between per-operative hpyoalbuminaemia and normal albumin group

Outcome	Hypoalbu-minaemia Group (n=10)	*Normal Albumin group (n=38)*	P value**
Pericardial effusion	4(40%)	2(5.2%)	0.01
Valvular regurgitation	9(90%)	13(30.9%)	0.12
Infection	6(60%)	1(2.3%)	0.0004

*Data was expressed as frequency and percentage
Chi-square test was done as a test of significance
**P value <0.05 was considered statistically significant

This table shows comparison of per-operative and post-operative qualitative outcome between hyoalbuminaemia group (n=10) and normal albumin group (n=38) based on per-operative serum albumin level. All the comparison was statistically significant except valvular regurgitation.

Table-IX

Comparison of per-operative and post-operative qualitative outcome between post-operative hpyoalbuminaemia and normal albumin group

Outcome	Hypoalbu-minaemia Group (n=13)	*Normal Albumin group (n=35)*	P value**
Pericardial effusion	5(38.4%)	1(2.85%)	0.005
Valvular regurgitation	10(76.9%)	12(34.2%)	0.12
Infection	6(46.13%)	1(2.85%)	0.002

*Data was expressed as frequency and percentage
Chi-square test was done as a test of significance
**P value <0.05 was considered statistically significant

This table shows comparison of per-operative and post-operative qualitative outcome between hyoalbuminaemia group (n=13) and normal albumin group (n=35) based on post-operative serum albumin level. All the comparison was statistically significant except valvular regurgitation.

This table shows correlation of pre-operative, per-operative and post-operative hypoalbuminemia and normal albumin group with per-operative and post-operative outcome. Here CPB time, ACC time, duration of MV, ICU stay and Hospital stay were negatively correlated whereas TAPSE, EF% and FS% were positively correlated and all the correlation parameters were statistically significant.

Table-X

Correlation of pre-operative, per-operative and post-operative hypoalbuminemia and normal albumin group with per-operative and post-operative outcome

	CPB tm min	ACC Tm min	MV hr	Icu St hr.	Hosp. St day	TAPSE mm	EF %	FS %	
Preoperative S.Albumin mg/dl	r-value	-.335*	-.267	-.433**	-.420**	-.213	.279	.478**	.467**
	p-value	.020	.067	.002	.003	.147	.055	.001	.001
PeroperativeS.Albumin mg/dl	r-value	-.552**	-.492**	-.660**	-.657**	-.531**	.533**	.664**	.666**
	p-value	.000	.000	.000	.000	.000	.000	.000	.000
Postoperative S.Albumin mg/dl	r-value	-.677**	-.593**	-.683**	-.575**	-.548**	.676**	.697**	.690**
	p-value	.000	.000	.000	.000	.000	.000	.000	.000

Pearson correlation test is done as test of significance
P value <0.05 was considered statistically significant

Discussion:

Mean pre-operative serum albumin was 3.5±0.9 mg/dl whereas per-operative and post-operative serum albumin was 3.3±0.7 mg/dl and 3.1±0.7 mg/dl respectively.CPB time was a bit higher in study population (98.4± 29.1min) whereas other outcome parameters were within normal range. Duration of hospital stay was 12.2±3.1days. 22 patient (45.8%) developed valvular regurgitation and 6 patient (12.5%) developed pericardial effusion in post-operative echocardiography. Infection was evident by positive blood culture in 7 patients (14.8%). Leite HP et al found similar finding when he studied 30 CHD patients who underwent cardiac surgery[5]. Like this study mean pre-operative serum albumin was 3.4±0.25g/dl which decreased in 2nd post-operative day. Concerning lowpostoperative values, the transcapillary flow of plasma proteins secondary to the endothelial lesion is the main underlying mechanism to explain hypoalbuminemia[7, 2]. The contact of the blood with the surface of cardiopulmonary bypass tubes may produce an endothelial lesion that in turn is a triggering factor of the systemic inflammatory response [8].They also found length of hospital stay 11±3.5 days and 26.6% patient suffered from infection[5] .

In this study comparison of quantitave outcome between hyoalbuminaemiagroup and normal albumin group based on pre-operative, per-operative and post-operative serum albumin level was statistically significant. KittisakmontriK et al stated that lower pre-operative serum albuminlevelswere associated with prolonged post-operative length of hospital stay [9]. Koertzen M et al concluded Pre-operative and admission hypoalbuminemia have been associated with increased duration of mechanical ventilation and ICU stayfor ICU patients undergoing CPB [10]. Probable explanation is lower albumin is likely most often a consequence of secondary protein energy malnutrition, plus heart failure in CHD. These factors influence the worse post-operative outcomes in patients undergoing CPB[1]. On the contrary Shiller O et al didn't find significant association between pre-operative albumin and post-operative outcome[4] .Concomitantly Davari P et al described that post-operative serum albumin was significantly associated with worst prognosis and outcome after cardiacsurgery[11]. A multicenter study of 203 study population conducted by Henry BM et al exerted similar association [12].

In this study comparison of qualitative outcome between hyoalbuminaemia group and normal albumin group based on pre,per and post-operative serum albumin level was also done and that revealed pericardial effusion and infection was higher in hyoalbuminaemiagroup. Rady MY et al and Kirklin JW et al noted higher infection cases in pre-operative hyoalbuminaemia group [13 , 14]. Low post-operative albumin concentrations have been associated with high concentrations of C-reactive protein, a1-antitrypsin, interleukin-6 and procalcitonin, in patients after cardiac surgery [15] .In this study Preoperative, per-operative and post-operative albumin level was chosen as a possible predictive variable since it may be helpful in communicating our assessment of the complexity of the per-operative and postoperative course to the patient's parents. There was a significant correlation between albumin levels with per-operative and post-operative outcome. Here CPB time, ACC time, duration of MV, ICU stay and Hospital stay were negatively correlated whereas TAPSE, EF% and FS% were positively correlated.

Conclusion:

Pre, per and post-operative hypoalbuminaemia are important indicators for identifying poor immediate outcome following cardiac surgery under CPB in children with CHD

References:

1. Radman M, Mack R, Barnoya J, Castañeda A, Rosales M, Azakie A, Mehta N, Keller R, Datar S, Oishi P, Fineman J. The effect of preoperative nutritional status on postoperative outcomes in children undergoing surgery for congenital heart defects in San Francisco (UCSF) and Guatemala City (UNICAR). The Journal of thoracic and cardiovascular surgery. 2014 Jan 1;147(1):442-50.
2. Ballmer PE. Causes and mechanisms of hypoalbuminaemia.Clinical Nutrition. 2001 Jun 1;20(3):271-3.
3. Blasquez A, Clouzeau H, Fayon M, Mouton JB, Thambo JB, Enaud R, Lamireau T. Evaluation of nutritional status and support in children with congenital heart disease. European journal of clinical nutrition. 2016 Apr;70(4):528-31.
4. Schiller O, Goldshmid O, Mowassi S, Shostak E, Manor O, Amir G, Frenkel G, Dagan O. The utility of albumin level as a marker of postoperative course in infants undergoing repair of congenital heart disease.Pediatric Cardiology. 2020 Jun;41:939-46.
5. Leite HP, Fisberg M, de Carvalho WB, de Camargo Carvalho AC. Serum albumin and clinical outcome in pediatric cardiac surgery. Nutrition. 2005 May 1;21(5):553-8.
6. Castleberry C, White Williams C, Naftel D, Tresler MA, Pruitt E, Miyamoto SD, Murphy D, Spicer R, Bannister L, Schowengerdt K, Gilmore L. Hypoalbuminemia and poor growth predict worse outcomes in pediatric heart transplant recipients. Pediatric transplantation. 2014 May;18(3):280-7.
7. Fleck A, Hawker F, Wallace PI, Raines G, Trotter J, Ledingham IM, Calman KC. Increased vascular permeability: a major cause of hypoalbuminaemia in disease and injury. The Lancet. 1985 Apr 6;325(8432):781-4.
8. Verrier ED, Boyle Jr EM. Endothelial cell injury in cardiovascular surgery.The Annals of thoracic surgery. 1996 Aug 1;62(3):915-22.
9. Kittisakmontri K, Reungrongrat S, Lao-Araya M. Hypoalbuminaemia at admission predicts the poor outcomes in critically ill children. Anaesthesiology intensive therapy. 2016 Jan 1;48(3).
10. Koertzen M, Punjabi PP, Lockwood GG. Pre-operative serum albumin concentration as a predictor of mortality and morbidity following cardiac surgery.Perfusion. 2013 Sep;28(5):390-4.
11. NAKHOSTIN DP, Tabib A, Ghaderian M, GIVTAJ N. Correlation of post-operative hypoalbuminemia with outcome of pediatric cardiac surgery.
12. Rady MY, Ryan T, Starr NJ. Clinical characteristics of preoperative hypoalbuminemia predict outcome of cardiovascular surgery. Journal of parenteral and enteral nutrition. 1997 Mar;21(2):81-90.
13. Kirklin JW, Barrat-BoyesBE. Cardiac surgery. New York: John Wiley & Sons. 1992. 26(1)
14. Fritz HG, Brandes H, Bredle DL, Bitterlich A, Vollandt R, Specht M, Franke UF, Wahlers T, Meier Hellmann A. Post operative hypoalbuminaemia and procalcitonin elevation for prediction of outcome in cardiopulmonary bypass surgery. Acta-Anaesthesiologica Scandinavica. 2003 Nov;47(10):1276-83.

Original Article

Association of Physical Activity Levels with Coronary Artery Disease Risk Factors in Middle aged (40-55) Bangladeshi Women

Afroza Ahmed[1], Abdul Wadud Chowdhury[2], Isha Abdullah Ali[3], Basudev Kumar Kashyapi[4], Sayeda Sadia Fathema[5], Taslima Afroz[6]

Abstract:

Background: A sedentary lifestyle is associated with increased risk of Coronary Artery Disease (CAD) in women. At least 150min/wk of moderate activity or 75min/wk of vigorous activity or combination is recommended by American Heart Association (AHA) for primary prevention of CAD. The purpose of this study was to assess the physical activity levels of middle aged women and to find out the association of CAD risk factors with physical activity level.

Methods: This cross-sectional analytical study was conducted in Dhaka Medical College Hospital (DMCH) cardiology OPD from May 2019 to April 2020. We interviewed 249 middle aged women (40-55) who attended our OPD during the study period and fulfilled the exclusion and inclusion criteria. Global Physical Activity Questionnaire (GPAQ) was used to assess physical activity level. Blood pressure and BMI was measured. OGTT and fasting lipid profile was done. Subjects with low physical activity was assigned in Group I (n=152), moderate activity in group II (n= 93) and high activity in group III (n= 4). Association between the physical activity levels and presence of CAD risk factors like DM, HTN, dyslipidemia and obesity was evaluated.

Results: In this study we found that most of the study subjects (61.0%) were in low active group. Overall 70.2% women were menopausal and premature menopause (£50 years) was found in 47.8% of subjects. Mean age of menopause was 47±3.8; (44-53) years and mean duration of menopause was 3.1±0.5 years. Overall prevalence of DM, HTN, obesity and dyslipidemia was 62.2%, 50.6%, 39.8% and 53.4% accordingly. Women in low active group were having significant higher proportion of DM (52.6%), HTN (65.8%), obesity (57.9%) and dyslipidemia (75.7%) in comparison to moderate active group. Only 4 women were in highly active group and none of the CAD risk factors was present among them.

Conclusion: Low physical activity level was associated with higher prevalence of conventional CAD risk factors in middle aged (40-55) women.

Keywords: *Physical Activity, Coronary Artery Disease, Risk Factors*

(Bangladesh Heart Journal 2024; 39(2): 127-137)

Introduction:

Coronary artery disease in women is now a day showing increasing trends.[1,2] Numbers of women suffering from CAD are increasing yearly in developed countries as well as low and middle income countries like India.[1] In a study in Tehran in the year 2011 showed middle aged women between 30 to 50 years of age are having high

1. Specialist, Department of Cardiology, United Hospital Limited, Dhaka, Bangladesh
2. Professor & Head of the Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh
3. Registrar & Specialist, Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka, Bangladesh
4. Medical Officer, Department of Cardiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh
5. Consultant, Department of Cardiology, Islami Bank Hospital & Cardiac Center, Mirpur, Dhaka, Bangladesh
6. Specialist, Department of Cardiology, United Hospital Limited, Dhaka, Bangladesh

Address of Correspondence: Dr. Afroza Ahmed, Specialist, Department of Cardiology, United Hospital Limited, Dhaka, Bangladesh. Mobile: +8801677309433, E-mail: afrozamoinrumana@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75796

prevalence of CAD risk factors including DM, HTN, obesity and Dyslipidemia.[3] A study in Pune, India which was conducted among middle aged women between 45 to 59 years old showed significant association of low physical activity with higher prevalence of CAD risk factors among those women.[4]

During last few decades, different studies in rural Bangladesh showed CAD mortality has increased dramatically in women compared to men.[5,6] In a recent study of CAD risk factors in postmenopausal women in rural Bangladesh showed traditional CAD risk factors have strong association with important metabolic and behavioral risk factors like physical activity.[7] The conventional CAD risk factors including obesity, dyslipidemia, DM, HTN tend to cluster in women around 45 years of age which is considered as age of menopausal transition for women, and the prevalence of risk factors increase with further advances.[8]

Though median age of presentation for CAD is higher in women, they have poorer prognosis compared to men. Major CAD risk factors like HTN and DM have higher risk in women. Women who are leading a sedentary life style are at increased risk of CAD related mortality and morbidity. On the other hand physically active women have lower CAD risk.[9] Regular physical activity improves cardiovascular parameter including coronary artery flow dilatation and collateral formation. Exercise also has antithrombotic effect like reduced platelet aggregation, increased fibrinolytic activity, lower plasminogen activator inhibitor -1. Regular physical activity also lower plasma fibrinogen concentration, CRP and white cell count. Physical activity (PA) has proven benefit in metabolic parameter in women. Higher PA has been associated with lower TG, higher HDL, lower weight, BMI, waist –Hip ratio, lower SBP and DBP. Higher PAL also reduce fasting insulin level when elevated insulin level is a marker of insulin resistance and predictor of NIDDM.[9]

According to non communicable disease (NCD) risk factor survey in 2010, Bangladeshi women especially in urban area was found to be less active.[10] According to STEPS survey 2010, the overall countrywide prevalence of low physical activity was 34.5% in which women form the predominant part and 53.6% women were generally inactive.[11]

Women have lower risk of CAD compared to men in younger age and the mean age of presentation in women is 10 years delayed than men. But women lose their 10 years advantage if they have premature menopause, DM, obesity, smoking, dyslipidemia. In a study among Bangladeshi rural women the authors found no significant difference in obesity components including BMI and waist circumference in pre and postmenopausal women.[12] Younger women with CAD has more mortality than men which may be due to the perception that women have lower risk of CAD, so, diagnostic and therapeutic management is delayed. Women in general also have higher mortality than men after their first attack and re infarction chance in women are also greater. So, assessment and aggressive management of risk factors are highly beneficial for women and is an unavoidable necessity in today's circumstances.[13,14]

In a recent study among Indian women, reporting to department of cardiology of a tertiary care hospital, it revealed that, among women aged less than 50 years, 66% had blocks in their coronaries. Manual laborers were having significantly lesser risk of CAD than homemakers and other sedentary workers. Among homemakers and laborers, 82% and 40% women showed coronary blocks. 80% of women who had attained menopause were having coronary artery blocks compared to 60% who did not. Among women with diabetes, 83% showed blocks in their coronaries compared to 69% of non-diabetics. Among women who gave family history of CAD, diabetes and hypertension, coronary blocks were found in 75%, 74% and 62% of women respectively. 63% of women with low or normal BMI and higher waist hip ratio were found to be having coronary blocks.[15]

Dyslipidemia is an important risk predictor for CAD in both male and female. Elevated low-density lipoprotein cholesterol (LDL-C) has been identified as the key lipid parameter in both men and women whereas other lipids and lipoproteins have been shown to be especially potent risk predictors in women. Throughout their middle age, women have lower total, LDL-, and non-HDL-cholesterol. In older age, all these parameters are higher in women.[16] In a study in Bangladesh in the year 2012, it was found that prevalence of dyslipidemia in sample adults aged 18 and over was 16.6%, 22.2% and 15.9% in males and females, respectively, and 21.0% and 17.7% in non-local and local population, respectively. In participants below 40 years, dyslipidemia showed higher prevalence in men. After 40 years, it showed progressive age dependent increase up to eighth decade in both. Maximum prevalence of dyslipidemia was 64% among men in seventh decade and women in sixth decade. Prevalence of dyslipidemia was higher among housewives, sedentary workers, those with high body mass indices, smokers, and individuals who take diet rich in meat, egg, more calories.[17]

Hypertension is the most common modifiable risk factor for CVD, the leading cause of death in women worldwide. As women age, they become more likely to develop hypertension and the associated CVD outcomes. Women also have unique forms of hypertension associated with pregnancy, menopause, and the use of OCP.[18]

Prevalence of obesity has increased worldwide over the past few decades regardless of sex, age, and development status of the country. In the general population, obesity and, especially, severe obesity (BMI ≥35 kg/m2) are consistently and strongly related with higher risk of incident CVD and CVD mortality. Not only does the degree of obesity influence CVD prognosis but also how long a person has been obese, supporting the notion that delaying obesity onset might have important CV health benefits and that efforts on preventing obesity should start as early as possible.[19]

Diabetes mellitus increases the risk of CVD by 3 to 4 times in women. Diabetes is a strong risk factor for future cardiovascular complications and in women, diabetes attenuates the usual female advantage. Unfortunately, there appears to be a heavy risk-factor burden in women with diabetes, and younger women appear especially sensitive to CVD risk factors.[20]

A review study of sex based differences of traditional ASCVD risk factors by Garcia, et al. (2016) revealed women with DM have 3 fold excess risk of fatal CAD compared with non diabetic women. Obesity increases the risk of CAD by 64% in women compared with 46% in men. It is recommended that women should accumulate at least 150 min/week of moderate exercise, 75 min/week of vigorous exercise or an equivalent combination to protect themselves from traditional CAD risk factors.[21]

Methods:

This cross-sectional analytical study was conducted in Dhaka Medical College Hospital (DMCH) cardiology OPD from May 2019 to April 2020 following ethical clearance. A total of 249 middle aged women (40-55) with no pre-existing CAD who attended our OPD during the study period and fulfilled the exclusion and inclusion criteria were included by convenient purposive sampling. Study subjects with established IHD, pre-existing DM, having congenital heart disease, cardiomyopathy, valvular heart disease, pericardial disease, any chronic disabling illness, having surgical menopause were excluded from the study. Informed written consent was taken from each participant. Global Physical Activity Questionnaire (GPAQ) was used to assess physical activity level. Blood pressure and BMI was measured. OGTT and fasting lipid profile was done. Subjects with low physical activity was assigned in Group I (n=152), moderate activity in group II (n= 93) and high activity in group III (n= 4). Association between the physical activity levels and presence of CAD risk factors like DM, HTN, dyslipidemia and obesity was evaluated. Data were collected in separate case-record form and analyzed by SPSS 26.

Results:

Table-I

Demographic distribution of study population (n=249)

Demographic variables	Frequency	Percentage
Age (in years)		
40-45	51	20.4%
45-50	59	23.6%
50-55	139	55.8%
Occupation		
Housewife	223	89.5%
service	26	10.4%
Marital status		
Married	216	86.7%
Divorced	01	0.4%
Widow	32	12.8%
Unmarried	00	00%

Most of the subjects were in 50-55 years age group (n=139, 55.8%). Most of them were married (n=216, 86.7%) and housewives (n=223, 89.5%).

Table-II

Distribution of study population according to physical activity levels (PAL) (n=249)

Physical activity level	Frequency	Percentage
Group- I (Low active)	152	61.0
Group-II (Moderate active)	93	37.3
Group-III (Highly active)	4	1.6
Total	249	100.0

Low active: < 600 MET minutes/week
Moderate active: 600-3000 MET minutes/week
Highly active: >3000 MET minutes/week

The frequency table shows, most of the study subjects were low active (n=153, 61.0%). Only 4 women were in highly active group (1.6%). Others were in moderate active group (n=93, 37.3%)

Table-III

Distribution of physical activity level at different age groups of middle aged women and comparison between mean age of three groups(n=249)

Age group (years)	Physical activity				p-value
	Group-I (n=152) No. (%)	Group-II (n=93) No. (%)	Group-III (n=4) No. (%)	Total (n=249) No. (%)	
40-45	23(15.1%)	28(30.1%)	0(0.0%)	51(20.5%)	
45-50	36(23.7%)	20(21.5%)	3(75.0%)	59(23.7%)	
50-55	93(61.2%)	45(48.4%)	1(25.0%)	139(55.8%)	
Total	152(100.0%)	93(100.0%)	4(100.0%)	249(100.0%)	
Mean±SD	50.0±4.9	48.2±5.5	47.8±4.9	49.3±5.2	0.023[s]

Chi-square test was done, ns= not significant
Values were expressed in percentage (%), Mean & SD
Group-I; low active, Group-II; moderate active, Group-III; highly active

In the age group of (50-55), 61.2% women were low active, 48.4% women were moderately active and only 25% women were highly active. In (45-50) age group only 23.7% were low active and in (40-45) age group, only 15.1% of women were low active. Women in higher age group were more physically inactive than women in lower age group. The mean ages of women in low active, moderate active and high active group were different and it was statistically significant (*p* value 0.023).

Among the study subjects 70.2% women were menopausal and only 29.7% were not in menopause. Among the menopausal women 61.7% were in low active group and 36% were in moderate active group. There were only 04 women in highly active group and all were menopausal. There was no statistically significant difference regarding menopausal status in three groups of physical activity. Mean age of menopause of the study population was 47±3.8. In Group-I, Group-II and Group-III the mean age of menopause was 48.0±5.7, 46.2±3.50 and 47.2±2.19 accordingly. Difference between mean ages of menopause in between three groups of physical activity was statistically significant.

Among women ≤50 years of age, around 47.8% were menopausal. Among them 48.3% were low active. Only 33.3% menopausal women ≤50 years of age were highly active and others were moderately active.

Among the study subjects, only 34.9% women were found to be habituated of smokeless tobacco use. Among the tobacco users 31.6% were in low active group. There was no statistically significant difference (*p* value 0.347) of numbers of tobacco users in each group of physical activity level.

Overall prevalence of DM was 62.2%, HTN was 50.6%, Obesity was 39.8% and Dyslipidemia was 53.4%. Among the components of dyslipidemia, high TC and low HDL was mostly prevalent.

All the conventional coronary artery disease risk factors were mostly prevalent in low active group in comparison to moderate active group. Significantly higher proportion of women in low active group was having DM (57.9%), HTN (65.8%), and obesity (57.9%). Dyslipidemia (75.7%) along with high TC (35.5%), LDL (23.0%), TG(66.4%) and low HDL (56.6%) was also mostly prevalent in low active group. There was statistically significant difference of prevalence of risk factors in between low active and moderately active group (*p* value 0.001).

There were only 4 women in highly active group. Most of them were in (45-50) years of age group, they were in different occupation, all were menopausal, 2 of them was habituated in smokeless tobacco use. None of them had DM, HTN, Dyslipidemia or Obesity.

Among the study subjects, TC (*p* value <0.001) and TG levels (*p* value 0.028) were significantly higher in Group-I and HDL (*p*value0.028) was significantly lower in that group. LDL was higher in Group-I in comparison to others but that was not statistically significant (*p* value 0.104). Both FBS (p value <0.001) and sugar level 2 hours after 75 gm glucose (*p* value<0.001) were significantly higher in Group-I. As there were only 4 subjects in Group-III, they were not considered here.

Among the study subjects, BMI was significantly high in group-I in comparison to group-II & and group-III (*p* value <0.001). Both SBP (*p* value <0.001) and DBP (*p* value 0.003) were also significantly high in group-I. Women

who were in group-I had significantly low MET minutes/ week (*p* value <0.001). As there were only 4 subjects in Group-III, they were not considered here.

BMI, SBP, DBP, TC level, TG level, FBS and blood sugar 2hrs after 75 gm oral glucose were found to have significant negative correlation with MET minutes (*p* value <0.001). HDL level was found to have significant positive correlation with MET minutes (p value 0.010). LDL cholesterol was also found to have negative correlation with MET minutes but that was not statistically significant (*p* value 0.406).

Low physical activity was found to have significant association with DM [OR 6.26; 95% CI (3.27-12.02)], HTN [OR 4.96, 95% CI (2.82-8.70)], Dyslipidemia [OR 4.96; 95% CI (2.82-8.70)] and Obesity [OR 10.25; 95% CI (5.05-20.78)].

Table-IV

Distribution of study population according to Menopausal status, mean age of menopause and Physical activity level (n=249)

Menopausal status	Physical activity								p-value
	Group-I (n=152)		Group-II (n=93)		Group-III (n=4)		Total (n=249)		
	No.	%	No.	%	No.	%	No.	%	
Yes	108	(61.7%)	63	(36%)	04	(01%)	175	(70.2%)	0.364^{ns}
No	44	(59%)	30	(40%)	00	(00%)	74	(29.7%)	
Total	152	(61.0%)	93	(37.3%)	04	(1.6%)	249	(100%)	
Mean±SD	48.0±5.7		46.2±3.50		47.2±2.19		47±3.8		0.052^{s}

Chi-square test and two way ANOVA test were done, ns= not significant, s=significant
Group-I; low active, Group-II; moderate active, Group-III; highly active

Table-V

Menopausal status of women ≤50 years of age and physical activity level (n=138)

Menopausal status	Physical activity				p-value
	Group-I (n=75) No. (%)	Group-II (n=60) No. (%)	Group-III (n=3) No. (%)	Total (n=138) No. (%)	
Yes	36(48.0%)	29(48.3%)	1(33.3%)	66(47.8%)	0.878^{ns}
No	39(52.0%)	31(51.7%)	2(66.7%)	72(52.2%)	
Total	75(100.0%)	60(100.0%)	3(100.0%)	138(100.0%)	

Chi-square test was done, ns= not significant

Table-VI

Distribution of study population according to Smokeless tobacco using status and Physical activity level (n=249)

Tobacco using status	Physical activity				p-value
	Group-I (n=152) No. (%)	Group-II (n=93) No. (%)	Group-III (n=4) No. (%)	Total (n=249) No. (%)	
Yes	48(31.6%)	37(39.8%)	2(50.0%)	87(34.9%)	0.347^{ns}
No	104(68.4%)	56(60.2%)	2(50.03%)	162(65.1%)	
Total	152(100.0%)	93(100.0%)	4(100.0%)	249(100.0%)	

Chi-square test was done, ns= not significant
Group-I; low active, Group-II; moderate active, Group-III; highly active

Table-VII

Distribution of Coronary Artery Disease risk factors in total study population (n=249)

Risk factors	No.	%
DM	155	62.2%
HTN	126	50.6%
Obesity	99	39.8%
Dyslipidemia	133	53.4%
High TC	58	45.4%
High TG	113	23.3%
High LDL	38	15.3%
Low HDL	99	39.8%

Table-VIII

Distribution of Coronary Artery Disease risk factors in between low active and moderately active subjects (n=245).

Risk factors	Group-I (n=152) No. (%)	Group-II (n=93) No. (%)	p-value
DM	80(52.6%)	14(15.1%)	<0.001[s]
HTN	100(65.8%)	26(28.0%)	<0.001[s]
Obesity	88(57.9%)	11(11.8%)	<0.001[s]
Dyslipidemia	115(75.7%)	18(19.4%)	<0.001[s]
High TC	54(35.5%)	4(4.3%)	<0.001[S]
High TG	101(66.4%)	12(12.9%)	<0.001[s]
High LDL	35(23.0%)	3(3.2%)	<0.001[S]
Low HDL	86(56.6%)	13(14.0%)	<0.001[S]

Chi-square test was done, s= significant
Group-I; low active, Group-II; moderate active

Table-IX

Demography and distribution of CAD risk factors in high active group (n=4)

Age group	45-50 years	3
	50-55 years	1
Occupation	Housemaid	2
	Day laborer	1
	Business	1
Menopausal status	Yes	3
	No	0
Tobacco using status	Yes	2
	No	2
DM	Yes	0
	No	4
HTN	Yes	0
	No	4
Dyslipidemia	Yes	0
	No	4
Obesity	Yes	0
	No	4

Table-X

Comparison of biochemical parameters among low active and moderately active subjects (n=245)

Variables	Group-I (n=152) No. (%)	Group-II (n=93) No. (%)	p-value
TC (mg/dl)	191.85±45.41	165.72±34.32	<0.001[s]
LDL (mg/dl)	118.78±37.05	110.1±28.4	0.104 [ns]
HDL (mg/dl)	38.68±8.20	41.05±5.55	0.028[s]
TG (mg/dl)	201.16±93.41	137.84±51.43	<0.001[s]
FBS (mmol/L)	7.16±1.71	6.18±1.25	<0.001[s]
2hrs after 75 gm glucose (mmol/L)	9.92±2.55	8.27±1.97	<0.001[s]

Data were expressed as mean±SD
ANOVA test was done, s= significant, ns= not significant
Group-I; low active, Group-II; moderate active

Table-XI

Comparison of SBP, DBP, BMI and MET minutes among low active and moderately active subjects (n=245)

Variables	Group-I (n=152) No. (%)	Group-II (n=93) No. (%)	p-value
BMI (kg/m$^{2)}$	24.47±2.73	22.01±2.52	<0.001[s]
SBP (mmHg)	135.89±20.08	124.95±14.50	<0.001[s]
DBP (mmHg)	83.82±9.74	79.89±9.27	0.003[s]
MET minutes/week	353.95±104.08	962.80±355.36	<0.001[s]

Data were expressed as mean±SD
ANOVA test was done, s= significant, ns= not significant
Group-I; low active, Group-II; moderate active

Table-XII

Spearman's rank correlation between MET minutes of physical activity and CAD risk factors (n=249)

CAD risk factors	Correlation coefficient (r)	p value
BMI (kg/m^2)	-0.426	<0.001*
SBP (mmHg)	-0.321	<0.001*
DBP (mmHg)	-0.212	0.005*
TC (mg/dl)	-0.215	0.001*
LDL (mg/dl)	-0.053	0.406
HDL (mg/dl)	0.244	<0.001*
TG (mg/dl)	-0.416	<0.001*
FBS (mmol/L)	-0.269	<0.001*
2hrs after 75 gm glucose (mmol/L)	-0.300	<0.001*

MET; metabolic equivalent of Tasks, BMI; body mass index, SBP; systolic blood pressure, DBP; diastolic blood pressure, LDL; low density lipoprotein, HDL; high density lipoprtotein, TG; triglyceride, TC; total cholesterol, FBS; fasting blood sugar.

Table-XIII

Association of DM, Hypertension, Obesity and Dyslipidemia with low physical activity (n=245).

Risk factors	Group-I (Low active) (n=152) No. (%)	Group-II (Moderate active) (n=93) No. (%)	OR 95% CI
DM	80(52.6%)	14(15.1%)	6.26 (3.27-12.02)
HTN	100(65.8%)	26(28.0%)	4.96 (2.82-8.70)
Obesity	88(57.9%)	11(11.8%)	10.25(5.05-20.78)
Dyslipidemia	115(75.7%)	18(19.4%)	12.95(6.87-24.41)

Odds Ratio and 95% CI was done
Group-I; low active, Group-II; moderate active

Discussion:

The mean age of the study population was 50.0 ± 4.9 years in Group-I, 48.2 ± 5.5 years in Group-II and 47.8 ± 4.9 years in Group-III. Women in higher age group (50-55 years) was found more physically inactive (n=85, 61.1%) than lower age group.

In this study both premenopausal and postmenopausal women were included and around 70.2% women were found postmenopausal which is much higher number than study conducted by Jesmin, et al., (2013) and Delavar, et al., (2011).[3,12] The possible reason may be that, both of the studies included lower age group and had larger sample size in comparison to this study. Among postmenopausal women 62% belonged to low active group and among premenopausal women 59% was low active. We also found that the mean age of menopause of the study subjects was 47± 3.8 years and 47.8% of our study subjects reached to their menopause at or below 50 years of age. Though the average age of menopause in Bangladeshi women was found 51.4±2 years in different studies[22] but the prevalence of premature menopause is also increasing among our women. According to Bangladesh Demography and Health Survey Report (BDHS) 2014, around 68% women achieved their menopause below 50 years of age. Studies also suggest that women experiencing menopause before 50 years of age has higher cardiovascular risk and fatal CV events.[23] Low socioeconomic status, less education and sedentary lifestyle were considered as a risk factor of premature menopause.[24] It was also found in different studies that, duration of menopause was associated with higher CAD risks in women. Tandon, et al. (2010) found higher prevalence of CAD risk factors in postmenopausal women when their mean duration of menopause was 4.70 years.[25] Cho et al., (2008) found in their study that, high BP and dyslipidemia was mostly prevalent in Korean postmenopausal women after 5 years of menopause whereas high blood sugar and BMI was prevalent in women who are menopausal for less than 5 years.[26] Matthews, et al., (2001) found in their study that women who were menopausal for at least 5 years had higher LDL-C, TG, TC and low HDL-C.[27] In our study, the mean duration of menopause of study subjects were 3.12±0.5 years. As the duration of menopause in our study subjects were less than 5 years, the conventional CAD risk factors present in these women are may be due to less physical activity rather than menopause itself. In our study we have included women in between 40-55 years age group and our mean age of menopause was 47±3 years. So our selected age limit is a time for menopausal transition for these women and as during menopausal transition women loss their hormonal protection against CAD, physical inactivity adds additional risks to these women. So, building awareness regarding physical activity in this age group has become an utmost necessity.

Regarding physical activity, in this study, most of the middle aged women were found low active (61.0%). The result was similar with the result of Barua, et al., (2018) who found 58.1% women as low active in their study.[7] Our result contradicted with Delavar, et al., (2011), who used lower age group and used International long physical activity questionnaire instead of GPAQ.[3] They found a higher proportion of women were involved in moderate (24.8%) and high (74.5%) physical activity and very small proportion was physically inactive.

In this study, the overall prevalence of DM among middle aged women was 37.8% which was similar to the findings (35%) of Jesmin, et al., 2013.[12] Conversely, Barua, et al., (2018) got 20.8% of postmenopausal rural women were having DM.[7] In India, Gupta, et al., (2014) in their study found that age adjusted prevalence of DM among women of 40 to 59 years was 18.8%.[28] We observed significantly higher proportion of DM in low active group (85.1%, n=

80). In our study we found significant association between fasting blood glucose level (r value -0.269; p value <0.001) or 2hrs after 75gm oral glucose (r vaule-0.300; p value <0.001) with physical activity level. Like us, Joseph et al., (2016) also found inverse association of type 2 DM and IFG with physical exercise level and walking pace.[29] Like us, Barua, et al., (2018), also found significant negative correlation between Physical activity level and 2 hours after 75gm oral glucose (p value 0.028) but they didn't find significant result while considering fasting blood glucose (p value 0.135).[7]

In this study, among middle aged women 50.6% was found to be hypertensive. Among women who were physically inactive, 65.8% were found to be hypertensive and in comparison to moderate or vigorous intensity group, low active group were found to have higher prevalence of HTN. Both Systolic and diastolic BP had statistically significant negative correlation with MET minutes (SBP; r value -0.321, p value <0.001 & DBP; r value -0.212, p value 0.005). The result was supported by several other studies.[7,30,31]

Overall prevalence of dyslipidemia was 53.4% and high TG level was mostly common (45.4%) in those women. Among low active group, dyslipidemia was much higher in comparison to moderately active and highly active women; 86.5%, 13.4%, 0% accordingly. High LDL level (23.0%), high TC (35.5%) and low HDL (56.6%) level was also prevalent in low active group. A lower percentage of subjects who were involved in moderate activity were found to have dyslipidemia (19.4%). The highly active group showed no derangement in their lipid profile status (0%). Our study found significant negative correlation between MET minutes with total cholesterol (r value -0.215 and p value 0.007) and triglyceride level (r value 0.416 and p value <0.001) level. Our study also found significant positive correlation with MET minutes and high density lipoprotein level(r value 0.244, p value <0.001). Several other studies found similar results while comparing level of physical activity with lipid profile status.[7,32,33] Our study found no significant correlation between MET minutes and low density lipoprotein level (r value -0.033 and p value 0.406). Like us, Chitra, et al., (2012) studied 316 adults and found a significant difference in total cholesterol level of subjects who exercised regularly in comparison to those who did not exercise regularly (p value 0.047).[33] Those who exercised also had higher HDL cholesterol level in comparison to low exercise group (p value 0.012). But exercise did not show any significant effect on serum LDL level (p value 0.972).

In our study, overall prevalence of obesity was 39.8% which is similar with the result (39%) found by Nagarkar, et al. (2018).[34] Delavar, et al., (2011) studied overweight and obesity in middle aged Iranian women and found 82.2% women were either overweight or obese.[3] In Bangladesh, Jesmin, et al., (2013) found 2.9% of adult rural women were having BMI >30kg/m2.[12] Barua, et al., (2018) found 7.9% of women having obesity.[7] They studied postmenopausal rural women and included higher age group. In our study, prevalence of obesity was much higher in low active group (57.9%) in comparison to moderate active and highly active group. We also found significant negative correlation with MET minutes and BMI of study subjects (r value -0.426, p value <0.001). The result was similar with Nagarkar, et al. (2018) and Barua, et al., (2018).[7,34]

Finally, in our study we found most of the middle aged (40-55) women were habituated in inadequate physical activity. Inadequate physical activity was found to have significant association with DM, HTN, dyslipidemia and obesity among the study subjects. Most of the women were menopausal but the mean duration of menopause was only 3.1±0.5 years. So, the age range (40-55) years, was the age of menopausal transition for those women. During this period doing adequate physical activity and building awareness among the women regarding inactivity related fatal CAD risk factors may protect them from future CAD related mortality and morbidity.

Conclusion:

The results of our study demonstrated that the association of physical activity levels with CAD risk factors remains statistically significant. The women in low active group were having significantly higher prevalence of DM, HTN, dyslipidemia and obesity. The SBP, DBP, BMI and the biochemical parameters were having significant correlation with MET minutes/week. Statistical analysis demonstrated that low physical activity was an important predictor for the presence conventional CAD risk factors in middle aged women. Whether low physical activity levels represent a independent risk marker for CAD remains to be elucidated.

Limitations:

This was a single-centre study and purposive sampling was done instead of random sampling. Therefore, the results of the study may not reflect the exact picture of the country. In this study, only 4 women were found to have highly active and doing vigorous physical activity. So,

comparison of risk factors between low active, moderately active and highly active group couldn't be appropriately applied. Subjective measurement of physical activity may be influenced by recall bias. Many factors that can contribute to DM, dyslipidemia, HTN and obesity (e.g., familial predisposition, diet etc.) were not taken into account in the study, and might have influenced, at least in part, the results. Central obesity was not considered separately here.

Recommendations:

The results of the present study suggest that low physical activity level has significant association with conventional CAD risk factors. Maintenance of adequate physical activity level in middle age women may be one of the main stay of preventive strategy against DM, HTN, dyslipidemia and obesity. Further longitudinal studies may also be warranted to validate the findings, to investigate the mechanisms underlying increased cardiovascular risk and to determine whether adequate physical activity can protect from future CAD.

References:

1. Prabhakaran D, et al. The changing patterns of cardiovascular diseases and their risk factors in the states of India: the Global Burden of Disease Study 1990–2016. The Lancet Global Health. 2018;6(12): e1339–e1351.
2. Benjamin EJ, et al. 2019 Heart Disease & Stroke Statistical Update Fact Sheet. Circulation. 2019;139:e56-e528
3. Delavar MA, et al. Physical activity, nutrition, and dyslipidemia in middle-aged women. Iranian Journal of Public Health. 2011;40(4):89–98.
4. Nagarkar AM and Kulkarni SS. Obesity and its Effects on Health in Middle-Aged Women from Slums of Pune. Journal of Mid-Life Health. 2018;9:79–8
5. Karar ZA, Alam N and Streatfield PK. Epidemiological transition in rural Bangladesh, 1986-2006. Global Health Action. 2009;2(1):1–9
6. Islam AM, Mohibullah A and Paul T. Cardiovascular Disease in Bangladesh: A Review. Bangladesh Heart Journal. 2017;31(2):80–99.
7. Barua L, et al. Physical activity levels and associated cardiovascular disease risk factors among postmenopausal rural women of Bangladesh. Indian Heart Journal. 2018;70(Suppl 3): S161–S166
8. Pranita A, et al. Prevalence of metabolic syndrome in urban middle aged women. International Journal Of Scientific Research. 2017;6(7):570–572
9. Owens JF, et al. It Is Never Too Late: Change in Physical Activity Fosters Change in Cardiovascular Risk Factors in Middle-Aged Women. Preventive Cardiology. 2003;6:22–28.
10. World Health Organization (2011) Non-Communicable Disease Risk Factor Survey Bangladesh 2010. Available at: internal-pdf://201.225.69.237/2010_STEPS_Report_Bangladesh.pdf.
11. Moniruzzaman M, et al. Physical activity levels in Bangladeshi adults: results from STEPS survey 2010. Public Health. Elsevier Ltd. 2016;137:131–138
12. Jesmin S, Islam AS, Akter S, et al. Metabolic syndrome among pre- and post-menopausal rural women in Bangladesh: Result from a population-based study. BMC Research Notes. 2013;6(1):157
13. Sharma K and Gulati M. Coronary Artery Disease in Women. Global Heart. World Heart Federation (Geneva). 2013;8(2):105–112.
14. Pathak LA, et al. Coronary artery disease in women. Indian Heart Journal. Cardiological Society of India. 2017;69(4):532–538
15. Hoogar V, et al. Coronary Heart Disease risk profile among women attending Tertiary Care Hospital in Southern Karnataka, India. International Journal Of Community Medicine And Public Health. 2017;4(4):1307
16. Cífková R and Krajèoviechová A. Dyslipidemia and Cardiovascular Disease in Women. Current Cardiology Reports. 2015;17(7)
17. Islam N, et al. Prevalence of Dyslipidemia and Associated Factors among the Sub-Urban Bangladeshi Population. University Heart Journal. 2012;8(1):15–19
18. Ahmad A and Oparil S. Hypertension in Women: Recent Advances and Lingering Questions. Hypertension. 2017;70(1):19–26
19. Ortega FB, Lavie CJ and Blair SN. Obesity and cardiovascular disease. Circulation Research. 2016;118(11):1752–1770.
20. Norhammar A and Schenck-Gustafsson K. Type 2 diabetes and cardiovascular disease in women. Diabetologia. 2013;56(1):1–9

21. Garcia M, et al. Cardiovascular disease in women: Clinical perspectives. Circulation Research. 2016;118(8):1273–1293

22. Rahman S, Salehin F and Iqbal A. Menopausal symptoms assessment among middle age women in Kushtia, Bangladesh. BMC Research Notes. BioMed Central. 2011;4(1):188.

23. El Khoudary SR, et al. Menopause Transition and Cardiovascular Disease Risk: Implications for Timing of Early Prevention: A Scientific Statement From the American Heart Association, Circulation. American Heart Association. 2020;142(25):e506–e532

24. Ali M, et al. Factors associated with early menopause in Bangladesh. Family Medicine and Primary Care Review. Polish Society of Family Medicine. 2020;22(1):13–17

25. Tandon VR, Mahajan A, Sharma S, Sharma A. Prevalence of cardiovascular risk factors in postmenopausal women: A rural study. J Midlife Health. 2010;1(1):26-29.

26. Cho GJ, Lee JH, Park HT, et al. Postmenopausal status according to years since menopause as an independent risk factor for the metabolic syndrome. Menopause (New York, N.Y.). 2008;15(3):524-529.

27. Matthews KA, et al. Changes in cardiovascular risk factors during the perimenopause and postmenopause and carotid artery atherosclerosis in healthy women. Stroke. Lippincott Williams and Wilkins. 2001;32(5):1104–1110

28. Gupta A, et al. Prevalence of diabetes and cardiovascular risk factors in middle-class urban participants in India. BMJ Open Diabetes Research & Care. 2014;2(1):e000048.

29. Joseph JJ, et al. Physical activity, sedentary behaviors and the incidence of type 2 diabetes mellitus: the Multi-Ethnic Study of Atherosclerosis (MESA). BMJ Open Diabetes Research and Care. 2016;4:185

30. You Y, et al. Hypertension and physical activity in middle-aged and older adults in China. Scientific Reports. Nature Publishing Group. 2018;8(1).

31. Millett C, et al. Associations between Active Travel to Work and Overweight, Hypertension, and Diabetes in India: A Cross-Sectional Study. PLoS Med. 2013;10(6)

32. Karvinen S, et al. Menopausal Status and Physical Activity Are Independently Associated With Cardiovascular Risk Factors of Healthy Middle-Aged Women: Cross-Sectional and Longitudinal Evidence. Frontiers in Endocrinology. Frontiers Media S.A. 2019;10:589

33. Chitra U, et al. Role of lifestyle variables on the lipid profile of selected South Indian subjects Cholesterol Diet Lipid profile Obesity. Indian Heart Journal. 2012;64:28-34.

34. Nagarkar AM, Kulkarni SS. Obesity and its Effects on Health in Middle-Aged Women from Slums of Pune. J Midlife Health. 2018;9(2):79-84

Original Article

Association Between Low Serum HDL Levels and Severity of Coronary Artery Disease Among Patients with Non-ST Elevated Myocardial Infarction

Md Afzal Hossain, Md Minhaj Arefin, Kh Shaheed Hussain, Md Zillur Rahman, Jafrin Jahan, Md Saiful Islam, Nurun Nobi Khondoker, Rohan Khan, M G Azam

Abstract:

Introduction: Coronary artery disease is one of the leading causes of non-communicable diseases related deaths worldwide. Decreased serum high-density lipoprotein level are associated with an increased severity of coronary artery disease. Present study aims to evaluate the association between this low HDL level and the severity of coronary artery disease assessed by SYNTAX Score in patients with non-ST elevation Myocardial infarction.

Materials & Methods: This was a cross sectional study conducted in the Department of Cardiology at National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2020 to April 2021, on 170 admitted adult patients of non-ST elevated myocardial infarction undergoing coronary angiogram. Study population was divided in two groups; Group-I: Respondents with HDL level ≥40 mg/dl, Group-II: Respondents with HDL level < 40 mg/dl. Transthoracic echocardiography was done before coronary angiography. All coronary lesions with diameter stenosis > 50% in vessels > 1.5 mm was scored, using the SYNTAX algorithm. A low score was defined as ≤22, an intermediate score as 23 to 32, and a high score as ≥33. To determine statistical significance, Chi-square test and independent sample t-test were considered according to applicability. P value of < 0.05 was considered statistically significant.

Results: Highest proportion of respondents were from age group 51 – 60 years, 48.2% and 43.5% for group-I and group-II respectively. Study population was male predominant, 88.2% among patients from group-I and 83.5% among patients from group-II. Smoking was the most prevalent risk factor for group-I patients at 58.8%. Hypertension was the most prevalent risk factor for group-II patients at 45.9%. Mean total cholesterol, low-density lipoprotein and high-density lipoprotein were higher among patients from group-I than group-II and these differences were statistically significant (p < 0.05). Mean triglycerides was higher among patients from group-II than group-I and this difference was statistically significant (p < 0.05). Triple vessel was more prevalent (36.5% vs 22.4%) among patients from group-II than group-I and this difference was statistically significant (p < 0.05). Mean SYNTAX score (SS) was higher among patients from group-II than group-I, 17.4 ± 8.6 and 11.5 ± 8.4 respectively, and this difference was statistically significant (p < 0.05). There was strong negative correlation between HDL level and Syntax score (r = - 0.299, p < 0.05).

Conclusion: Present study demonstrated significant negative correlation between low serum HDL levels with severity of coronary artery disease among patients with non-ST elevated myocardial infarction. Serum HDL levels can be used as a predictor for the severity of coronary artery disease among such patients.

Keywords: *HDL, Coronary Artery Disease, Non-ST Elevated Myocardial Infarction*

(Bangladesh Heart Journal 2024; 39(2): 138-143)

Introduction:

Cardiovascular diseases (CVD) are considered as one of the leading causes of death worldwide, accounting for around 50% of all non-communicable diseases (NCD) related deaths in the world each year.1 About 17.3 million deaths globally was contributed to CVD.2 In Bangladesh, the prevalence of coronary artery disease is 1.85% - 3.4%

Department of Cardiology, National Institute of Cardiovascular Diseases & Hospital(NICVD), Dhaka
Address of Correspondence: Dr M G Azam, Professor of Cardiology, NICVD, Dhaka, Bangladesh. Mob: 01711238696, Email: mgazam71@yahoo.com,

DOI: https://doi.org/10.3329/bhj.v39i2. 75795

in rural population and 19.6% in urban population.3 The burden of non-ST elevation Myocardial infarction (NSTEMI) is increasing globally as compared to ST-elevation MI, with comparable 6 months mortality rates for both incidents.4–6 NSTEMI remains the leading causes of death in individuals with coronary artery disease (CAD).6

Although factors like age, family history, hypertension, diabetes mellitus and smoking have been shown to determine the severity and extent of coronary atherosclerosis,7,8 dyslipidemias, including increased low-density lipoprotein (LDL) and triglyceride (TG) concentrations and decreased high-density lipoprotein (HDL) concentration, are major risk factors for CHD.9 One of the major predisposing factors to atherosclerosis is an abnormal lipoprotein metabolism and it may be present in over 70% of patients with CAD.10,11 HDLs are a heterogeneous class of lipoproteins with the ability to drive reverse cholesterol transport.12,13 Studies have shown the risk for CAD to increase sharply as HDL levels fall progressively below 40 mg/dl.11,14,15

Low HDL values were associated with an increased both triple vessel disease and left main coronary artery.16 Severity of CAD is inversely correlated with levels of HDL in both men and women.17 In angiographic studies the relation between HDL levels and CAD has varied widely ranging from significant inverse correlation with HDL and were the only significant predictor of the number of lesions.18

Studies related to the association between low serum HDL levels and severity of coronary artery disease among Bangladeshi population is scarce. Present study aims to evaluate the association between this low HDL level and the severity of coronary artery disease assessed by SYNTAX Score (SS) in patients with non-ST elevation Myocardial infarction (NSTEMI).

Materials & Methods:

This was a cross sectional study conducted in the Department of Cardiology at National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh, from May 2020 to April 2021, on 170 admitted patients of non-ST elevated myocardial infarction undergoing coronary angiogram, under the strict supervision of the institute authority and only after receiving the ethical clearance from the institutional review board. Adult patients of either sex were included in this study. Severely ill patients and patients with prior history of PTCA, prior history of CABG, associated with valvular heart diseases, associated with congenital heart diseases, cardiomyopathy, prior history of taking anti-lipid drugs, LDL level more than 130 mg/dl, comorbid conditions such as severe renal impairment, hepatic failure and hypothyroidism were excluded from the study. Aims and objectives of the study along with its procedure, risks and benefits of the study were explained to the respondent in easily understandable local language. Data were collected through face-to-face interview using a semi-structured questionnaire and data collection tools, only after Informed written consent was taken from the respondents. As per the selection criteria, 170 patients of both gender, age ≥18 years, were enrolled in the study through purposive sampling technique.

Study population underwent detail history taking, physical examination and relevant investigations. Risk factor profile including smoking, hypertension, diabetes, dyslipidemia, and family history of coronary artery disease was noted. Patients were treated in accordance with the current guideline. Aspirin, clopidogrel, enoxaparin, beta blockers, statins, and ACE inhibitors angiotensin receptor blocker medications were administered to every patient unless contraindicated. Twelve lead resting ECG was done at a paper speed 25mm/s and 10mm standardization at admission and as needed. Lipid profile was done within 24 hours of admission by using BECMAN COULTER AU480 analyzer at NICVD biochemistry laboratory. Two groups were defined based on HDL value. Group-I: Respondents with HDL level e" 40 mg/dl, Group-II: Respondents with HDL level < 40 mg/dl. Transthoracic echocardiography was done before coronary angiography. Coronary angiography was performed through trans femoral and trans radial approach. Angiographic severity assessment was done by visual estimation. The Syntax scores of all patients was calculated. All coronary lesions with diameter stenosis >50% in vessels >1.5 mm was scored, using the

Results:

Among the study population, highest proportion of respondents were from age group 51 –60 years, 48.2% and 43.5% for group-I and group-II respectively (Table I). Mean age was 54.8 ± 8.1 years for group-I and 52.7 ± 9.4 years for group-II, but the difference was not statistically significant. Study population was male predominant, 88.2% among patients from group-I and 83.5% among patients from group-II. Body mass index (BMI) was 24.5 ±2.7 kg/m2 and 24.7 ± 3.4 kg/m2 for group-I and group-II respectively and there was no statistically significant difference between the two groups. Obesity was most prevalent among both groups, 50.6% and 45.9% for group-I and group-II respectively.

Table II shows cardiac risk factor profiles for both groups. Many of the respondents had more than one risk factors present. Smoking was the most prevalent risk factor for group-I patients at 58.8%. Hypertension was the most prevalent risk factor for group-II patients at 45.9%. No statistically significant differences were present between the two groups in terms of cardiac risk factors. Mean total cholesterol, low-density lipoprotein and high-density lipoprotein were higher among patients from group-I than group-II and these differences were statistically significant ($p < 0.05$). Mean triglycerides was higher among patients from group- II than group-I and this difference was statistically significant ($p < 0.05$). Triple

Table-I

Descriptive statistics of the study population (n = 170)

Characteristics	Group-I(n=85)	Group-II(n=85)	Significance(p value)
Age (in years)	54.8 ± 8.1	52.7 ± 9.4	0.13b
Age group (in years)			
<40 6 (7.1%)	11 (12.9%)		
41-50	21 (24.7%)	25 (29.4%)	
51-60	41 (48.2%)	37 (43.5%)	-
61-70	17 (20.0%)	10 (11.8%)	
>70 0	2 (2.4%)		
Sex			
Male	75 (88.2%)	71 (83.5%)	0.38a
Female	10 (11.8%)	14 (16.5%)	
BMI Classification (kg/m2)			
Underweight (< 18.5 kg/m2)	3 (3.5%)	2 (2.4%)	
Normal (18.5 - 22.9 kg/m2)	21 (24.7%)	21 (24.7%)	-
Overweight (23 - 24.9 kg/m2)	18 (21.2%)	22 (25.9%)	
Obese (≥25 kg/m2)	43 (50.6%)	40 (45.9%)	
BMI (kg/m2)	24.5 ± 2.7	24.7 ± 3.4	0.597b

Data presented as n (%) or mean ± SD. Group-I: Respondents with HDL level ≥40 mg/dl, Group-II: Respondents with HDL considered statistically significant. b - Independent sample t test was done, p < 0.05 was considered statistically significant.

Table-II

Clinical characteristics of the study population (n = 170)

Characteristics	Group-I(n=85)	Group-II(n=85)	Significance(p value)
Cardiac risk factor profiles			
Hypertension	33 (38.8%)	39 (45.9%)	0.352[b]
Diabetes mellitus	30 (35.3%)	29 (34.1%)	0.872[b]
Dyslipidemia	26 (30.6%)	19 (22.4%)	0.224[b]
Smoking	50 (58.8%)	37 (43.5%)	0.065[b]
Family history of CAD	21 (24.7%)	20 (23.5%)	0.858[b]
Lipid profile			
TC (mg/dl)	187.3 ± 39.6	150.8 ± 39.0	< 0.05[b]
LDL (mg/dl)	97.1 ± 21.9	86.9 ± 28.5	< 0.05[b]
TG (mg/dl)	168 ± 7.9	188 ± 61.9	< 0.05[b]
HDL (mg/dl)	43.2 ± 3.7	31.8 ± 4.5	< 0.05[b]
Vessel score			
None	19 (22.4%)	10 (11.8%)	< 0.05a
Single vessel	27 (31.8%)	13 (15.3%)	
Double vessel	14 (16.5%)	22 (25.9%)	
Triple vessel	19 (22.4%)	31 (36.5%)	
Left main disease	6 (7.1%)	9 (10.6%)	
SYNTAX Score (SS) classification			
Low SS (≤22)	70 (82.4%)	50 (58.8%)	
High SS (≥23)	15 (17.7%)	35 (41.2%)	
SYNTAX Score (SS)	11.5 ± 8.4	17.4 ± 8.6	< 0.05[b] SYNTAX Score (SS)

Data presented as n (%) or mean ± SD. Group-I: Respondents with HDL level ≥40 mg/dl, Group-II: Respondents with HDL
level < 40 mg/dl. TC: Total cholesterol, LDL: Low-density lipoprotein, TG: Triglycerides, HDL: High-density lipoprotein. a - Chi-square test was done. b
- Independent sample t test was done.

vessel was more prevalent (36.5% vs 22.4%) among patients from group-II than group-I and this difference was statistically significant ($p < 0.05$). Table II also shows statistically significant ($p < 0.05$) differences between the two groups in terms of SYNTAX score (SS) classification. Mean SYNTAX score (SS) was higher among patients from group-II than group-I, 17.4 ± 8.6 and 11.5 ± 8.4 respectively, and this difference was statistically significant ($p < 0.05$).

Figure 1 shows strong negative correlation between HDL level and Syntax score ($r = - 0.299$, $p < 0.05$).

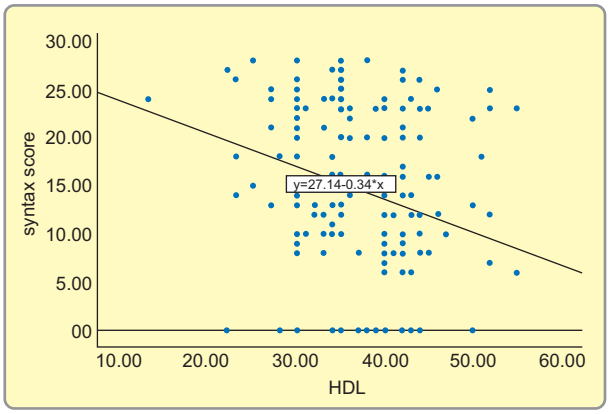

Figure 1: *Correlation between HDL and SYNTAX Score (SS).*

Discussion:

This cross-sectional study was carried out to find out the association between low HDL and angiographic severity of coronary artery disease among patients with NSTEMI assessed by SYNTAX score. Age distribution of study population showed 48.2% and 43.5% of the respondents from group-I and group-II respectively were from age group 51 – 60 years. This is consistent with prior Bangladeshi studies showing age group 41 – 60 years having highest frequency of respondents with coronary artery disease.20,21 Mean age was 54.8 ± 8.1 years for group-I and 52.7 ± 9.4 years for group-II, but the difference was not statistically significant. This is consistent with Ahmed et al., 2018 study, showing similar mean age for study population and no statistically significant difference in mean age between the two groups.21 In another study among Brazilian population, Luz et al., 2008 showed mean age to be 57.2 ± 11.1 years, which is higher than present study findings.22 This difference also supports the earlier incidence of coronary artery disease among Bangladeshi population.3 Study population was male predominant, 88.2% and 83.5% from group-I and group-II respectively. This indicates that males are more affected by coronary artery disease, which is also consistent with Sabah et al., 2014 study showing similar male predominance among study population.23

Present study showed the prevalence of hypertension, diabetes mellitus, dyslipidemia, smoking and family history of coronary artery disease to be 45.9%, 34.1%, 22.4%, 43.5% and 23.5% respectively for respondents with low HDL (< 40 mg/dl), which is consistent with Amin et al., 2016 study.24 Present study found no statistically significant difference in prevalence of these risk factors among respondents with normal and low HDL levels, which is consistent with Ahmed et al., 2018 study showing similar findings.21 Hypertension was the most prevalent risk factor for respondents with low HDL at 45.9%, which is consistent with prior studies showing similar findings.25–27 In present study, respondents with normal HDL level had higher mean TC and LDL levels and lower TG levels than respondents with low HDL levels and these differences were statistically significant ($p < 0.05$). Ahmed et al., 2018 study also showed similar significant differences between study population when grouped based on serum HDL levels, which is consistent with present study findings.21 Triple vessel disease was more prevalent (36.5% vs 22.4%) among patients with low HDL than patients with normal HDL and this difference was statistically significant ($p < 0.05$). Higher frequency of triple vessel disease was also reported by previous study, which supports present study findings.21 Present study showed statistically significant ($p < 0.05$) differences between groups of respondents with normal HDL and groups of patients with low HDL, in terms of SYNTAX score (SS) classification. Presence of triple vessel disease had clear cut impact on treatment decision, only patients with low SYNTAX score (≤22) can be treated with PCI (Percutaneous Coronary Intervention). Patients with these conditions can undergo CABG (Coronary Artery Bypass Grafting) irrespective of SYNTAX score.28 Those with low HDL level are more likely to have CABG as present study has shown that these patients had higher SYNTAX score compared with those with normal HDL level. Mean SYNTAX score (SS) was higher among patients with low HDL than patients with normal HDL, 17.4 ± 8.6 and 11.5 ±8.4 respectively, and this difference was statistically significant ($p < 0.05$). This is consistent with prior studies showing patients with low HDL having a low SYNTAX score.29–32 This also supports the finding of strong negative correlation between HDL level and SYNTAX score ($r = -0.299$, $p<0.05$) in present study.

Conclusion:

Present study demonstrated significant negative correlation between low serum HDL levels with severity of coronary artery disease among patients with non-ST elevated myocardial infarction. Patients with low HDL levels were found to have higher SYNTAX score. The value of HDL levels can be used as a predictor for the severity of coronary artery disease among patients with non-ST elevated myocardial infarction

References:

1. Clark, H. NCDs: a challenge to sustainable human development. *Lancet* 381, 510–511 (2013).
2. Townsend, N. *et al.* Cardiovascular disease in Europe: epidemiological update 2016.

Eur. Heart J. 37, 3232–3245 (2016).

3. Islam, A. K. M. M. & Majumder, A. A. S. Coronary artery disease in Bangladesh: A review. *Indian Heart J.* 65, 424–435 (2013).
4. Rosamond, W. *et al.* Heart Disease and Stroke Statistics—2007 Update. *Circulation*

115, (2007).

5. Yeh, R. W. *et al.* Population Trends in the Incidence and Outcomes of Acute Myocardial Infarction. *N. Engl. J. Med.* 362, 2155–2165 (2010).
6. Terkelsen, C. J. *et al.* Mortality rates in patients with ST-elevation vs. non-ST- elevation acute myocardial infarction: observations from an unselected cohort. *Eur. Heart J.* 26, 18–26 (2005).
7. Sadeghi, M., Pourmand, K., Sanei, H., Heidari, R. & Talaei, M. Which major atherosclerosis risk factors represents the extent of coronary artery disease? *ARYA Atheroscler. J.* 7, 0 (2012).
8. Truelsen, T. *et al.* Trends in Stroke and Coronary Heart Disease in the WHO MONICA Project. *Stroke* 34, 1346–1352 (2003).
9. Jung, C. H. *et al.* Association of Apolipoprotein B/ Apolipoprotein A1 Ratio and Coronary Artery Stenosis and Plaques Detected by Multi-Detector Computed Tomography in Healthy Population. *J. Korean Med. Sci.* 28, 709 (2013).
10. Tarchalski, J., Guzik, P. & Wysocki, H. Correlation between the extent of coronary atherosclerosis and lipid profile. *Mol. Cell. Biochem.* 246, 25–30 (2003).
11. Després, J.-P., Lemieux, I., Dagenais, G.-R., Cantin, B. & Lamarche, B. HDL-cholesterol as a marker of coronary heart disease risk: the Québec cardiovascular study. *Atherosclerosis* 153, 263–272 (2000).
12. Toth, P. P. Reverse cholesterol transport: High-density lipoprotein's magnificent

mile. *Curr. Atheroscler. Rep.* 5, 386–393 (2003).

13. Nofer, J.-R., Brodde, M. F. & Kehrel, B. E. High-density lipoproteins, platelets and the pathogenesis of atherosclerosis. *Clin. Exp. Pharmacol. Physiol.* 37, 726–735 (2010).
14. Castelli, W. P. *et al.* Incidence of coronary heart disease and lipoprotein cholesterol levels. The Framingham Study. *JAMA* 256, 2835–8 (1986).
15. Ashen, M. D. & Blumenthal, R. S. Low HDL Cholesterol Levels. *N. Engl. J. Med.* 353, 1252–1260 (2005).
16. Safeer, R. & Cornell, M. THE EMERGING ROLE OF HDL CHOLESTEROL Is it time to focus more energy on raising high-density lipoprotein levels? *Postgrad. Med.* 108, (2000).
17. Phillips, N. R., Waters, D. & Havel, R. J. Plasma lipoproteins and progression of coronary artery disease evaluated by angiography and clinical events. *Circulation* 88, 2762–2770 (1993).
18. Assmann, G. & Schulte, H. Relation of high-density lipoprotein cholesterol and triglycerides to incidence of atherosclerotic coronary artery disease (the PROCAM experience). *Am. J. Cardiol.* 70, 733–737 (1992).
19. Yadav, M. *et al.* Prediction of Coronary Risk by SYNTAX and Derived Scores. *J. Am. Coll. Cardiol.* 62, 1219–1230 (2013).
20. Shirin, M. *et al.* Detection of Coronary Artery Diseases: Comparative Study of Multidetector Computed Tomography Angiogram (64 slice scanner) and Conventional Angiogram. *Cardiovasc. J.* 4, 120–126 (2012).
21. Ahmed, M. I., Mohammad Akhtaruzzaman, K., Rahman, M. A., Mahmod, M. S. & Nahar,
22. S. Relationship between HDL-Cholesterol and Angiographic Severity of Coronary Artery Disease. *Bangladesh Hear. J.* 33, 32–38 (2018). Luz, P. L. da, Favarato, D., Junior, J. R. F.-N., Lemos, P. & Chagas, A. C. P. High Ratio of Triglycerides to HDL-Cholesterol Predicts Extensive Coronary Disease. *Clinics* 63, 427–432 (2008).

23. Sabah, K. M. N. *et al.* Body mass index and waist/height ratio for prediction of severity of coronary artery disease. *BMC Res. Notes* 7, 246 (2014).

24. Amin, M. R., Rahman, M. A., Alam, N., Hasan, M. N. & Hasan, G. S. Relationship between triglyceride HDL-cholesterol ratio and severity of coronary artery disease in patient with acute coronary syndrome. *Bangladesh Med. J.* 43, 157–161 (2016).

25. Wyszyñska, J., £uszczki, E., Sobek, G., Mazur, A. & Dereñ, K. Association and Risk Factors for Hypertension and Dyslipidemia in Young Adults from Poland. *Int. J. Environ. Res. Public Health* 20, 982 (2023).

26. Islam, S., Choudhury, K. N., Mainuddin, A. & Wahiduzzaman, M. Serum lipid profile and its association with hypertension in Bangladesh. *Vasc. Health Risk Manag.* 327 (2014) doi:10.2147/VHRM.S61019.

27. Goldbourt, U., Yaari, S. & Medalie, J. H. Isolated Low HDL Cholesterol As a Risk Factor for Coronary Heart Disease Mortality. *Arterioscler. Thromb. Vasc. Biol.* 17, 107–113 (1997).

28. Neumann, F.-J. *et al.* 2018 ESC/EACTS Guidelines on myocardial revascularization. *Eur. Heart J.* 40, 87–165 (2019).

29. Almeida, A. S. *et al.* The performance of SYNTAX score versus the coronary angiogram standard evaluation in the prediction of cardiovascular events in a cohort of patients with stable coronary heart disease. *Cardiovasc. Diagn. Ther.* 12, 563–576 (2022).

30. Esper, R. B. *et al.* SYNTAX Score in Patients With Diabetes Undergoing Coronary Revascularization in the FREEDOM Trial. *J. Am. Coll. Cardiol.* 72, 2826–2837 (2018).

31. Saif Mohammed, A. A., Lin, X., Al hashedi, E., Sun, R. & Yu, J. Correlation between Hypertension and SYNTAX Score in Patients with Chest Pain Admitted to Cardiology Department for Coronary Angiography. *World J. Cardiovasc. Dis.* 11, 231–241 (2021).

32. Xu, W. *et al.* The Association of Syntax Score with Levels of Lipoprotein(a) and Inflammatory Biomarkers in Patients with Stable Coronary Artery Disease and Different Low-Density Lipoprotein Cholesterol Levels. *Diabetes, Metab. Syndr. Obes. Targets* 33. 310 (2020)

Original Article

Association of QRS Duration with Echocardiographic Left Ventricular Dimensions

Mostaque Ahmed[1], Abdul Wadud Chowdhury[2], Md. Gaffar Amin[3], Azizul Haue[4], Isha Abdullah Ali[5], Jayanta Malakar[6], Md. Abu Bakar Siddique[7], Amit Kumar Pramanik[8], Chitra Das[9]

Abstract:

Background: QRS duration (QRSd) is used to diagnose left bundle branch block (LBBB) and is important for determining cardiac resynchronization therapy eligibility. Others have reported associations of left bundle branch block (LBBB) and interventricular conduction delay with left ventricular (LV) systolic and diastolic dysfunction in patients without clinical HF. Individualized QRSd thresholds may improve diagnosis and intervention strategies. The goal of this study was to assess the relations of QRS duration to echocardiographic left ventricular (LV) dimensions in individuals.

Methods: This was a hospital-based cross-sectional analytical study. A total of 134 purposively selected respondents were included in the study from the patients attending the outpatient or inpatient department of cardiology, Dhaka Medical College Hospital, advised for an echocardiogram. They were divided into two groups depending on their QRS complex duration (Group I≤100 ms and Group II >100 ms). After taking informed written consent, a case record form was filled and Echo measurements were taken following standard procedure with confidentiality.

Results: Among the respondents, the mean age was found 52.68 ± 14.24 years. The majority were male (68%), and around 1/3rd of the respondents were overweight or obese. Males were found to have less QRS duration than females (p<0.001) but there was no difference in age (p=0.814) between the groups. All the risk factors considering obesity, diabetes mellitus, hypertension, family history, smoking status, and dyslipidemia were found in similar proportions in both groups (p>0.05). The study found that the interventricular septum thickness and inferolateral wall thickness were higher among those having a QRS duration of more than 100 ms (Group II), but this difference was not significant (p > 0.05). On the other hand, left ventricular diastolic dimension, systolic dimension, and left ventricular mass were found to be increased significantly (p<0.05) with a reduction in ejection fraction in Group II (p<0.05).

Conclusion: Left ventricular diastolic and systolic dimensions along with left ventricular mass significantly increase according to QRS duration among the patients. Meanwhile, a reduction in ejection fraction was also evident.

Keywords: *QRS duration, LV dimensions*

(Bangladesh Heart Journal 2024; 39(2): 144-150)

1. Resident Physician, Kuwait Bangladesh Friendship Hospital, Dhaka, Bangladesh.
2. Professor & Head of the Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
3. Associate Professor, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
4. Senior Consultant, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
5. Registrar and Specialist, Department of Cardiology, Ibrahim Cardiac Hospital & Research Institute, Dhaka, Bangladesh.
6. Junior Consultant, DGHS, Dhaka, Bangladesh.
7. Indoor Medical Officer, Department of Cardiology, Dhaka Medical College & Hospital, Dhaka, Bangladesh.
8. Medical Officer, Department of Transfusion Medicine, Rajshahi Medical College and Hospital, Rajshahi, Bangladesh.
9. Medical Officer, OSD (DG Health), On course: Mymensingh Medical College and Hospital, Mymensingh, Bangladesh.

Address of Correspondence: Dr. Mostaque Ahmed, Resident Physician, Kuwait Bangladesh Friendship Hospital, Dhaka, Bangladesh. Mobile: +8801711840940, E-mail: protik8889@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75797

Introduction:

QRS duration serves as a key prognostic and diagnostic determinant of several cardiac conditions.[1] Prolonged QRS duration (QRSd) is a marker of long-term mortality in different patient categories.[2,3] However large interindividual variability of the QRS duration exists, not only in different patient categories but also in healthy subjects.[4] Normal values of the QRS duration can overlap with abnormal values suggesting heart disease. Distinguishing between abnormal QRS duration and normal variants can be difficult.[5]

A QRSd ≥120 ms has traditionally been classified with complete bundle branch blocks and unspecified intraventricular conduction delay, and a QRSd ≤100 ms has been considered normal. A QRSd between 100 and 120 ms is considered prolonged, specifying either incomplete bundle branch block or intraventricular conduction delay. The degree of QRS widening may be a manifestation of left ventricular (LV) structure (such as increased LV mass or LV dimension). Still, it can also suggest functional abnormalities, such as LV systolic dysfunction (LVSD).[6]

Standard 12 lead electrocardiography remains the most widely used initial screening test for the noninvasive detection of left ventricular hypertrophy, However, electrocardiographic (ECG) criteria based only on QRS voltage have exhibited poor sensitivity for left ventricular hypertrophy at the high levels of specificity necessary for adequate clinical utility.[7,8]

Again, a prolonged electrocardiographic QRS duration (≥120ms) may be a marker of inter or intraventricular mechanical dyssynchrony, and has been associated with adverse prognosis in systolic heart failure.[9] Cardiac resynchronization therapy has favorably influenced clinical outcomes in systolic HF patients with QRS duration ≥150 ms.[10] Others have reported altered electrical activation in patients with isolated LBBB causing ventricular abnormalities, manifested by abnormal diastolic filling times, abnormal heart sounds, abnormal interventricular septal motion, abnormal left ventricular regional ejection fraction, and interventricular conduction delay.[3,11] This is also a fact in left ventricular (LV) systolic and diastolic dysfunction in patients without clinical HF.

LV chamber size and wall thickness represent the determinants of decision-making in several clinical Guidelines.[12,13] Measurement of these critical parameters by transthoracic echocardiography (TTE) in the parasternal long-axis (LAX) view is supported by accepted conventions whereas cardiovascular magnetic resonance (CMR) lacks a standardized approach to clinical routine.[14,15] The presence of left ventricular hypertrophy detected by echocardiography has been associated with an increased risk of future cardiac morbidity and mortality both in hypertensive patients[16,17] and in a sample of the general population.[1819] So echo diagnosis of LVH is a simple cost-effective screening method and a clinical priority.[20] These reports linking increased QRS duration to LV dysfunction are paralleled by reports emphasizing associations of prolonged QRS duration with LV structural changes.[21] Experimental investigations suggest that asynchronous LV contraction (indicated by prolonged electrocardiographic QRS duration) may promote LV remodeling, manifested by increases in wall thickness of late-activated LV segments.[19,20]

Several studies have shown a correlation between LV size and QRSd.[22,23,24] LV mass, diameter, volumes, and length have all been shown to correlate positively with QRSd both in patients with and without the presence of bundle branch block.[22,23] Of these measurements, indices of LV dilatation (LV volumes and diameters) have been more.

Methods:

This cross-sectional analytical study was conducted at the Department of Cardiology, Dhaka Medical College Hospital (DMCH), Dhaka between May 2019 to April 2020. The study protocol was approved by the Ethical Review Committee (ERC) of Dhaka Medical College and Hospital. Patients advised for ECG and echocardiography from OPD/IPD of the Cardiology Department, Dhaka Medical College Hospital, within the study period, who fulfilled the inclusion and exclusion criteria were included in this study by convenient purposive sampling. Patients suffering from heart failure, having a history of previous MI, PTCA, CABG, cardiomyopathy, valvular and congenital heart disease, pacemaker implantation taking digoxin or quinidine, having electrolyte imbalance, arrhythmias and unwilling to participate were excluded from the study. All the participants included in this study were informed about the nature, risks, and benefits of the study. Informed written consent was taken from all patients. Among the patients advised for ECG and echocardiography from OPD/IPD, Cardiology, Dhaka Medical College Hospital was initially sorted to find out eligible respondents. Those who were eligible underwent electrocardiography and echocardiography. Advanced 12 lead ECG machine (Advanced electrocardiograph, model: ECG-12C manufactured by advanced Instrumentations, INC, USA) was used for electrocardiography (Electrocardiographs automatically measure the QRS duration which is globally measured from the earliest onset to the latest

offset of the QRS complex and averaged among all 12 leads) and evaluated by the principal investigator. A total of 134 study subjects were included in the study, they were divided into two groups according to the QRS duration on 12 Leads surface ECG. Subjects with QRS duration ≤100 ms were taken in Group I and subjects with QRS duration >100 ms were taken in Group II. Transthoracic echocardiography was performed among all the study subjects in a Philips Affiniti 70c echocardiography machine and the LV dimensions were measured. Patients were positioned in left lateral decubitus and a raised left arm. Images were displayed on the echocardiographic system and measurements were obtained from recordings in the parasternal LAX acoustic window directly from the 2D images. Dimensions were measured in the LV minor axis plane at the mitral chordae level at the tips of the papillary muscles. LVIDd and LVIDs, respectively, and wall thickness (anteroseptal – IVSd and inferolateral – LVPWd) were measured at end-diastole(d) and end-systole(s) respectively, and were averaged over three consecutive heart cycles. All the results were validated by two competent cardiologists. The ejection fraction was measured in the modified Simpsons biplane method. A4C view was used. Detailed clinical history and physical examination were done and required data were recorded in a preformed data collection sheet. Interviews of the participants were conducted to ascertain socio-demography-related information (age, sex), health status information about risk factors for coronary heart disease (diabetes, hypertension, dyslipidemia, smoking, and family history of premature coronary artery disease), and physical measurement (blood pressure, height, and weight). All the information was recorded properly in the preformed data collection sheet. After compiling data from all patients, statistical analysis was done. Statistical analysis was performed using SPSS 21.0 for Windows. p-value < 0.05 was considered statistically significant.

Results:

This cross-sectional analytical study was carried out in the Department of Cardiology, Dhaka Medical College Hospital, Dhaka from May 2019 to April 2020. The primary objective was to find out the difference in echocardiographically determined left ventricular dimensions between the study subjects having QRS duration >100 ms and ≤100 ms. A total number of 134 patients who fulfilled inclusion and exclusion criteria, were included in the study. The patients were classified into two groups based on QRS duration. The patients with QRS duration d”100 ms were assigned to Group I (n = 67) and those with QRS duration >100 ms were assigned to Group II (n = 67).

Fig:1 shows the distribution of the respondents according to their age. The minimum age was found 18 years and the maximum was 80 years. The mean age was found 52.68 ±14.24 years.

The mean age of the total population was 52.7±14.2 years. The major proportion 56(41.8%) were in the 40–59 years age group. Age distribution was similarly distributed between both groups (p=0.814).

Among the study subjects, the majority of the respondents were males (91, 68%). The rest of them were females (43,32%).

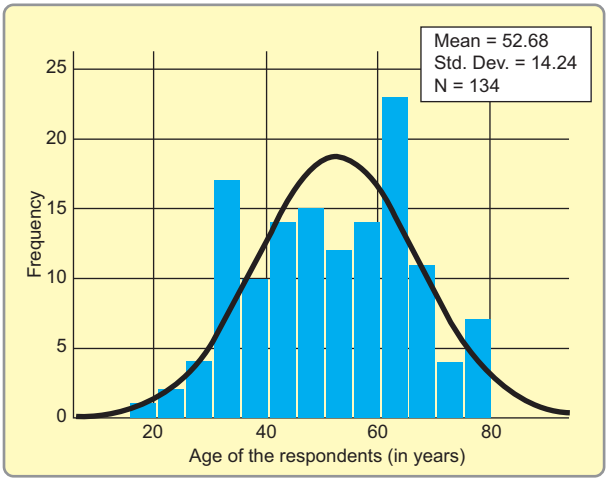

Figure 1: *Distribution of the respondents according to their age (n=134)*

Table-I

Distribution of the study subjects by age (n = 134)

Age group(years)	Total (n=134)		Group I (n=67)		Group II (n=67)		p-value
	No.	%	No.	%	No	%	
18-39	27	20.1	13	19.4	14	20.9	0.938^{ns}
40-59	56	41.8	29	43.3	27	40.3	
≥60	51	38.1	25	37.3	26	38.8	
Mean±SD(years)	52.7±14.2		52.9±13.6		52.4±14.9		0.814^{ns}

The Chi-square Test ($\chi^2$2) was done to observe an association between variables and
An Independent sample t-test was done to compare Mean±SD. ns = not significant
Group I: patients with QRSd ≤100 ms; Group II: patients with QRS>100 ms

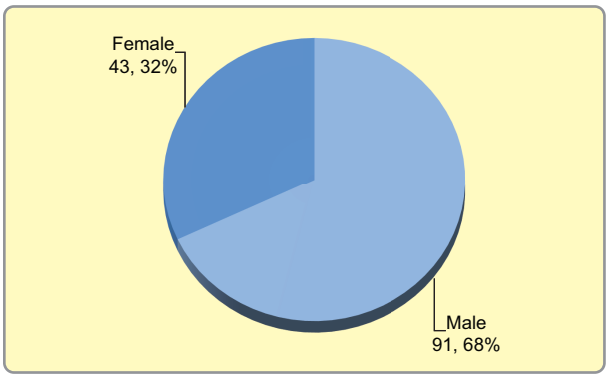

Figure 2: *Distribution of the total respondents according to their sex (n=134)*

Table II shows the distribution of cardiovascular risk factors among both groups which are similarly distributed.

Table III shows echocardiographic variables in between groups. LV mass, LV systolic dimension, and LV diastolic dimension are significantly higher in Group II (p-value 0.002, 0.001, and <0.001 respectively). Whereas, inferolateral wall thickness and interventricular septal thickness in diastole are similarly distributed between groups. Ejection fraction is significantly reduced in Group II (p=.001)

Table-II

Distribution of the study subjects according to cardiovascularrisk factors (n = 134)

Risk factors	Group I (n=67) No (%)	Group II (n=67) No (%)	p-value	
BMIcategory	Underweight	5 (7.5%)	4 (5.9%)	0.700^{ns}
	Normal weight	42(62.7%)	38(56.7%)	
	Overweight	17 (25.4%)	19 (28.4%)	
	Obese	3 (4.5%)	6 (8.9%)	
Diabetes Mellitus	19 (28.4%)	19 (28.4%)	1.000^{ns}	
Hypertension		22 (32.8%)	23 (34.3%)	1.000^{ns}
Family History of Premature CAD	8 (11.9%)	6 (8.9%)		
			0.778^{ns}	
Smoking	Ex-smoker	10 (14.9%)	5 (7.4%)	
	Present smoker	16 (23.9)	13 (19.4%)	
				0.256^{ns}
	Non-smoker	41 (61.2%)	49 (73.1%)	
Dyslipidemia		21 (31.3%)	24 (35.8%)	0.714^{ns}

Chi-squared Test (χ^2) was done to observe the association. ns = not significant
Group I: patients with QRS ≤100 ms; Group II: patients with QRS>100 ms

Table-III

Distribution of the study subjects by Echocardiographic variables(n=134)

Echocardiographic Variables	Mean+SD		
	Group I	Group II	P value
LV mass (gram)	96.9±26.6	118.0±46.7	0.002s
Inferolateral wall thickness (mm)	8.3±1.6	8.4±1.8	0.7605
LV systolic dimension (mm)	26.5±3.5	29.1±4.3	0.001s
LV diastolic dimension (mm)	40.2±4.7	43.9±5.4	0.001s
Interventricular septal thickness in diastole (mm)	7.9±1.6	8.2±2.0	0.326ns
Ejection Fraction (%)	62.6±5.6	59.0±4.2	0.001s

Unpaired Student t-test was performed to compare between groups
ns=not significant; s=significant
Group I = QRS duration ≤100 ms; Group II = QRS duration >100ms

Discussions:

In this study, the major proportion 56(41.8%) belonged to the age group 40-59 years. The mean age of the total population was 52.7±14.2 years. Age in both groups were similarly distributed (p=0.814). Chan et al in 2014 found a mean age of 56 years which is similar to our study.[22]

The number of males in Group I and Group II was 57(85.1%) and 34(50.7%) respectively. The number of females was higher in Group II than in Group I. Predominance of male gender was statistically significant in Group I (p<0.001) and gender distribution was nearly equal in Group II which is different from other studies conducted before. In patients with QRSd >100ms number of male patients was found significantly higher in studies conducted by Rickard et al. in 2017 (p≤0.03)[22] and Ilkhanoff et al. in 2012 (p<0.01)[6]. Dhingra et al. 2005 showed that the association between all the parameters regarding LVEDD, LV mass, and wall thickness vs QRSd was consistent in both genders which is similar to our study.[23] The reason for this difference from other studies might be due to the relatively smaller sample size and single center-based sample collection.

Regarding risk factors of IHD, they were similarly distributed in both groups and there was no significant association with QRSd and LV dimensions. Among the echocardiographic variables, LV mass, LV systolic dimension, and LV diastolic dimension were significantly higher in Group II (p-value 0.002, 0.001, and <0.001 respectively). Whereas, the thickness of the inferolateral wall and interventricular septum in diastole were also higher in group II which is not statistically significant (0.76, 0.32). That also shows the similarity with the study done by Dhingra et al. in 2005 (p<0.05).[23] Braun et al. (2005) also found a similar relationship.[26] Chan et al. in 2014 found a positive correlation between inferolateral wall thickness and QRS duration (p=0.002).[22] This may happen due to our small number of study subjects.

A weak but nonsignificant correlation between LVEDD and QRS duration in patients with non-LBBB QRS morphology among the study population was evident in another study done by Rickard et al. in 2017.[25] Hakacova et al. in 2010 found that the influence of the left ventricular mass on the QRS duration does not seem to have a dominant role (p=0.05).[5] But both Dhingra et al. in 2005 and Chan et al. in 2014 found this relationship significant (p<0.001).[22,23]

Regarding the systolic function, this study found significantly (p= 0.001) reduced ejection Fraction, in Group II (QRS duration >100 ms) than those in Group I (QRS Duration ≤100 ms). This evidence also coincides with the previous findings by Dhingra et al. in 2005 and Wang et al. in 2008.[23,27] Dhingra et al. in 2005 showed that fractional shortening was significantly lower in patients with QRSd>100ms and inversely proportional.[23]

Considering other studies and results that we found, 12 lead ECG tracing can be used as a predictor for assuming anatomical changes but it did not correlate strongly. It is difficult to comment about any normality or abnormality based on one categorical data only whether it is electrophysiological or anatomical. Though in our study, parameters like LVEDD, LVESD, LV mass, and ejection fraction were strongly associated with QRSd based on parameters like wall thickness (IVS and inferolateral wall) we can predict QRSd weakly. So for deciding the case of future management of a patient, we advise considering both electrophysiological and anatomical modalities to be reviewed.

Conclusion:

In our hospital-based cross-sectional analytic study, we observed a positive association between wide QRS duration and echocardiographic findings of LV mass, LV diastolic dimension, and LV systolic dimension. The association between wall thickness (IVS and inferolateral wall) and QRSd was nonsignificant. On the other hand, the inverse relationship between QRS duration and systolic function was also observed considering a significant decrease in ejection fraction.

Limitations of the study:

Although the result of this study supports the hypothesis, there are some facts to be considered which might have affected the result of the current study. It was a single-center study. The study population was small. Purposive sampling was done instead of random sampling. Therefore, the results of the study may not reflect the exact picture of the country. Follow-up of the patients for a longer duration was beyond the scope.

Recommendations:

To confirm these findings additional investigations are warranted with a heterogeneous group of people. Further clinical study with a larger sample size involving multiple centers is recommended.

References:

1. Bleeker GB and Bax JJ. What is the value of QRS duration for the prediction of response to cardiac resynchronization therapy? American Heart Hospital Journal. 2007;5(2):110-113.

2. Kalahasti V, Nambi V, Martin DO, Lam CT, Yamada D, Wilkoff BL, et al. QRS duration and prediction of mortality in patients undergoing risk stratification for ventricular arrhythmias. The American Journal of Cardiology. 2003;92(7):798-803.

3. Murkofsky RL, Dangas G, Diamond JA, Mehta D, Schaffer A and Ambrose JA. A prolonged QRS duration on surface electrocardiogram is a specific indicator of left ventricular dysfunction. Journal of the American College of Cardiology. 1998;32(2):476-482.

4. Schless BG, Müller HP, Pasquarelli A, Erné SN and Hombach V. On the variability of QRS time-duration in magnetocardiographic recordings. Journal of Medical Engineering & Technology. 2003; 27(3):113-117.

5. Hakacova N, Steding K, Engblom H, Sjögren J, Maynard C and Pahlm O. Aspects of left ventricular morphology outperform left ventricular mass for prediction of QRS duration. Annals of Noninvasive Electrocardiology. 2010;15(2):124-129.

6. Ilkhanoff L, Liu K, Ning H, Nazarian S, Bluemke DA, Soliman EZ et al. Association of QRS duration with left ventricular structure and function and risk of heart failure in middle aged and older adults: the Multi Ethnic Study of Atherosclerosis (MESA). European Journal of Heart Failure. 2012.14(11):1285-1292.

7. Devereux RB, Casale PN., Eisenberg RR, Miller DH and Kligfield P. Electrocardiographic detection of left ventricular hypertrophy using echocardiographic determination of left ventricular mass as the reference standard: comparison of standard criteria, computer diagnosis, and physician interpretation. Journal of the American College of Cardiology. 1984;3(1):82-87.

8. Levy D, Labib SB, Anderson KM, Christiansen JC, Kannel WB, and Castelli WP. Determinants of sensitivity and specificity of electrocardiographic criteria for left ventricular hypertrophy. Circulation. 1990;81(3):815-820.

9. Kearney MT, Zaman A, Eckberg DL, Lee AJ, Fox KA, Shah AM, et al. Cardiac size, autonomic function, and 5-year follow-up of chronic heart failure patients with severe prolongation of ventricular activation. Journal of Cardiac Failure. 2003;9(2):93-99.

10. Bradley DJ, Bradley EA, Baughman KL, Berger RD, Calkins H, Goodman SN, et al. Cardiac resynchronization and death from progressive heart failure: a meta-analysis of randomized controlled trials. JAMA. 2003;289(6):730-740.

11. Grines CL, Bashore TM, Boudoulas H, Olson S, Shafer P and Wooley CF. Functional abnormalities in isolated left bundle branch block. The effect of interventricular asynchrony. Circulation. 1989;79(4):845-853.

12. Bonow RO, Carabello BA, Chatterjee K, de Leon AC, Faxon DP, et al. 2008 focused update incorporated into the ACC/AHA 2006 guidelines for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to revise the 1998 guidelines for the management of patients with valvular heart disease) Endorsed by the Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. Journal of the American College of Cardiology. 2008;52(13):e1-e142.

13. Elliott P, Andersson B, Arbustini E, Bilinska Z, Cecchi F, Charron P, et al. Classification of the cardiomyopathies: a position statement from the European Society Of Cardiology Working Group on Myocardial and Pericardial Diseases. European Heart Journal. 2008;29(2):270-276.

14. Cheitlin MD, Armstrong WF, Aurigemma GP, Beller GA, Bierman FZ, Davis JL, et al. ACC/AHA/ASE 2003 guideline update for the clinical application of echocardiography: summary article: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (ACC/AHA/ASE Committee to Update the 1997 Guidelines for the Clinical Application of Echocardiography). Journal of the American College of Cardiology. 2003;42(5):954-970.

15. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA, et al. Recommendations for chamber quantification: a report from the American Society of Echocardiography‘s Guidelines and Standards Committee and the Chamber Quantification Writing Group, developed in conjunction with the European Association of Echocardiography, a branch of the European Society of Cardiology. Journal of the American Society of Echocardiography. 2005; 18(12):1440-1463.

16. Casale PN, Devereux RB, Milner M, Zullo G, Harshfield GA, Pickering TG, et al. Value of

echocardiographic measurement of left ventricular mass in predicting cardiovascular morbid events in hypertensive men. Annals of Internal Medicine. 1986;105(2):173-178.

17. Koren MJ, Devereux RB, Casale PN, Savage DD and Laragh JH. Relation of left ventricular mass and geometry to morbidity and mortality in uncomplicated essential hypertension. Annals of Internal Medicine. 1991;114(5):345-352.
18. Levy D, Garrison RJ, Savage DD, Kannel WB, and Castelli WP. Left ventricular mass and incidence of coronary heart disease in an elderly cohort: the Framingham Heart Study. Annals of Internal Medicine. 1989;110(2):101-107.
19. Levy D, Garrison RJ, Savage DD, Kannel WB and Castelli WP. Prognostic implications of echocardiographically determined left ventricular mass in the Framingham Heart Study. New England Journal of Medicine. 1990;322(22):1561-1566.
20. Devereux RB, Casale PN, Wallerson DC, Kligfield PAUL, Hammond IW, Liebson PR, et al. Cost-effectiveness of echocardiography and electrocardiography for detection of left ventricular hypertrophy in patients with systemic hypertension. Hypertension. 1987;(2):II69.
21. Prinzen FW, Cheriex EC, Delhaas T, van Oosterhout MF, Arts T, Wellens HJ, et al. The asymmetric thickness of the left ventricular wall resulting from asynchronous electric activation: a study in dogs with ventricular pacing and patients with left bundle branch block. American Heart Journal. 1995;130(5):1045-1053.
22. Chan DD, Wu KC, Loring Z, Galeotti L, Gerstenblith G, Tomaselli G, et al. Comparison of the relation between left ventricular anatomy and QRS duration in patients with cardiomyopathy versus without left bundle branch block. The American Journal of Cardiology. 2014;113(10):1717-1722.
23. Dhingra R, Ho Nam B, Benjamin EJ, Wang TJ, Larson MG, D'Agostino RB, et al. Cross-sectional relations of electrocardiographic QRS duration to left ventricular dimensions: The Framingham Heart Study. The American Journal of Cardiology. 2005;45:685–689.
24. Stewart RA, Young AA, Anderson C, Teo KK, Jennings G and Cowan BR. Relationship between QRS duration and left ventricular mass and volume in patients at high cardiovascular risk. Heart. 2011;97(21):1766-1770.
25. Rickard J, Baranowski B, Grimm RA, Niebauer M, Varma N, Tang WW, et al. Left ventricular size does not modify the effect of QRS duration in predicting response to cardiac resynchronization therapy. Pacing and Clinical Electrophysiology. 2017;40(5):482-487.
26. Braun J, Bax JJ, Versteegh MI, Voigt PG, Holman ER, Klautz RJ, et al. Preoperative left ventricular dimensions predict reverse remodeling following restrictive mitral annuloplasty in ischemic mitral regurgitation. European Journal of Cardio-Thoracic Surgery. 2005;27(5):847- 853.
27. Wang NC, Maggioni AP, Konstam MA, Zannad F, Krasa HB, Burnett JC, et al. Clinical implications of QRS duration in patients hospitalized with worsening heart failure and reduced left ventricular ejection fraction. JAMA. 2008;299(22):2656- 2666.

Original Article

Association of Preoperative Neutrophil to Lymphocyte Ratio with Early Postoperative Acute Kidney Injury Following Isolated Off-Pump Coronary Artery Bypass Grafting

Arvi Nahar[1], AKM Manzurul Alam[2], Asraful Hoque Sium[3], Md. Amirul Islam[4], Sumaiya Naznee[5], Kaushik Roy[6], Sumit Barua[7]

Abstract:

Objective: Acute kidney injury (AKI) is a frequent complication after off-pump coronary artery bypass grafting (OPCAB) that complicates recovery, increases treatment cost and mortality. Neutrophil to lymphocyte ratio (NLR) is a systemic inflammatory marker easily derived from complete blood count that has many prognostic potentials. The purpose of this study was to evaluate if there is an association of preoperative NLR with early postoperative AKI following isolated OPCAB.

Methods: This cross-sectional study was carried out in the Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD) on a total of 60 patients aged 31-70 years with no preoperative renal dysfunction undergoing isolated OPCAB between August 2021 and July 2022. Group A included 30 patients with preoperative NLR < 2.65 and Group B included 30 patients with preoperative NLR ≥2.65. Patients were monitored for development of early postoperative AKI according to serum creatinine criteria of Kidney Disease Improving Global Outcomes (KDIGO) 2012 guideline.

Results: Two patients from group A and twenty patients from group B developed early postoperative AKI ($p < 0.001$). Events of AKI were significantly higher in group B patients at all postoperative time points. Multivariate binary logistic regression analysis revealed preoperative NLR ≥2.65 as an independent predictor of early post OPCAB AKI ($p = 0.004$, OR = 13.746). In receiver operating curve (ROC) analysis area under curve (AUC) was 0.933 (95% CI 0.874-0.992, $p < 0.001$). It showed 90.91% sensitivity and 73.7% specificity at the pre-set cut off value of NLR at 2.65 where optimal predictability of post-OPCAB AKI occurred with 66.67% positive predictive value, 93.33% negative predictive value and 80% accuracy.

Conclusion: Preoperative NLR is significantly associated with early postoperative AKI following isolated OPCAB and therefore it should be incorporated in routine clinical practice for early prediction of AKI and implementing timely preventive strategies.

Keywords: *NLR,OPCAB,AKI*

(Bangladesh Heart Journal 2024; 39(2): 151-160)

Introduction

Off-pump coronary artery bypass (OPCAB) surgery first became popular in the 1990s in an effort to lessen acute organ dysfunction caused by cardiopulmonary bypass (CPB). [1] OPCAB was anticipated to have a lower incidence

1. Assistant Registrar, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
2. Professor & Head of the Department, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
3. Associate Professor, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
4. Assistant Professor, Department of Anesthesiology, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
5. Medical Officer, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
6. Assistant Registrar, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh.
7. Medical Officer, Department of Cardiac Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh.

Address of correspondence: Dr Arvi Nahar, Assistant Registrar, Department of Cardiac Surgery, National Institute of Cardiovascular Diseases, Dhaka, Bangladesh. Mobile +8801710936944, e- mail arvinaharasha@gmail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75800

of acute kidney injury (AKI) due to lack of CPB associated systemic inflammatory response, non-pulsatile flow, hemodilution, hemolysis, low output syndrome, and global hypoperfusion.[2] However, AKI still remains a serious and frequent morbidity after OPCAB with incidence ranging from 8% to 30%[3] and is an independent predictor of increased mortality irrespective of perioperative risk factors.[4] This may be attributed to renal ischemia brought on by poor hemodynamics, athero-embolism from side clamping of aorta and, intraoperative hemodynamic instability and global hypoperfusion due to displacement of the heart during distal anastomosis.[5]

Serum creatinine is an indirect and slow response marker of renal function that is influenced by numerous non-renal factors like age, race, sex, muscle mass, medication, nutrition and hydration status.[6] In the acute setting, more than 50% of kidney function is lost before serum creatinine even begins to rise.[7] Novel biomarkers for early prediction of AKI include neutrophil gelatinase-associated lipocalin (NGAL), kidney injury molecule-1 (KIM-1), cystatin-C (CysC), liver type fatty acid-binding protein (L-FABP), tissue inhibitor of metalloproteinases-2 (TIMP-2), insulin growth factor binding protein-7 (IGFBP-7), interleukin-6 (IL-6), interleukin-18 (IL-18).[8] But high cost of assays and lack of adequate testing facilities impede their serial evaluation for routine assessment.

Atherosclerosis, the main cause of coronary artery disease (CAD), is an inflammatory disease in which immune mechanisms interact with metabolic risk factors.[9] Moreover, surgical revascularization triggers additional release of potent inflammatory mediators eliciting a systemic inflammatory response like syndrome in the postoperative period leading to major organ-related complications.[10]

Neutrophils are key effectors of the inflammatory cascade. Biopsies from patients and animal models with AKI revealed increased neutrophils in the peritubular capillary network of the outer medulla as early as 30 minutes after ischemia–reperfusion.[11] Neutrophils adhere to endothelial cells with the help of intercellular adhesion molecule-1 and P-selectin. Along with platelets and red blood cells they cause capillary plugging leading to vascular congestion.[12] Degranulation of

neutrophils, release of proteases, myeloperoxidase, cytokines and generation of reactive species can aggravate injury and damage endothelial and epithelial cells in the outer medulla.[13]

Neutrophils regulate the acute phase of inflammation within the first 24 hours but in later phases of AKI, infiltration of lymphocytes and macrophages predominates. Regulatory T cells are significant in renoprotection and renal regeneration processes through anti-inflammatory cytokine release and promoting tubular proliferation.[14] Higher risk of AKI has been related to neutrophilia due to associated pro-inflammatory function and lymphopenia & monocytopenia due to a lack of protective function.[15]

The neutrophil to lymphocyte ratio (NLR) is an inexpensive surrogate marker of systemic inflammatory response.[16] NLR has been demonstrated to effectively predict AKI and other adverse effects following CABG, though the cutoff value varied among different studies.[17-22] Preoperative NLR measured on the immediate day before surgery is an effective index reflecting inflammation and oxidative stress,[23] therefore, is expected to make an early identification of patients more susceptible to renal injury. The purpose of this study was to find the association of preoperative NLR with early postoperative AKI following isolated OPCAB in our population so that early preventive measures can be implemented to protect the renal function to the maximum extent.

Methods:

This comparative cross-sectional study was conducted on 60 patients who underwent isolated OPCAB by standard median sternotomy approach for ischemic heart disease at Department of Cardiac Surgery, National Institute of Cardiovascular Diseases (NICVD) from 1st August 2020 to 31st July 2022. Approval for the study was obtained from the Ethical Review Committee of NICVD.

Patients with preoperative renal dysfunction (serum creatinine <1.5 mg/dl &/or eGFR < 60 mL/min/1.73m^2), severe left ventricular systolic dysfunction (LVEF < 30%), history of acute myocardial infarction, cerebrovascular accident or percutaneous coronary intervention in the last 30 days prior to operation, known acute infections, autoimmune disease, malignancy, hematological proliferative disease, systemic inflammatory disease, chronic obstructive pulmonary disease or peripheral vascular disease, low preoperative hemoglobin levels (<10 g/dl), ongoing steroid treatment or chemotherapy, prior history of undergoing cardiac surgery with or without CPB and patients who required emergency conversion to on-pump revascularization or re- exploration due to excessive bleeding or perioperative intra-aortic balloon pump were excluded from this study.

After obtaining informed written consent, meticulous history was taken, detailed clinical examination was performed and relevant investigation findings were recorded in a pre-

designed semi-structured questionnaire. Age, gender, body mass index (BMI), history of smoking, diabetes, hypertension, dyslipidemia, LVEF, coronary angiogram findings, preoperative and postoperative laboratory parameters (complete blood count, serum creatinine, eGFR, C-reactive protein), number of grafts given, duration of surgery, amount of blood products used, mechanical ventilation time, urine output, duration of inotrope support, length of stay in the intensive care unit and hospital and postoperative morbidity (renal dysfunction, arrythmia, wound infection, psychosis or respiratory compromise), mortality were recorded.

On day before surgery, blood sample was taken by venipuncture.Complete blood count was performed in EDTA tube using Beckman Coulter DxH 500 and serum creatinine was measured using Beckman coulter AU 480 at biochemistry laboratory of NICVD. eGFR was calculated using the 2005 MDRD formula. NLR was calculated by dividing number of neutrophils to number of lymphocytes.

Patients were divided into two groups. Group A included 30 patients with preoperative NLR< 2.65 and Group B had 30 patients with preoperative NLR ≥2.65. This cut-off value was set according to the findings of a similar retrospective study by Parlar & Şaşkin in 2018.[19]

All patients received a standard general anesthesia protocol for surgery through standard median sternotomy approach. Mean blood pressure was maintained above 60 mm Hg and blood glucose level was maintained between 120-180 mg/dL throughout the perioperative period.

Left internal mammary artery (LIMA) and great saphenous vein, radial artery or right internal mammary artery (RIMA) were harvested according to plan. Heparin, in a dose of 100-200 IU/kg of body weight, was administered to maintain an activated clotting time of >300 sec. LIMA was the preferred conduit for left anterior descending artery in all cases. The Octopus Evolution Tissue Stabilizer (Medtronic, Inc, Minneapolis, MN) was used in each patient to stabilize the target coronary artery. After opening the target coronary, the intra-coronary shunts were placed. All the distal anastomoses were performed with either 7-0 or 8-0 polypropylene suture. And proximal anastomoses with 6-0 polypropylene sutures with the assistance of a side-biting clamp in the ascending aorta. After completion of the coronary anastomoses, heparin was reversed with protamine at a dose of 1 mg/100 IU of heparin. All patients were given tablet aspirin in a dose of 75 mg per day commenced from postoperative day one onward.

Postoperatively patients were shifted to ICU and extubated when they became alert, hemodynamics were stable, proper ventilation was maintained and blood gas values were within safety levels. Antibiotic and analgesics were used following the standard protocol of the institution. Blood samples for serum creatinine were collected at 24 hours, 48hours, 72 hours and 7 days after surgery. Urine output was monitored until inotropic support was withdrawn. To obviate volume depletion and prerenal azotemia, fluid management was optimized.

The primary outcome variable was development of postoperative AKI according to serum creatinine criteria of KDIGO 2012 guideline where AKI was defined as increase in serum creatinine by ≥0.3 mg/dl (≥26.5 µmol/l) within 48 hours or increase in serum creatinine to e" 1.5 times baseline, which is known or presumed to have occurred within the prior 7 days. [24]

Statistical analyses were performed using Statistical Packages for Social Sciences (SPSS) version

26. Continuous data were summarized by mean ± SD and categorical data as frequency distribution and percentage. To make comparison between groups, we performed Chi-square (χ^2) test or Fisher's exact test for qualitative data and independent sample t-test for quantitative data between preoperative NLR < 2.65 and e" 2.65 group. To assess performance of preoperative NLR as a biomarker for early detection of postoperative AKI, receiver operating characteristic (ROC) curve was generated and area under the curve (AUC) was calculated. To determine independent predictor of AKI, multivariate binary logistic regression analysis was performed among those variables which were found to be significantly different between the two groups on univariate analysis. For all analytic tests, the statistical significance threshold was set at 5% and a p value of d"0.05 was considered statistically significant. The summarized data were interpreted accordingly and then presented in the form of tables and figures.

Interest of the patients or their guardians were given the highest priority and confidentiality was maintained with safeguard of health and rights of the participants throughout the study.

Results:

There were no significant differences between the two groups in terms of demographics, risk factors, coronary angiogram findings, LVEF or baseline biochemical investigations (Table I).

Table-I

Comparison of preoperative demographic, clinical and biochemical characteristics

Patient's characteristics	Group A (n = 30)	Group B (n = 30)	p value
Age in years (mean ± SD)	53.10 ± 9.25	53.70 ± 7.48	0.783*
Male (%)	25 (83.33%)	24 (80%)	0.739**
Female (%)	5 (16.67%)	6 (20%)	
BMI in kg/m^2 (mean ± SD)	25.57 ± 3.64	23.95 ± 3.09	0.068*
Diabetes mellitus (%)	12 (40%)	16 (53.33%)	0.301**
Hypertension (%)	16 (53.33%)	19 (63.3	0.432**
Dyslipidemia (%)	15 (50%)	16 (53.33%)	0.796**
Smoking (%)	14 (46.67%)	19 (63.33%)	0.194**
Coronary angiogram findings			
SVD (%)	1 (3.33%)	0 (0%)	
DVD (%)	6 (20%)	8 (26.67%)	0.520**
TVD (%)	23 (76.67%)	22 (73.33%)	
Left main disease (%)	5 (16.67%)	9 (30%)	0.222**
LVEF (mean ± SD)	48.43 ± 8.15	50.00 ± 7.28	0.435*
Serum creatinine in mg/dL (mean ± SD)	1.05 ± 0.13	1.11 ± 0.13	0.097*
eGFR in mL/min/1.73m^2 (mean ± SD)	71.28 ± 9.56	67.04 ± 8.63	0.076*
CRP in mg/dL (mean ± SD)	3.03 ± 1.48	3.7 ± 1.89	0.132*

BMI = body mass index, SVD = single vessel disease, DVD = double vessel disease, TVD = triple vessel disease, LVEF = left ventricular ejection fraction, eGFR = estimated glomerular filtration rate, CRP = C reactive protein

*Independent sample t-test

**Chi-square test

Patients in group B had significantly higher neutrophil count ($p < 0.001$), lower lymphocyte count ($p < 0.001$), and higher NLR (4.85 ± 3.13 vs. 1.78 ± 0.48; $p < 0.001$) compared to group A patients (Table II). Other hematological indices had no significant difference between two groups.

There was no significant difference between the two groups in regards of total number of grafts ($p= 0.133$) or events of per-operative arrythmia ($p = 0.136$). However, patients in Group B had significantly increased duration of surgery ($p = 0.022$), increased amount of perioperative blood transfusion ($p < 0.001$) and decreased per-operative mean urine output ($p < 0.001$) compared to Group A patients (Table III).

Table IV summarizes comparison of postoperative attributes between the two groups. Patients in group B had significantly longer mechanical ventilation time ($p < 0.001$), longer duration of ICU stay ($p < 0.001$) and longer length of postoperative hospital stay ($p < 0.001$) compared to group A patients. No significant difference was found between two groups regarding postoperative blood loss ($p = 0.343$), need for ≥2 inotropes for > 24 hours ($p = 0.432$) or mean urine output measured in mL/kg/hour at 24 hours ($p = 0.125$), 48 hours ($p = 0.445$) and 72 hours ($p = 0.323$) after surgery. However, serum creatinine was significantly higher in group B patients compared to group A at 24 hours ($p < 0.001$), 48 hours ($p < 0.001$), 72 hours ($p < 0.001$) and 7 days ($p < 0.001$) after surgery.

Patients in group B also had significantly higher incidence of in hospital morbidity (80% vs. 20%; $p < 0.001$) in the form of renal dysfunction, arrythmia, wound infection, psychosis or respiratory compromise. There was no in hospital mortality during the study period.

Total 22 out of 60 patients developed early postoperative AKI, only 2 were from group A and 20 belonged to group B ($p < 0.001$). AKI incidence was significantly higher in group B patients at 24 hours ($p = 0.003$), 48 hours ($p < 0.001$), 72 hours ($p = 0.001$) and 7 days ($p = 0.001$) after surgery. Number of AKI cases were highest at 48 hours after surgery and declined afterwards in both groups. Only 9 cases from group B still had AKI at 7 days after surgery.(Table V).

Binary logistic regression analysis was done to assess predictors of early post OPCAB AKI. Potential predictors were preoperative NLR ≥2.65, duration of surgery and perioperative blood transfusion- which were found to be

significantly different between the two groups on univariate analysis. Multivariate logistic regression analysis identified only preoperative NLR ≥2.65 as an independent predictor of early postoperative AKI (p = 0.004) with highest odds ratio (OR = 13.746). Other variables showed insignificant association (p > 0.05) with OR < 1 (Table VI).

Area under the curve (AUC) value was calculated using the Receiver Operating Characteristic (ROC) curve to determine the quality of preoperative neutrophil to lymphocyte ratio as a biomarker to predict early post-OPCAB AKI (Figure 1). ROC curve analysis revealed an area under the curve (AUC) of 0.933, indicating preoperative NLR had an outstanding diagnostic accuracy for predicting early postoperative AKI. At our pre-set cutoff value of 2.65, preoperative NLR could optimally predict early post-OPCAB AKI with 90.91% sensitivity, 73.7% specificity, 66.67% positive predictive value, 93.33% negative predictive value and 80% accuracy (Table VII)

Table-II

Comparison of preoperative complete blood count

Hematological parameter	Group A (n = 30)Mean ± SD	Group B (n = 30)Mean ± SD	p value
Hemoglobin (g/dL)	12.78±1.45	12.38±1.48	0.298
ESR (mm in 1st hour)	14.93±11.15	20.40±11.11	0.062
Hematocrit (%)	38.19±4.13	36.70±3.72	0.150
Platelet count (/cmm)	250600±96008	238620±89853	0.620
Mean platelet volume (fL)	8.51±0.89	8.61±0.89	0.683
Total count of WBC (/cmm)	7935.0±2056.5	9021.7±2946.8	0.103
Neutrophils (/cmm)	4281.37±1141.38	6515.97±2583.50	<0.001
Lymphocytes (/cmm)	2557.13±931.26	1549.10±635.91	<0.001
Monocytes (/cmm)	576.90±230.32	536.95±162.88	0.441
Eosinophils (/cmm)	513.90±329.56	439.65±238.69	0.322
Basophils (/cmm)	2.5±1.69	1.67±1.13	0.782
Neutrophil to lymphocyte ratio	1.78±0.48	4.85±3.13	<0.001

ESR = Erythrocyte sedimentation rate, WBC = white blood cell Independent sample t-test

Table-III

Comparison of per-operative attributes

Per-operative attribute	Group A(n=30)	Group B(n=30)	p value
Duration of surgery in hours (mean ± SD)	4.61±0.61	5.15±1.09	0.022*
Number of grafts (%)			
One (%)	2 (6.67%)	0 (0%)	
Two (%)	6 (20%)	10 (33.33%)	0.133**
Three (%)	19 (63.33%)	16 (53.33%)	
Four (%)	1 (3.33%)	4 (13.33%)	
Five (%)	2 (6.67%)	0 (0%)	
Perioperative arrythmia (%)	5 (16.67%)	10 (33.33%)	0.136**
Perioperative blood transfusion in units(mean ± SD)	3.83 ± 0.70	5.03 ± 1.10	<0.001*
Per-operative urine output in mL/kg/hr(mean ± SD)	1.61 ± 0.29	1.06 ± 0.14	<0.001*

*Independent sample t-test
**Chi-square test

Table-IV

Comparison of postoperative attributes

Post-operative outcome	Group A (n =30)	Group B (n =30)	p value
Blood loss in mL (mean ± SD)	674.00 ± 381.47	813.33 ± 291.23	0.343*
Mechanical ventilation time in hours(mean ± SD)	6.55 ± 1.42	9.32 ± 3.82	< 0.001*
ICU stay in days (mean ± SD)	5.72 ± 0.61	9.60 ± 3.57	< 0.001*
Postoperative hospital stay in days(mean ± SD)	8.00 ± 1.91	11.43 ± 3.81	< 0.001*
Needed ≥2 inotropes for >24 hours	16 (53.33%)	19 (63.33%)	0.432**
Postoperative urine output in mL/kg/hr(mean ± SD)			
At 24 hours	1.25±0.28	1.17±0.24	0.125*
At 48 hours	1.40±0.24	1.39±0.20	0.445*
At 72 hours	1.25±0.29	1.28±0.22	0.323*
Postoperative serum creatinine in mg/dL(mean ± SD)			
24 hours after surgery	1.14 ± 0.14	1.43 ± 0.32	< 0.001*
48 hours after surgery	1.24 ± 0.14	1.61 ± 0.36	< 0.001*
72 hours after surgery	1.13 ± 0.15	1.40 ± 0.29	< 0.001*
7 days after surgery	1.08 ± 0.12	1.26 ± 0.24	< 0.001*
In hospital morbidity	5 (16.67%)	20 (66.67%)	< 0.001*
In hospital mortality	0	0	-

*Independent sample t-test
**Chi-square test

Table-V

Comparison of development of early postoperative AKI (Chi-square test)

Postoperative AKI	Group A (n = 30)f (%)	Group B (n = 30)f (%)	p value
AKI at 24 hours			
Stage 1	1 (3.33%)	11 (36.67%)	
Stage 2	0 (0%)	1 (3.33%)	
Stage 3	0 (0%)	0 (0%)	0.003
No AKI	29 (96.67%)	18 (60%)	
AKI at 48 hours			
Stage 1	2 (6.67%)	17 (56.67%)	
Stage 2	0 (0%)	3 (10%)	
Stage 3	0 (0%)	0 (0%)	<0.001
No AKI	28 (93.33%)	10 (33.33%)	
AKI at 72 hours			
Stage 1	1 (3.33%)	13 (43.33%)	
Stage 2	0 (0%)	1 (3.33%)	
Stage 3	0 (0%)	0 (0%)	0.001
No AKI	29 (96.67%)	16 (53.33%)	
AKI at 7 days			
Stage 1	0 (0%)	9 (30%)	
Stage 2	0 (0%)	0 (0%)	
Stage 3	0 (0%)	0 (0%)	0.001
No AKI	30 (100%)	21 (70%)	
Total AKI cases	2 (6.67%)	20 (66.67%)	<0.001

AKI = Acute kidney injury, f = frequency

Table-VI

Determinants of early postoperative AKI following OPCAB

Variables	β	SE	p value	OR	95% CI	
					Lower	Upper
Preoperative NLR ≥2.65	2.621	0.903	0.004	13.746	2.343	80.643
Duration of surgery	0.015	0.368	0.968	0.985	0.479	2.025
Perioperative blood transfusion	0.799	0.433	0.065	0.450	0.254	1.072

Multivariate binary logistic regression analysis. Data were expressed as Odds Ratio (OR).
β = coefficient for constant in the null model, SE= standard error around the coefficient for constant, CI= confidence interval, NLR= neutrophil to lymphocyte ratio

Table-VII

Analysis of performance of preoperative NLR at preset cutoff point to predict early postoperative AKI following OPCAB from ROC curve

Cut-off point	AUC	95% CI	Sensitivity	Specificity	p value	PPV	NPV	Accuracy
2.65	0.933	0.874-0.992	90.91%	73.7%	<0.001[s]	66.67%	93.33%	80%

AUC= area under the curve, PPV= positive predictive value, NPV= negative predictive value

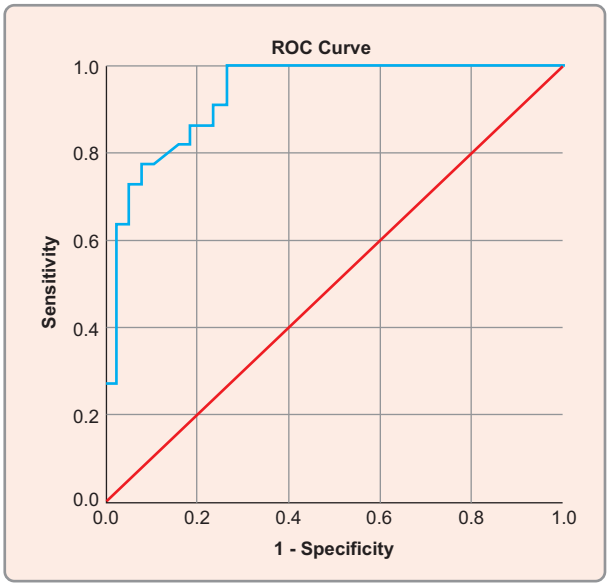

Figure 1: *Receiver operating characteristic (ROC) curve for preoperative NLR to predict early post-OPCAB AKI*

Discussion:

The major finding of this study was that elevated preoperative neutrophil to lymphocyte ratio (e"2.65) was associated with increased occurrence of early postoperative AKI. Group B patients, who were later found to develop increased incidence of postoperative AKI, had significant relative neutrophilia and lymphopenia compared to group A patients. This finding is in consistent with the U-shaped relationship between differential white blood cell count and risk of AKI & mortality in a prospective cohort of critically ill patients demonstrated by Seok Han et al.[15]

Patients in group B were found to have significantly reduced amount of per-operative urine output ($p < 0.001$). This could be an early manifestation of the increased incidence of postoperative AKI later found in this group. The increased preoperative NLR probably made these patients more susceptible to the additional insult by release of potent inflammatory mediators triggered by surgical revascularization resulting in increased incidence of postoperative AKI as suggested by Magoon & Makhija.[10]

In contrast to the findings of Parlar & Şaşkin [19], we found no significant difference of postoperative blood loss ($p = 0.343$) or duration of vasoactive inotropic support ($p = 0.432$) between the two groups. These findings further strengthen the fact that the association of preoperative NLR with postoperative AKI in our study was not confounded by postoperative anemia, hypovolemia or inotrope induced renal vasoconstriction.

Postoperative urine output measured at 24 hours ($p = 0.125$), 48 hours ($p = 0.045$) and 72 hours ($p= 0.323$) after surgery did not vary significantly between the two groups. Judicious use of diuretics, inotrope adjustment to maintain adequate cardiac output and thereby adequate renal perfusion as

well as meticulous monitoring of central venous pressure to optimize volume status in the ICU might have masked the reduced urine output expected in early stages of AKI.

In this study, serum creatinine showed gradual rise after surgery and peaked at 48 hours demonstrating the fact that it is an unreliable indicator during acute changes in kidney function rising late in the course of AKI.[24] Reno-protective measures were initiated in AKI patients by this time. As a result, serum creatinine showed a gradual decline in both groups at 72 hours and by 7 days after surgery almost neared baseline in group A patients.

As previously demonstrated by Parlar & Şaşkin [19] frequency of postoperative AKI was significantly higher at all time points in high preoperative NLR group. Over all, only 6.67% patients in group A developed postoperative AKI compared to 66.67% patients in group B ($p < 0.001$), indicating strong association between elevated preoperative NLR and early postoperative AKI.

The overall incidence of AKI following OPCAB in this study was 21.67% at 24 hours, 36.67% at 48 hours, 25% at 72 hours and 15% at 7 days. This correlates well with findings of previous studies that 5 to 30% of patients develop AKI after OPCAB with varying severity.[1,5,7]

Contrary to the findings of Dey et al.[18], we found that patients in group B had a significantly prolonged duration of surgery ($p = 0.022$). This prolonged operative period could be an indicator of longer time taken for distal anastomosis during which mechanical displacement of the heart was needed leading to a prolonged period of hemodynamic compromise which is a recognized risk factor for development of post OPCAB AKI.

We found patients in group B needed significantly increased amount of blood transfusion in the perioperative period. This finding is in agreement with the findings of Tewari, Pandye & Agarwal that intraoperative blood transfusion may increase the incidence of AKI in patients undergoing elective OPCAB.[25]

To determine if prolonged duration of surgery or increased amount of perioperative blood transfusion confounded the association between preoperative NLR and post OPCAB AKI, multivariate binary logistic regression analysis was performed. It revealed only preoperative NLR ≥ 2.65 as an independent determinant of post OPCAB AKI in our study ($p = 0.004$) with highest odds ratio (OR = 13.746).

Patients with high NLR were also found to require significantly prolonged duration of mechanical ventilation, length of ICU stay and length of postoperative hospital stay. This may be due to the fact that occurrence of in hospital morbidity, namely- renal dysfunction, arrythmia, psychosis, wound infection or respiratory complications were significantly higher in this group. These findings correlate well with a previous study by Dey et al. where increased preoperative NLR was found to be a predictor of adverse outcome after elective OPCAB.[18]

Our study revealed preoperative NLR has an outstanding potential to be used as an early predictor of post OPCAB AKI. AUC of the ROC curve for preoperative NLR was 0.933 ($p < 0.001$) with 90.91% sensitivity and 73.7% specificity at our preset cut off value of 2.65 where optimal predictability occurred with 66.67% positive predictive value, 93.33% negative predictive value and 80% accuracy. Parlar & Şaşkin found an AUC of 0.691 at a similar cut off value of 2.65 with 66.1% sensitivity and 64.7% specificity for preoperative NLR in predicting AKI after CABG.[19] The exclusion of on-pump cases may explain the remarkably improved diagnostic performance of preoperative NLR in our study. In another study, AUC of 0.981 with 98% sensitivity and 89.8% specificity at a cut off value of 4.625 for preoperative NLR was showed by Dey and colleagues in predicting poor outcome following elective OPCAB (Dey *et al.* 2020, p. 2403). But they defined new-onset renal failure in accordance with stage 3 of the AKIN criteria which might explain the increased cut off value in their study.

The present study revealed that patients with elevated preoperative NLR were more susceptible to develop post OPCAB AKI in spite of having no pre-existing renal impairment. The strength of this study was isolated inclusion of off-pump cases which obviated the consequences of hemodilution, cellular lysis, inflammatory and coagulation pathway activation associated with the use of an extracorporeal circuit in altering the baseline hematologic indices. Ischemia/reperfusion here was limited to the coronary artery territory being grafted. This allowed the opportunity of evaluating the exclusive effect of immediate preoperative day NLR on early postoperative AKI.

Preventive measures like identification of risk factors, avoiding nephrotoxic medication, dehydration and hyperglycemia, minimizing period of hemodynamic instability during distal grafting, maintenance of MAP and sinus rhythm, optimization of hemodynamics and intravascular volume with goal-directed protocols, judicious use of blood products, inotrope dose adjustment to maintain adequate renal perfusion, optimum diuresis etc. initiated early on in patients with elevated

baseline NLR may significantly reduce the incidence of post OPCAB AKI. As AKI prolongs the duration of ICU stay, complicates recovery, delays discharge and significantly increases the risk of chronic renal impairment and need for RRT in the long run, early prediction for timely intervention is of utmost need to reduce cost burden, morbidity and mortality. Since monitoring of AKI evolution with novel biomarkers is economically very challenging in our context, use of preoperative NLR for early prediction of postoperative AKI can be a very lucrative option in this case for its major asset of being cost-effective and easily available in daily clinical practice.

Conclusion:

This study revealed that elevated preoperative NLR is significantly associated with early postoperative AKI in patients undergoing isolated OPCAB. This result will encourage routine use of NLR as a biomarker for early prediction of post-OPCAB AKI after off-pump coronary artery bypass grafting and help to implement timely preventive measures.

References:

1. Seabra VF, Alobaidi S, Balk EM, Poon AH, Jaber BL. Off-Pump Coronary Artery Bypass Surgery and Acute Kidney Injury: A Meta-Analysis of Randomized Controlled Trials. Clinical Journal of the American Society of Nephrology. 2010 Jul 29;5(10):1734–44.
2. Mathison M, Edgerton JR, Horswell JL, Akin JJ, Mack MJ. Analysis of hemodynamic changes during beating heart surgical procedures. The Annals of Thoracic Surgery. 2000 Oct;70(4):1355– 60.
3. Rydén L, Ahnve S, Bell M, Hammar N, Ivert T, Holzmann MJ. Acute kidney injury following coronary artery bypass grafting: early mortality and postoperative complications. Scandinavian Cardiovascular Journal. 2012 Feb 10;46(2):114–20.
4. Kandler K, Jensen ME, Nilsson JC, Møller CH, Steinbrüchel DA. Acute kidney injury is independently associated with higher mortality after cardiac surgery. Journal of Cardiothoracic and Vascular Anesthesia. 2014 Dec;28(6):1448–52.
5. Kumada Y, Yoshitani K, Shimabara Y, Ohnishi Y. Perioperative risk factors for acute kidney injury after off-pump coronary artery bypass grafting: a retrospective study. JA Clinical Reports. 2017 Oct 4;3(1).
6. McIlroy DR, Wagener G, Lee HT. Biomarkers of Acute Kidney Injury. Anesthesiology. 2010 Apr;112(4):998–1004.
7. Oda T. Acute Kidney Injury After Off-Pump Coronary Artery Bypass Grafting. Circulation Journal. 2010;74(6):1069–70.
8. Jefferies JL, Devarajan P. Early detection of acute kidney injury after pediatric cardiac surgery. Progress in Pediatric Cardiology. 2016 Jun; 41:9–16.
9. Hansson GK. Inflammation, Atherosclerosis and Coronary Artery Disease. New England Journal of Medicine. 2005 Apr 21;352(16):1685–95.
10. Magoon R, Makhija N. Endothelial Glycocalyx and Cardiac Surgery: Newer Insights. Journal of Cardiothoracic and Vascular Anesthesia. 2020 Jan;34(1):310–11.
11. Li L, Huang L, J. Sung SS, L. Vergis A, L. Resin D, Rose Jr CE, et al. The chemokine receptors CCR2 and CX3CR1 mediate monocyte/macrophage trafficking in kidney ischemia–reperfusion injury. Kidney International. 2008 Oct 8;74(12):1526–37.
12. Singbartl K, Green SA, Ley K. Blocking P selectin protects from ischemia/reperfusion induced acute renal failure. The FASEB Journal. 2000 Jan;14(1):48–54.
13. Jang HR, Rabb H. The innate immune response in ischemic acute kidney injury. Clinical Immunology. 2009 Jan;130(1):41–50.
14. Kinsey GR, Sharma R, Huang L, Li L, Vergis AL, Ye H, et al. Regulatory T Cells Suppress Innate Immunity in Kidney Ischemia-Reperfusion Injury. Journal of the American Society of Nephrology. 2009 Jun 4;20(8):1744–53.
15. Seok Han S, Young Ahn S, Ryu J, Ha Baek S, Kim K, Jun Chin H, et al. U-Shape Relationship of White Blood Cells with Acute Kidney Injury and Mortality in Critically Ill Patients. The Tohoku Journal of Experimental Medicine. 2014;232(3):177–85.
16. Bhat T, Teli S, Rijal J, Bhat H, Raza M, Khoueiry G, et al. Neutrophil to lymphocyte ratio and cardiovascular diseases: a review. Expert Review of Cardiovascular Therapy. 2013 Jan;11(1):55– 9.
17. Shao Q, Chen K, Rha SW, Lim HE, Li G, Liu T. Usefulness of Neutrophil/Lymphocyte Ratio as a Predictor of Atrial Fibrillation: A Meta-analysis. Archives of Medical Research. 2015 Apr;46(3):199–206.

18. Dey S, Kashav R, Kohli JK, Magoon R, ItiShri, Walian A, et al. Systemic Immune- Inflammation Index Predicts Poor Outcome After Elective Off-Pump CABG: A Retrospective, Single-Center Study. Journal of Cardiothoracic and Vascular Anesthesia. 2020 Sep;35(8):2397– 404.

19. Parlar H, Şaşkin H. Are Pre and Postoperative Platelet to Lymphocyte Ratio and Neutrophil to Lymphocyte Ratio Associated with Early Postoperative AKI Following CABG? Brazilian Journal of Cardiovascular Surgery. 2018; 33(3): 233-41.

20. Guangqing Z, Liwei C, Fei L, Jianshe Z, Guang Z, Yan Z, et al. Predictive value of neutrophil to lymphocyte ratio on acute kidney injury after on-pump coronary artery bypass: a retrospective, single-center study. General Thoracic and Cardiovascular Surgery. 2022 Feb 1;70(7):624–33.

21. Ishikawa M, Iwasaki M, Dai Namizato, Yamamoto M, Morita T, Ishii Y, et al. The neutrophil to lymphocyte ratio and serum albumin as predictors of acute kidney injury after coronary artery bypass grafting. Scientific Reports. 2022 Sep 14;12(1).

22. Chen D, Xiao D, Guo J, Chahan B, Wang Z. Neutrophil–lymphocyte count ratio as a diagnostic marker for acute kidney injury: a systematic review and meta-analysis. Clinical and Experimental Nephrology. 2019 Oct 24;24(2):126–35.

23. Tang Y, Chen L, Li B, Yang L, Ouyang W, Li D. Preoperative Neutrophil-Lymphocyte Ratio for predicting surgery-related acute kidney injury in non-cardiac surgery patients under general anaesthesia: A retrospective cohort study. PLOS ONE. 2022 Jul 29;17(7): e0270066.

24. Fliser D, Laville M, Covic A, Fouque D, Vanholder R, Juillard L, et al. A European Renal Best Practice (ERBP) position statement on the Kidney Disease Improving Global Outcomes (KDIGO) Clinical Practice Guidelines on Acute Kidney Injury: Part 1: definitions, conservative management and contrast-induced nephropathy. Nephrology Dialysis Transplantation. 2012 Oct 8;27(12):4263–72.

25. Tewari P, Pandye S, Agarwal SK. Intraoperative blood transfusion increases the incidence of acute kidney injury in elective off pump coronary artery surgery. Journal of Cardiothoracic Surgery. 2015 Dec;10(S1).

Original Article

Retrospective Study on Anterolateral Mini-Thoracotomy in Emergency Surgical Drainage for Massive Pericardial Effusion Including Sternotomy Case

Md. Mohammad Armane Wadud[1], Md. Imran[2], Israt Jahan[3], Ibrahim Khalilullah[4], Mohammod Humayun Kabir[5], Mohammad Ahsan Habibur Rahman[6] Nusrat Ghafoor[7], Sharif Hasan[8], Masoom Siraj[9]

Abstract:

Background: The conventional method for managing the surgical drainage of an acute massive pericardial effusion typically involves a median sternotomy. Nevertheless, advancements in surgical optics and tools have enabled the utilization of progressively smaller incisions, such as a left anterolateral thoracotomy, for the same purpose. Aim of the Study: This study aimed to assess the surgical outcomes of left anterolateral mini-thoracotomy compared to median sternotomy for draining acute massive pericardial effusion. Methods: This research took place in the Cardiac Surgery Department at Ibrahim Cardiac and Research Institute, following approval from the local ethics committee, from June 2021 to June 2023. Fourteen patients with acute massive pericardial effusion necessitating emergency surgical drainage were included. The investigation concentrated on evaluating operative and short-term postoperative results to gauge the influence of two surgical drainage methods on patients' quality of life. Result: Both groups exhibited similar age, preoperative comorbidities, and ejection fraction. The sternotomy group required more operation time than the left anterolateral mini-thoracotomy group. Furthermore, the sternotomy group had a prolonged stay in the intensive care unit and hospital compared to the left anterolateral mini-thoracotomy group. Similar rates were observed for blood transfusion and chest tube drainage. However, two cases of superficial wound infection occurred in the sternotomy group. In the anterolateral thoracotomy group, no patients required conversion to full sternotomy, and all patients were alive at the one-month follow-up after hospital discharge. Conclusion: Employing a left anterolateral mini-thoracotomy for draining acute massive pericardial effusion was deemed a secure and reliable alternative to the traditional median sternotomy incision. Despite its limited operating field, requiring proficiency, this approach preserved sternal integrity, offered a more aesthetically pleasing incision, reduced the risk of wound infection, and decreased the need for analgesia. Additionally, it was associated with a faster recovery process and a shorter stay in the intensive care unit (ICU).

Keywords: *cardiac surgery; pericardial effusion; left anterolateral thoracotomy; surgical drainage; postoperative outcomes*

(Bangladesh Heart Journal 2024; 39(2): 161-167)

1. Associate Professor, Cardiac Surgery Department, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
2. Specialist, Cardiac surgery department, Green life hospital LTD., Dhaka, Bangladesh.
3. Registrar, Critical Care Medicine, BIRDEM, Dhaka, Bangladesh.
4. Assistant Professor, Department of Cardiac Anesthesia, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
5. Assistant Professor, Department of Cardiac Anesthesia, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
6. Assistant Professor, Department of Cardiac Anesthesia, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
7. Associate Professor, Radiology Department, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
8. Professor and Senior Consultant, Cardiac Surgery Department, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.
9. Professor and Senior Consultant, Cardiac Surgery Department, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.

Address of Correspondence: Dr Mohammad Armane Wadud, Associate Professor, Cardiac Surgery Department, Ibrahim Cardiac and Research Institute, Dhaka, Bangladesh.

DOI: https://doi.org/10.3329/bhj.v39i2. 75802

Introduction:

Pericardial effusion, a condition characterized by the abnormal accumulation of fluid around the heart within the pericardial sac,[1-2] poses a potential and, in some cases, life-threatening threat. Pericardial effusion may appear as transudate (hydropericardium), exudate, pyopericardium or haemopericardium. Large effusions are common with neoplastic, tuberculous, cholesterol, uremic pericarditis, myxedema, and parasitoses.[3-4] Effusions that develop slowly can be remarkably asymptomatic, while rapidly accumulating smaller effusions can present with tamponade. Loculated effusions are more common when scarring has supervened (e.g., postsurgical, posttrauma, purulent pericarditis). Massive chronic pericardial effusions are rare (2–3.5% of all large effusions).[3,5-6]

Cardiac tamponade is the decompensated phase of cardiac compression caused by effusion accumulation and the increased intrapericardial pressure. In “surgical” tamponade intrapericardial pressure is rising rapidly, in the matter of minutes to hours (i.e. haemorrhage), whereas a low-intensity inflammatory process is developing days to weeks before cardiac compression occurs (“medical” tampon ade). Heart sounds are distant. Orthopnoea, cough and dysphagia, occasionally with episodes of unconsciousness can be observed. Insidiously developing tamponade may present with the signs of its complications (renal failure, abdominal plethora, shock liver and mesenteric ischemia).[3,6] In 60% of the patients, the cause of pericardial effusion may be a known medical condition. Tamponade without two or more inflammatory signs (typical pain, pericardial friction rub, fever, diffuse ST segment elevation) is usually associated with a malignant effusion.[3]

cardiac tamponade is an uncommon complication of percutaneous coronary intervention (PCI). A relatively small blood volume within the pericardial space may cause severe hemodynamic instability and death, even with early diagnosis and prompt treatment. Previous reports suggest that cardiac tamponade is most frequently caused by coronary artery perforation during PCI.[6] Acute postoperative cardiac tamponade (defined as up to 7 days post-surgery) is an uncommon entity that requires prompt diagnosis and diligent management to avoid circulatory collapse and cardiorespiratory arrest. Anesthetic management for surgical pericardial drainage of an effusion causing cardiac tamponade in the postoperative period after cardiac surgery is a challenge for the anesthesiologist, considering the unstable hemodynamic situation resulting from abnormal ventricular filling and the subsequent reductions in systolic volume, cardiac output, and systemic blood pressure.[10]

Cardiac tamponade was associated with a very high overall mortality rate, especially for those patients who developed cardiac tamponade in the cardiac catheterization laboratory There are procedures to treat cardiac tamponade, including emergency pericardiocentesis or surgical intervention.[6] Surgical intervention can be done through sternotomy or an anterolateral mini-thoracotomy approach. The latter has gained prominence owing to advancements in surgical techniques, providing a more refined and less invasive alternative.

Historically, median sternotomy (MST) has been the standard approach for excision of these masses. For the past decades, minimally invasive cardiac surgery (MICS) has emerged as an accepted approach for a variety of cardiac procedures such as mitral valve surgery, aortic valve surgery, and surgery for arrhythmia.[7-8] The rise of MICS has mainly been driven by its potential benefits, such as decreased length of intensive care unit (ICU) and hospital stay, decreased surgical trauma with reduced need for blood transfusion, and increased patient cosmetics and satisfaction. The advantages of MICS have mainly been studied in mitral valve surgery, where comparable efficacy was demonstrated without compromising patient safety.[7,9]

As pericardial effusions become larger or massive, the risk of cardiac tamponade increases—a life-threatening condition that needs immediate treatment to save the patient’s life. Quick and effective management is crucial in these situations.The primary objective of this study is to contribute valuable insights by sharing our experiences with pericardial drainage using the anterolateral mini-thoracotomy approach. By doing so, we aim to provide a comprehensive understanding of patient outcomes following this specific surgical intervention. This research serves as a crucial platform for furthering our knowledge and refining the clinical management of pericardial effusion, emphasizing the importance of tailoring interventions to ensure the optimal well-being of affected individuals.

In this study, we conducted a retrospective analysis of 14 pericardiectomy procedures performed to address acute massive pericardial effusion. We compared the outcomes of pericardiectomy performed through left anterolateral thoracotomy versus median sternotomy, both carried out without the use of cardiopulmonary

bypass. Our assessment focused on parameters including morbidity, mortality, and functional outcomes

Methodology:

A retrospective study was undertaken at the Department of Cardiac Surgery, Ibrahim Cardiac Hospital & Research Institute, following approval from the local ethics committee. The study, conducted from June 2021 to June 2023, involved the enrolment of fourteen patients (n=14) with acute massive pericardial effusion necessitating emergency surgical drainage. The retrospective design encompassed a thorough examination of historical medical records and outcomes.

The main goal of this inquiry was to retrospectively evaluate and compare the operative and short-term postoperative results linked to two separate surgical drainage methodologies utilized within this timeframe. These methods were applied to manage acute massive pericardial effusion in the included patients. Furthermore, the study sought to assess the potential impact of these surgical interventions on the overall quality of life experienced by the patients throughout their recovery.

Throughout the study duration, comprehensive data pertaining to the surgical procedures, immediate postoperative outcomes, and subsequent patient recovery were systematically gathered and analysed. This thorough retrospective methodology facilitated comprehensive scrutiny of the efficacy and influence of the selected surgical drainage techniques on both the immediate health outcomes and the overall well-being of the participants in the study.

Every patient in our cohort underwent preoperative evaluation, encompassing a thorough history-taking and routine investigations conducted upon referral to the cardiac surgery department in anticipation of surgical drainage. A comprehensive set of routine investigations for general anesthesia, including X-ray, ECG, and echocardiography, were conducted to evaluate the extent of pericardial effusion.

Table-I

patient Inclusion and Exclusion criteria

Inclusion criteria:
1. Patients with age equal to or >18 years.
2. Patients had body weight greater than 50 Kg.
Exclusion criteria:
1. Patients who had bleeding diathesis.
2. Patients with kidney or liver dysfunction.
3. Patients with chest wall deformity.
4. Patients with severe fixed pulmonary hypertension.
5. Obese patients.

Table-II

Patient Intraoperative and Postoperative assessment

Intraoperative assessment:
1. Calculation of the total operative time.
2. Identification and documentation of the type of incision employed.
3. Measurement of blood loss during the procedure.
4. Quantification of blood units required.
Postoperative assessment:
1. Mechanical ventilation time
2. Chest tube drainage
3. Blood transfusion
4. Monitoring for bleeding
5. Occurrence of re-exploration
6. Evaluation of wound infection and/or seroma
7. Mortality
8. Duration of Intensive Care Unit (ICU) stay
9. Length of hospital stay
10. Total analgesic requirements
11. Identification and management of postoperative complications
12. Pre-discharge and one-month post-discharge echocardiography.
13. Assessment of cosmetic outcomes, patient perception, and pain levels, including overall satisfaction

Results:

The entirety of our patient cohort, comprising 14 individuals, was systematically categorized into two distinct groups to facilitate a comprehensive comparative analysis. Group A was constituted of patients who underwent the surgical drainage of pericardial effusion through a left anterolateral mini-thoracotomy, while Group B underwent the same procedure employing the median sternotomy approach. Delving into the demographics of these groups, the age distribution among patients in Group A ranged from 45 to 71 years, reflecting the diverse age spectrum within this cohort. In contrast, patients in Group B exhibited an age range of 48 to 68 years, adding further granularity to the comparative assessment. Turning our attention to gender distribution, Group A

comprised 4 male individuals, constituting 57.14% of the group, and 3 female individuals, making up the remaining 42.85%. In Group B, the gender distribution manifested differently, with 3 male individuals accounting for 42.85% and 4 female individuals constituting 57.14% of the group.

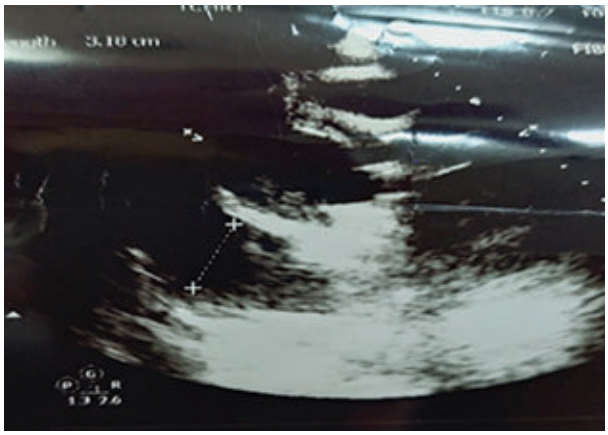

Figure 1: *Preoperative Echocardiography show Massive Pericardial Effusion.*

In both groups, 2 (28.57%) patients had diabetes mellitus (DM). In Group A, 1 (14.28%) patient had a history of stroke, while in Group B, 2 (28.57%) had experienced a stroke. Smoking habits were observed in 1 (14.28%) patient in Group A and 2 (28.57%) patients in Group B.

The causes of pericardial effusion in Group A were post-transcatheter pulmonary valve replacement (TPM)-related right ventricle perforation, tuberculosis, and post-mechanical valve replacement (MVR) massive pericardial effusion due to high international normalized ratio (INR), accounting for 5 (71.42%), 1 (14.28%), and 1 (14.28%) case, respectively. In Group B, the causes were post-TPM-related right ventricle perforation and tuberculosis, with 4 (57.14%) and 3 (42.85%) cases, respectively

In Group A, the surgical technique involved an anterolateral mini-thoracotomy of 6-12 cm in length under general anesthesia. Pericardiectomy was performed on the left side, creating a large pleuropericardial window. Repair of right ventricular (RV) perforation was undertaken when necessary. The chest was subsequently closed, and a drain was placed for drainage.

In Group B, the surgical approach comprised a standard median sternotomy of 19-26cm in length under general anesthesia. Pericardiectomy was performed parallel to the sternotomy, and, if required, RV perforation repair was conducted. Two chest drains were placed retrosternally and retrocardiac, and the sternum was closed using sternal wires, with wound closure in layers.

Table-III
Comparision of Demographic data and clinical characteristics in two groups

Variable	Group A Left anterolateral mini thoracotomy (n=7)	Group B Standard mini sternotomy (n=7)
Age (years)	45-71	48-68
Male	4(57.14%)	3(42.85%)
Female	3(42.85%)	4(57.14%)
DM	2(28.57%)	2(28.57%)
Smoker	1(14.28%)	2(28.57%)
Stroke	1(14.28%)	NA
Issues:post-TPM-related	5(71.42%)	
RV perforation	1(14.28%)	4(57.14%)
Tuberculosis	1(14.28%)	3(42.85%)
Post-MVR massive pericardial effusion due to high INR		NA

Within Group A, the recorded patient blood loss varied between 500 and 800ml, while in Group B, the range extended from 600 to 950ml. Blood transfusion requirements were noted as follows: in Group A, 6 patients (85.71%) necessitated 1 unit of blood transfusion, and 1 patient (14.28%) required 2 units during the procedure. In contrast, Group B exhibited 5 patients (71.42%) requiring 1 unit of blood transfusion, and 2 patients (28.57%) requiring 2 units during the same procedural phase. The total operating time within Group A spanned from 30 to 45 minutes, presenting a relatively concise timeframe. Conversely, in Group B, the operating time extended from 55 to 75 minutes, reflecting a comparatively longer duration for the procedural completion. This detailed breakdown of key procedural metrics contributes to a thorough understanding of the variations and nuances between the two groups.

When comparing the outcomes of the two groups, Group A, which underwent the left anterolateral mini-thoracotomy, exhibited favorable results. The ventilation duration for this group ranged from 130 to 185 minutes, with an intensive care unit (ICU) stay spanning 24 to 28 hours. Removal of chest drains took place on the 2nd to 3rd postoperative day, and the subsequent hospital stay extended from 3 to 4 days. Patients in Group A reported a pain score within

the range of 3-4, and notably, no instances of wound infection were observed. Importantly, all patients (100%) expressed satisfaction with the cosmetic outcomes.

Table-IV

Comparision of operative data in two groups

Variable	Group A Left anterolateral mini thoracotomy (n=7)	Group B Standard mini sternotomy (n=7)
Skin incision (cm)	6-12	19-26
Times of surgery(minutes)	30-45	55-75
Blood loss	500-800 ml	600-950ml
Blood transfusion		
1 unit	6(85.71%)	5(71.42%)
2 unit	1(14.28%)	2(28.57%)

In contrast, Group B, where the standard mini-sternotomy was performed, exhibited some variations in outcomes. The ventilation duration for this group ranged from 180 to 240 minutes, with a lengthier ICU stay ranging between 38 and 52 hours. Chest drain removal occurred on the 3rd to 5th postoperative day, and the subsequent hospital stay was prolonged, ranging from 6 to 8 days. Patients in Group B reported a higher pain score in the range of 5-6. Notably, two patients (28.57%) experienced wound infection, and satisfaction with cosmesis was divided, with 3 patients (42.85%) expressing satisfaction and 4 patients (57.14%) not satisfied. All patients in both groups were subject to continuous follow-up for a duration of 1 year.

Table-V

Comparision of postoperative data in two groups

Variable	Group A Left anterolateral mini thoracotomy (n=7)	Group B Standard mini sternotomy (n=7)
Ventilation time (minute)	130-185	180-240
ICU stay (hours)	24-28	38-52
Post operative hospital stay(day)	3-4	6-8
Pain score	3-4	5-6
Wound infection	NA	2(28.57%)
Patient satisfaction with cosmesis n(%)		
Yes	7(100%)	3(42.85%)
No	NA	4(57.14%)

Discussion:

The study encompassed 14 patients, stratified into two groups for comparative analysis. Group A underwent left anterolateral mini-thoracotomy, while Group B opted for median sternotomy. In Group A, aged between 45 and 71 years, there were 4 (57.14%) males and 3 (42.85%) females. Conversely, Group B, aged from 48 to 68 years, comprised 3 (42.85%) males and 4 (57.14%) females. Both groups displayed similar occurrences of diabetes mellitus, noted in 2 patients (28.57%), and a history of stroke, observed in 1 patient (14.28%) in Group A and 2 patients (28.57%) in Group B. Smoking habits were reported by 1 patient (14.28%) in Group A and 2 patients (28.57%) in Group B.

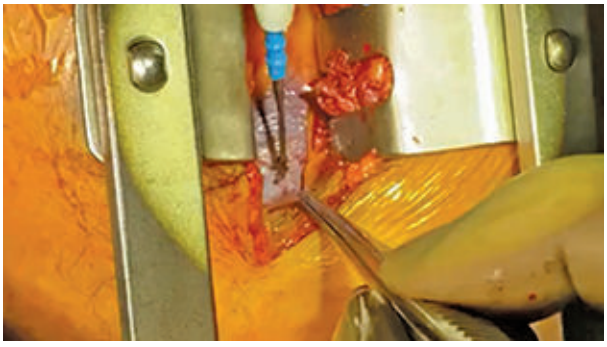

Figure 2: *Show operative field through left anterolateral thoracotomy.*

The etiology of pericardial effusion varied between the groups, with Group A presenting instances such as post-TPM-related right ventricle (RV) perforation, tuberculosis, and post-mitral valve replacement (MVR) massive pericardial effusion attributed to elevated International Normalized Ratio (INR). In contrast, Group B's causes included post-TPM-related RV perforation and tuberculosis. The surgical approaches differed, as Group A underwent anterolateral mini-thoracotomy, while Group B underwent sternotomy.

Group A exhibited favorable outcomes characterized by reduced blood loss, a shorter operative duration, and fewer complications. Importantly, all patients in Group A expressed satisfaction with the cosmetic results. Conversely, Group B experienced lengthier ventilation time, prolonged stays in the intensive care unit (ICU) and hospital, higher pain scores, and incidences of wound infections.

Anterolateral mini-thoracotomy presents a feasible and secure option in cardiac surgery, aligning with the principles of minimally invasive techniques to mitigate trauma and enhance cosmetic outcomes. Its dual

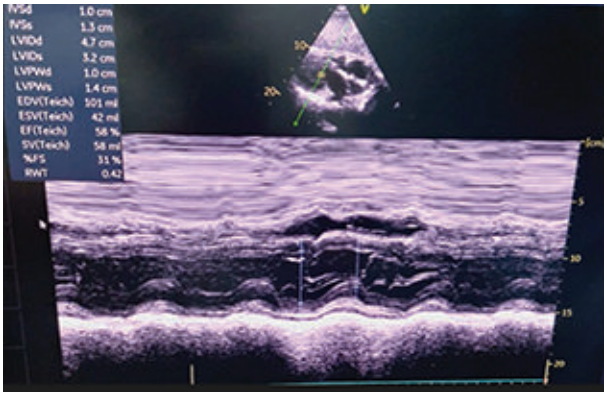

Figure 3: *Postoperative Echocardiography show minimum Pericardial Effusion.*

capability allows for the simultaneous resolution of right ventricular (RV) issues during the drainage of pericardial effusion, underscoring its versatility in the comprehensive management of cardiac pathologies. The establishment of a pleuropericardial window minimizes the risk of pericardial fluid reaccumulation, effectively addressing this critical aspect. The attractiveness of anterolateral mini-thoracotomy is further heightened by its capacity to execute such interventions through a minimally invasive approach.

Figure 4: *Show left anteolateral thoracotomy scar.*

Furthermore, the safety profile of anterolateral mini-thoracotomy becomes particularly evident in the postoperative period. Deemed the safest approach one month after cardiac surgery, it hints at a potential reduction in both mortality and morbidity compared to the traditionally employed sternotomy.[7,9,11-12]

In conclusion, the diverse advantages of anterolateral mini-thoracotomy, including its less invasive nature, concurrent RV repair, and pleuropericardial window creation, position it as a promising and safe alternative in cardiac surgery. These benefits emphasize the importance of considering this approach in specific clinical scenarios, recognizing its potential to enhance patient outcomes and postoperative recovery.

The retrospective design introduces potential limitations from reliance on existing medical records, while the small sample size (14 patients) may limit generalizability and the ability to detect subtle differences. Future studies should consider adopting a prospective design with larger, diverse populations for increased accuracy and statistical power. The study's one-year follow-up duration may constrain the assessment of long-term outcomes, so extending follow-up periods in future investigations can provide more comprehensive insights into intervention effectiveness and safety over an extended timeframe. Collaborative efforts or multicentre approaches could enhance sample size and research robustness.

Acknowledgement:
The authors acknowledge the valuable contribution of Dr. Faizus Sazzad (National University of Singapore), in preparation of the manuscript.

Financial Disclosure: The authors declare that they have no conflicts of interest.

Funding/Support: This project did not receive funding/ support.

Conclusion:

Performing urgent surgical drainage of massive pericardial effusion through anterolateral mini-thoracotomy offers a method that is both minimally invasive and effective in managing cardiac tamponade. This approach brings advantages such as reduced surgical trauma, accelerated recovery, and enhanced cosmetic results, making it a fitting option for critically ill patients requiring prompt intervention. Continuous research and progress in this field are essential for continually refining the technique and optimizing outcomes for patients in need.

References:

1. Vakamudi S, Ho N, Cremer PC. Pericardial effusions: causes, diagnosis, and management. Progress in cardiovascular diseases. 2017 Jan 1;59(4):380-8.

2. Yamani, N., Abbasi, A., Almas, T., Mookadam, F. and Unzek, S., 2022. Diagnosis, treatment, and management of pericardial effusion-review. Annals of Medicine and Surgery, p.104142.

3. Maisch B, Seferoviæ PM, Ristiæ AD, Erbel R, Rienmüller R, Adler Y, Tomkowski WZ, Thiene G, Yacoub MH, Priori SG, Alonso Garcia MA. Guidelines on the diagnosis and management of pericardial diseases executive summary: the Task Force on the Diagnosis and Management of Pericardial Diseases of the European Society of Cardiology. European heart journal. 2004 Apr 1;25(7):587-610.

4. Mercé J, Sagristà-Sauleda J, Permanyer-Miralda G, Soler-Soler J. Should pericardial drainage be performed routinely in patients who have a large pericardial effusion without tamponade?. The American journal of medicine. 1998 Aug 1;105(2):106-9.

5. Soler-Soler J. Massive chronic idiopathic pericardial effusion. InPericardial Disease: New Insights and Old Dilemmas 1990 (pp. 153-165). Dordrecht: Springer Netherlands.

6. Sagristà-Sauleda J, Mercé J, Permanyer-Miralda G, Soler-Soler J. Clinical clues to the causes of large pericardial effusions. The American journal of medicine. 2000 Aug 1;109(2):95-101.

7. Olsthoorn JR, Daemen JH, de Loos ER, Ter Woorst JF, van Straten AH, Maessen JG, Sardari Nia P, Heuts S. Right Anterolateral Thoracotomy Versus Sternotomy for Resection of Benign Atrial Masses: A Systematic Review and Meta-Analysis. Innovations. 2021 Sep;16(5):426-33.

8. Sündermann SH, Sromicki J, Biefer HR, Seifert B, Holubec T, Falk V, Jacobs S. Mitral valve surgery: right lateral minithoracotomy or sternotomy? A systematic review and meta-analysis. The Journal of thoracic and cardiovascular surgery. 2014 Nov 1;148(5):1989-95.

9. Misfeld M, Borger M, Byrne JG, Chitwood WR, Cohn L, Galloway A, Garbade J, Glauber M, Greco E, Hargrove CW, Holzhey DM. Cross-sectional survey on minimally invasive mitral valve surgery. Annals of Cardiothoracic Surgery. 2013 Nov;2(6):733.

10. Carmona P, Mateo E, Casanovas I, Peña JJ, Llagunes J, Aguar F, De Andrés J, Errando C. Management of cardiac tamponade after cardiac surgery. Journal of cardiothoracic and vascular anesthesia. 2012 Apr 1;26(2):302-11.

11. Al-Fattah A, ElSayed H, Sharaa ME. Surgical Outcomes of Right Anterolateral Minithoracotomy versus Median Sternotomy in Atrial Septal Defect. The Egyptian Journal of Hospital Medicine. 2019 Jan 1;74(4):735-43.

12. AHMED S, MOHAMMED AE, HUSSIEN M, SALEH R. Right anterolateral minithoracotomy versus median sternotomy in mitral valve replacement. The Medical Journal of Cairo University. 2018 Dec 1;86(December):4039-45.

Case Report

David Procedure for Aortic Root Aneurysm in a Post-Mitral Valve Repair patient with Marfan's Syndrome – a Case Report

P K Chanda[1], Saikat Das Gupta[2], A Mohammed Idhrees[3], Sheikh Nafis-Ur Rahman[4], Mozibul Hoque[5]

Abstract:

Marfan's syndrome is a multisystem connective tissue disorder caused by mutation of FBN1 gene, frequently affects the human cardiac valves. These patients commonly die due to cardiovascular diseases. David procedure has been recognized as a durable treatment option in younger adults for aortic root replacement in aortic aneurysm. But performing a David re-implantation for aortic root replacement in a post cardiac (mitral valve repair/MVR) surgery patient is not an easy task. We hereby present a case of successful David re-implantation of aortic root in a young post MVR patient.

Keywords: *David procedure; Valve sparing aortic root replacement; David re-implantation; Aortic valve repair/ root replacement; Aortic aneurysm.*

(Bangladesh Heart Journal 2024; 39(2): 168-171)

Introduction:

Marfan's syndrome is a connective tissue disorder usually caused by mutation of the FBN1 genes. Along with many other complications (ocular, skeletal, skin or pulmonary) these patients often suffer from severe cardiovascular diseases.[1] The atrioventricular valves are commonly affected leading to variable degree of regurgitation, whereas aortic valve dysfunction occurs in late years of life. Aortic aneurysm or dissection are the most fatal expression of this disease.

Patient with Marfan's syndrome having aortic root aneurysm, usually dies due to proximal aortic dissection and rupture. Surgical correction by means of aortic root replacement along with ascending aortic replacement prevents aortic dissection thus increasing their lifespan.[2-4] In Marfan's syndrome, patients with aortic root aneurysm, surgery is recommended if the transverse aortic diameter reaches 50mm or even 45mm in case patient have a family history of aortic dissection, or willing to bear a child.[2] Conservation of the Aortic valve is of vital importance whenever possible in these patients. We report a young male in whom aortic valve was conserved during a redo sternotomy. The challenges faced during dissecting the Aortic root has been enumerated.

Case report:

A 32-year-old male presented with the complaints of exertional breathlessness (New York Heart Association - Class III). Patient did not have history of chest pain, syncope or palpitation. He has a history of minimal invasive mitral valve repair (with 36 mm CG Future annuloplasty ring) done three years back in an overseas cardiac center, for severe mitral regurgitation due to mitral valve prolapse. At the time of first surgery, his ascending aortic diameter was 4.4 cm with a normal functioning aortic valve.

1. Senior Consultant, Department of Cardiovascular and Thoracic Surgery, Square Hospitals Ltd, Dhaka, Bangladesh;
2. Associate Consultant, Department of Cardiovascular and Thoracic Surgery, Square Hospitals Ltd, Dhaka, Bangladesh;
3. Consultant, Department of Cardiovascular Surgery, SRM Institutes for Medical Science, Chennai, India;
4. Consultant, Department of Diagnostic Radiology & Imaging, Square Hospitals Ltd, Dhaka, Bangladesh;
5. Senior Consultant, Department of Cardiac Anesthesia, Square Hospitals Ltd, Dhaka, Bangladesh

Address of Correspondence: Dr. Saikat Das Gupta, Associate Consultant, Square Hospitals Ltd, 18/F, Bir Uttam Qazi Nuruzzaman Sarak, West Panthapath, Dhaka-1205. Phone +8801715739487, E-mail: saikatdasgupta@ymail.com, drsaikatdasguptanhfh@gmail.com,

DOI: https://doi.org/10.3329/bhj.v39i2. 75805

His biochemical investigations were essentially normal. His serum creatinine was 0.9mg/dl and EUROScore II for in-hospital mortality was 3.42%.

Color Doppler echocardiography showed ascending aortic aneurysm with possible dissection flap in the ascending aorta. His aortic valve annulus was 22-24mm, aortic valve was tri-leaflet. The sino-tubular junction was 44mm leading severe type-I aortic regurgitation. Mitral valve was normally functioning, along with a normal bi-ventricular functions. Computed tomography scan (CT scan) of aorta revealed a dilatation of aortic root (annulus-24mm, sinus of Valsalva- 56mm, sino-tubular junction-44mm). The ascending aorta was dilated (51 mm), Infra-renal segment of the abdominal aorta shows mild fusiform dilatation (38mm) and length of involved segment was 9.5 cm.

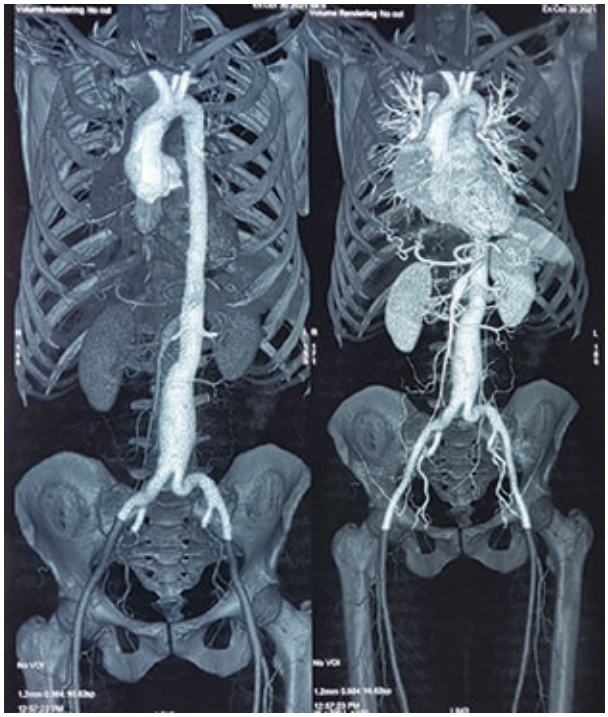

Figure 1: *Pre-operative contrast CT aortogram showing ascending aortic aneurysm along with mild fusiform dilatation of infra-renal segment of abdominal aorta,*

Surgery:

On December, 2021 he was taken to the OR for surgery. After establishment of all essential lines' sternotomy was done. Careful dissection was done to enter pericardial cavity as there was mild to moderate adhesion between the heart, great vessels and pericardium. CPB (cardiopulmonary Bypass) was established with distal aortic arch and two stage single venous cannula. Patient was cooled down to 28°C, and after applying aortic cross clamp a horizontal aortotomy was done one cm above the STJ. Antegrade selective del-Nido blood cardioplegia was delivered and heart was arrested at diastole. Aortic valve was found tricuspid and grossly incompetent. Careful dissection of aortic root was done as low as possible giving special emphasis not to injure main pulmonary artery, both coronary arteries with branches and LV outflow tract. Both coronary buttons were then created and suspended with stay silk suture. Sizing of the tube graft was done with regular valve sizer (the size of valve sizer corresponded with annulus was 25, we prefer to use 5 size larger tube graft). Proximal anastomosis was done with 30 mm straight tube graft with 12 interrupted pledgeted polyester sutures (inside out) first keeping the Hagger's dilator inside the aortic annulus, and later re-implantation was completed with running polypropylene sutures after fixation of the three

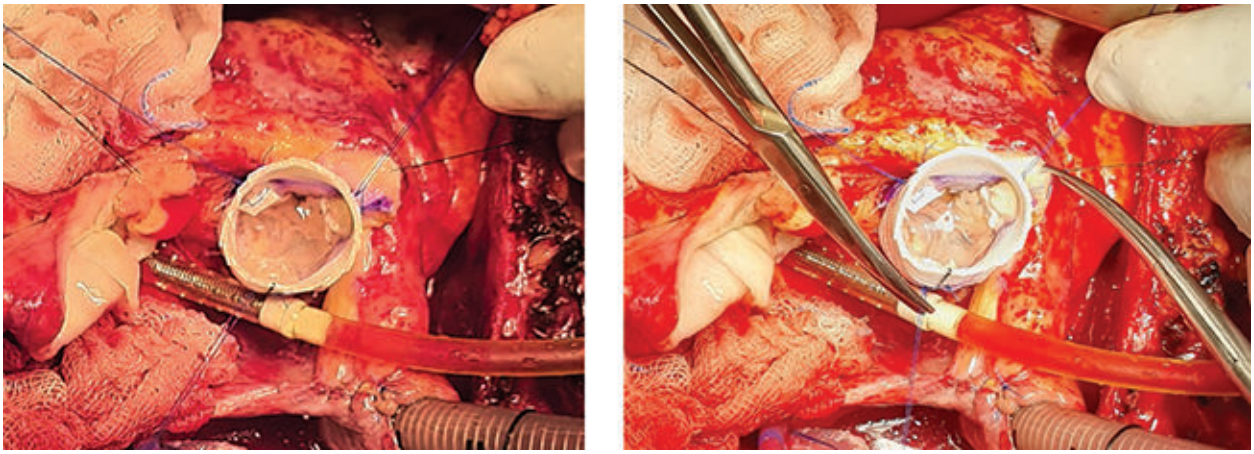

Figure 2 a, b: *Per-operative picture showing excellent competent aortic valve manifested by saline test*

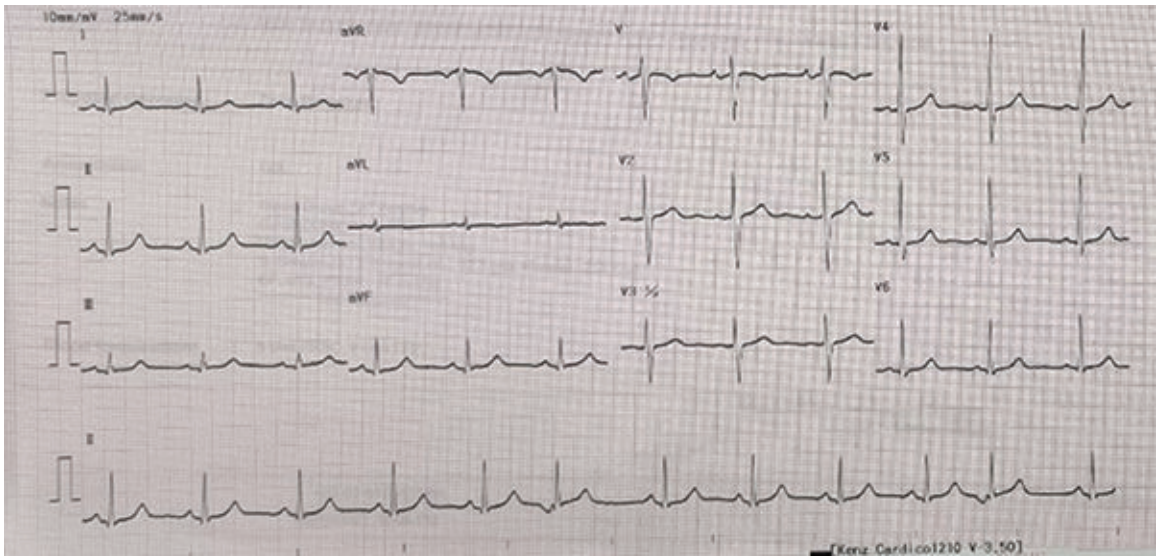

Figure 3: *Post-operative ECG of the patient,*

commissures. Suture lines were checked for bleeding using foley catheter and after satisfactory hemostasis coronary buttons were re-implanted in the tube graft. Tisseel-lyo (tissue-glue) was then applied at the proximal suture line and coronary anastomosis line. The distal aortic anastomosis was then completed with running 4-0 and 5-0 polypropylene sutures. The cross clamp was released after proper de-airing, and heart was weaned to normal sinus rhythm. Total CPB and cross-clamp time was 205 min and 150 min respectively. Per-operative TEE showed normally functioning aortic valve.

Patient was later on shifted to ICU and subsequently extubated on the next morning. The patient spent an eventless in-hospital course. Post-operative color Doppler echo on 6th post-op day showed laminar flow across the aortic conduit and trace eccentric aortic regurgitation along with normal mitral valve function. Normal bi-ventricular functions were also seen. Patient was discharged on 7th post-op day with oral Metoprolol, Aspirin, Clopidogrel, and Frusemide.

Discussion:

Aortic root re-implantation is challenging especially in redo cardiac surgery. Redo cardiac surgeries are associated with bleeding, structural injury and even death, as intra-pericardial adhesions make sternotomy pretty difficult. Moreover, as in our case performing David re-implantation is technically difficult in the background of previous mitral valve surgery, because this procedure necessitates extensive meticulous dissection. During the creation of coronary buttons caution must be taken not to injure the coronary arteries, pulmonary arterial wall or the ventricular wall. Some author reported the need of an interposition cabrol's technique for injured coronary artery anastomosis[4] In our patient careful dissection and meticulous hemostasis caused the patient minimum (350ml) blood loss on the 1st postop day. Burgstaller et al, [6] at a review showed patients with Marfan's syndrome treated with David aortic root reimplantation were clearly having superior in-hospital, mid- and long-term survival rates compared to Bentall's composite valved graft group. Although the David group requires longer cross-clamp time, CPB time as well as longer circulatory arrest time, it showed superior in-hospital survival rate in aortic root reimplantation patients. The reimplantation group showed superior outcome in terms of mortality rate.[6]

Recent studies showed that both Bentall and David procedure are associated with admirable early and long-term results.[7] Studies showed 5- and 10-years survival rates were 85% and 70% respectively, whereas freedom from valve replacement at 5 and 10 years were 91% and 87%.[8] Moreover, the David procedure is associated with less bleeding than Bentall procedure and with a less frequent re-opening rate for bleeding. As a result, to avoid bleeding risk and other prosthesis related adversaries David re-implantation is preferred wherever indicated.

At 1 month, 3 months, 6 months and 1year and 2 year follow-up patient showed excellent exercise tolerability and no sign of exertional dyspnea. Patient is now waiting for EVAR for his abdominal aortic aneurysm.

Conclusion:

David's re-implantation technique of aortic root replacement has been established as an excellent choice for the treatment of young patients with aortic root aneurysm. From our limited experience we think performing valve sparing root replacement in the younger active adults will spare the patient from unnecessary valve related anticoagulation and thrombotic complications. Then again performing David procedure is not everyone's cup of tea. It requires extraordinary training and exceptional experience to complete a procedure like this, and in a re-do scenario it becomes a strenuous job.

Acknowledgements:

The authors would like to acknowledge the sincere efforts of Mr. Kamal Uddin, during operative procedure and data collection.

Ethical approval:

Ethical approval was taken from the institutional ethics review committee for publication of this case report.

Informed consent:

Informed consent was taken from the patient about the possible publication, and the importance of such publication was described to the patient.

Human and animal rights:

Not applicable.

Conflict of Interest: None

Fundings: None

References:

1. Judge DP, Dietz HC. Marfan's syndrome. Lancet. 2005;366(9501):1965-1976. doi:10.1016/S0140-6736(05)67789-6
2. Jondeau G, Detaint D, Tubach F, et al. Aortic event rate in the Marfan population: a cohort study. Circulation. 2012;125(2):226-232. doi:10.1161/CIRCULATIONAHA.111.054676
3. Gott VL, Greene PS, Alejo DE, et al. Replacement of the aortic root in patients with Marfan's syndrome. N Engl J Med. 1999;340(17):1307-1313. doi:10.1056/NEJM199904293401702
4. Zulkifli MFE, Marican MAM, Nor MAM, Jasid AM, Kamarulzaman MH. David procedure for aortic root aneurysm in the background of Marfan syndrome patient with severe kyphoscoliosis and previous mitral valve replacement Int Surg J 2021;8(7):2150-2153. doi.org/10.18203/2349-2902.isj20212319
5. Une D, Ruel M, David TE. Twenty-year durability of the aortic Hancock II bioprosthesis in young patients: is it durable enough?. Eur J Cardiothorac Surg. 2014;46(5):825-830. doi:10.1093/ejcts/ezu014
6. Burgstaller JM, Held U, Mosbahi S, et al. A systemic review and meta-analysis: long-term results of the Bentall versus the David procedure in patients with Marfan syndrome. Eur J Cardiothorac Surg. 2018;54(3):411-419. doi:10.1093/ejcts/ezy158
7. Leontyev S, Schamberger L, Davierwala PM, Aspern VK, Etz C, Lehmann S, Misfeld M, et al. Early and Late Results After David vs Bentall Procedure: A Propensity Matched Analysis. Ann Thorac Surg. 2020;110(1):120-126. doi:10.1016/j.athoracsur.2019.10.020
8. Shrestha M, Baraki H, Maeding I, et al. Long-term results after aortic valve-sparing operation (David I). Eur J Cardiothorac Surg. 2012;41(1):56-62. doi:10.1016/j.ejcts.2011.04.012

Case Report

Successful Repair of Distal Aortic Arch and Proximal Descending Aortic Aneurysm with Coronary Artery Bypass Grafting- A Case Report

Saikat Das Gupta[1], PK Chanda[2], A Mohammed Idhrees[3], Mozibul Hoque[4]

Abstract:

Thoracic aortic aneurysm (TAA) is a rare condition causing dilatation of the thoracic aorta. TAA puts the individual at the risk of aortic dissection, aortic rupture and ultimate death. Diagnosis often requires good radiological support, whereas treatment requiring dedicated aortic program. In a third world country like us, with a population of 170 million or more, due to scarce facilities, surgeons are less interested to perform these types of surgeries. We hereby presenting a case of aortic aneurysm that involved distal aortic arch and proximal descending thoracic aorta (DTA) with significant double vessel coronary artery disease, who was successfully treated by our team.

Keywords: *Thoracic aortic aneurysm, aortic aneurysm, distal aortic arch aneurysm, proximal aortic aneurysm, open aortic aneurysm repair;*

(Bangladesh Heart Journal 2024; 39(2): 172-1176)

Introduction:

The thoracic aorta is grossly divided into the aortic root, the ascending aorta, the arch of aorta and the descending thoracic aorta.[1,2,3] Thoracic aortic aneurysm (TAA) is an abnormal enlargement of the thoracic aorta that can involve single to multiple, even all segments of the thoracic aorta. There has been no fixed cut-off value for aortic aneurysm as there is enormous variability in normal aortic diameter.[1] TAA grossly refers to enlargement of the aorta 1.5 times larger than the predicted one, whereas the normal aortic diameter depends on patient's age, sex, and body habitus, etc.[1,4] The commonest location of TAA is the aortic root, ascending aorta while it can also occur in the descending aorta and less commonly, in the arch of aorta.[3] TAA worldwide is accountable for significant cardiovascular morbidity and mortality.

Patients with TAA are diagnosed incidentally and may remain asymptomatic, but sudden chest or back pain should warrant assessment for possible aortic dissection or rupture at an emergency basis. TAA can be identified during routine imaging procedures like routine chest X-ray, transthoracic echocardiography (TTE), computerized tomography of the chest (CT chest), magnetic resonance imaging of chest (CMRI).[2] Moreover, it can also be detected as an acute presentation of the thoracic aortic dissection and sometimes as part of screening of a relative of an individual presenting with aortic disease or congenital cardiac anomalies.[2] Although TTE can give all the measurements, for accurate dimensions three dimensional CT and MRI should be done. We hereby presenting such a case of

1. Department of Cardiac Surgery, Square Hospitals Ltd, Dhaka, Bangladesh;
2. Department of Cardiac Surgery, Square Hospitals Ltd, Dhaka, Bangladesh;
3. Department of Cardiovascular Surgery, SIMS Hospital, Chennai, India;
4. Department of Cardiac Anesthesia, Square Hospitals Ltd, Dhaka, Bangladesh;

Address of Correspondence: Dr. Saikat DasGupta, Associate Consultant, Square Hospitals Ltd, 18/F, Bir Uttam Qazi Nuruzzaman Sarak, West Panthapath, Dhaka-1205. Mobile: +8801715739487, E-mail: saikatdasgupta@ymail.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75807

aortic aneurysm involving distal aortic arch and proximal DTA with double vessel coronary artery disease, who was treated by us.

Case reports:

Mr. X, 41 years old, hypertensive, gentleman got admitted to our hospital with the complaints of chest pain with tightness for last few months. His pain was relieved by taking rest and sublingual nitro-glycerine spray. For these complaints he visited chest physician where he was diagnosed of having aortic aneurysm. Patient used to smoke 5/6 sticks per day for 20 years. He had no history of cerebrovascular disease, chronic kidney disease, chronic obstructive pulmonary disease or any major surgery.

His pre-operative biochemical investigations were within normal limits and his serum creatinine was 1.0 mg/dl. Chest X-ray (Fig-1) Postero-Anterior view revealed an abnormal, spherical, radio-opaque shadow over the left lung shadow compressing the left lung and hilum, which continued with the aortic shadow. Color doppler echocardiogram was done, which showed normal cardiac chamber dimensions, normal valve morphology and function with good bi-ventricular function. His ascending aorta was 35 mm, whereas distal aortic arch and proximal descending thoracic aorta was 57 mm with aneurysmal dilatation. CT coronary angiogram showed severe stenosis of Diagonal (D) and left circumflex (LCx). Chest CT also showed (Fig-2, Fig-3) aneurysmal dilatation of aorta extending proximally from the origin of subclavian artery to proximal descending thoracic aorta distally. Conventional coronary angiogram confirmed 90% proximal D1 stenosis and 90% LCx stenosis.

Figure 1: *X-ray chest PA view showing large aortic aneurysm compressing the left hilum and left lung*

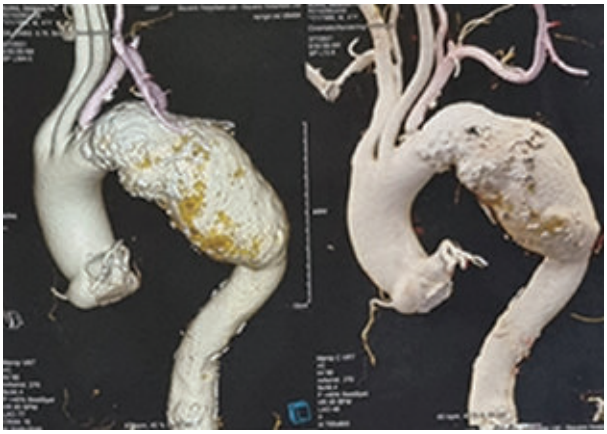

Figure 2: *Pre-operative CT scan showing aneurysmal segment of aorta with extent and measurements*

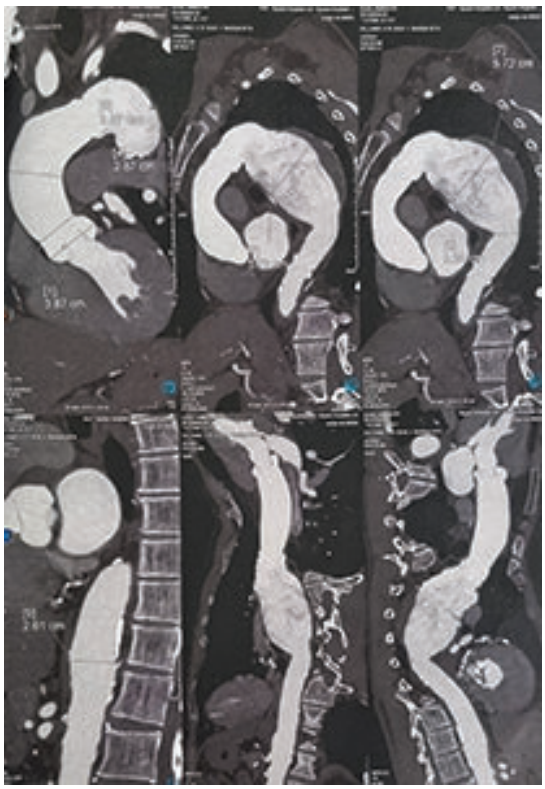

Figure 3: *Pre-operative CT scan showing aneurysmal segment of aorta with extent and measurements*

On March 2021, under all aseptic precaution general anaesthesia was induced after establishment of all necessary lines and probes. Left posterolateral thoracotomy was done through 4th intercostal space. Left lung was found grossly adherent to grossly dilated aorta (Fig-4a, Fig-4b). Cautious dissection of aorta was done and controls were taken around arch of aorta, proximal DTA, distal aorta and the left subclavian artery. CPB was established with left femo-femoral bypass and systemic cooling was done with Left Ventricular (LV) vent through LV apex. Distal coronary anastomoses were done with reversed saphenous vein (RSV) to D1 and OM1, sequentially. At 20°C under total circulatory arrest (TCA) proximal DTA was approached, and upper limit of aortic aneurysm (zone-2) was identified (Fig-5a) and transected. Proximal aortic anastomosis (Fig-5b) was done with 24 mm tube graft at zone 2 (LCC/LSA). During TCA (15 minutes), NIRS was used to see the adequacy of cerebral oxygen supply. CPB was re-established with arterial inflow to femoral and foley catheter to tube graft. For de-airing of proximal aorta, we use low flow carbon-di-oxide insufflation throughout the procedure and after proximal anastomosis we filled the heart with blood by stopping the vent and using foley catheter forward flow from aortic line, as we had no supply of tube graft with side branch. During re-warming LSA was de-branched with 10 mm tube graft and distal aortic anastomosis was completed. Proximal coronary anastomosis was then done to LSA (Fig-6). Heart was then picked up to normal sinus rhythm. Chest was closed after proper haemostasis, keeping two chest drain tubes in situ.

Patient was then shifted to ICU without any inotropes and was extubated on the 1st post-operative day without any difficulty. His post-operative hospital stay was

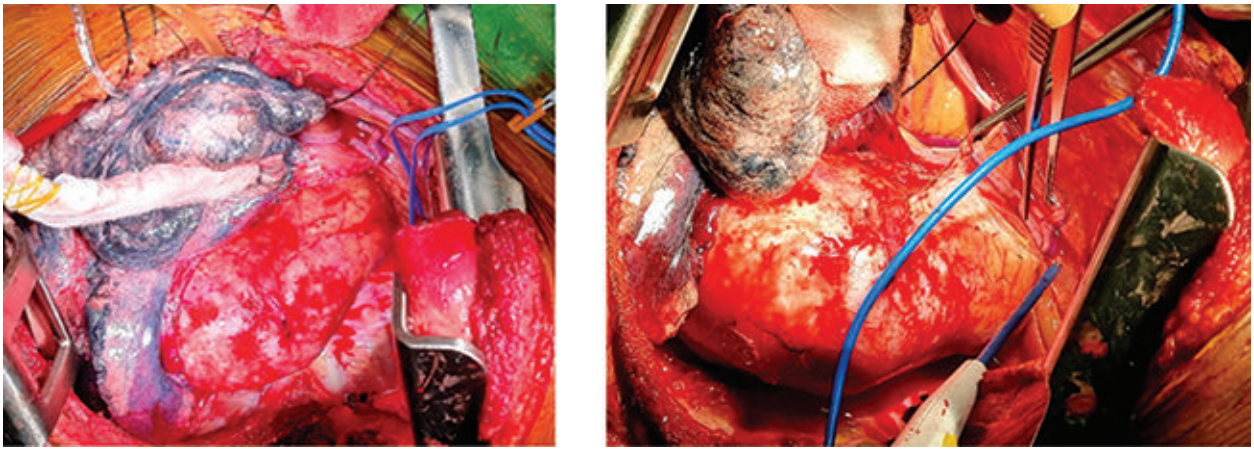

Figure 4: *(a) Per-operative pictures showing hugely dilated aorta, (b) Per-operative pictures showing hugely dilated aorta*

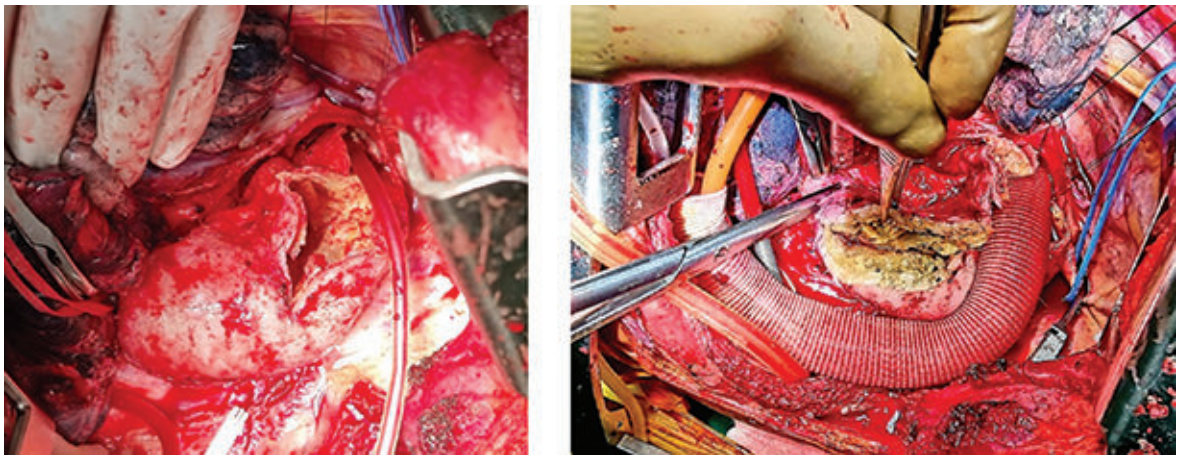

Figure 5: *(a) Per-operative pictures showing distorted aneurysmal wall of thoracic aorta, (b) Per-operative pictures showing distorted aneurysmal wall of thoracic aorta*

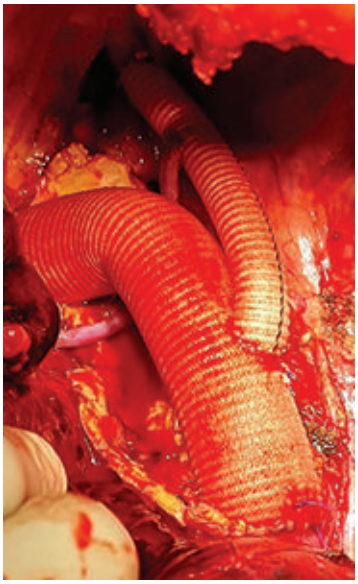

Figure 6: *Post aortic replacement picture showing interposition aortic conduit, debranched LSA and venous conduit for coronary revascularization*

Figure 7: *Follow-up CT scan after 1 year showing replaced segment of aorta with debranched left subclavian artery*

eventless except excessive serous drainage through chest drain tubes which were kept until 7th post-operative days. Patient was discharged on 8th post-operative day.

Discussion:

Medical treatment for TAA consists of aggressive blood pressure control, usually with beta-blockers or angiotensin receptor blockers.[1,5] Blood pressure should be as close as 120/80 mm of Hg.[6,7] Patient who has got associated atherosclerosis are usually benefitted by taking Statins and Aspirin. Other supportive measures to treat TAA are control of diabetes smoking cessation, weight reduction etc.[8]

Thoracic endovascular aortic repair (TEVAR) although relatively costly than open repair, usually are less invasive option with lower mortality and morbidity rates, as well associated with less hospital stays. Spinal cord complications are also less in TEVAR.[1] Alarming complications associated with TEVAR for TAA repair are stroke, spinal cord injury and post procedure endoleak.[1] The choice to treat by open or endovascular (TEVAR) techniques depend on anatomy of the aneurysm, and the achievability of effective repair[1] We thought However, in our patient TEVAR would be less appropriate than the open surgical repair as, a) zone 1-2 landing zone will be required for endovascular graft which in turn will necessitate debranching of left common carotid or subclavian artery or both; moreover, b) our patient was young (41 years), so we avoided endovascular repair and underwent open surgery in our patient. We could have deployed Frozen Elephant Trunk (FET) by median sternotomy but as patient might need sternotomy for coronary artery disease or ascending aortic disease in future, we avoided FET and median sternotomy.

In open surgical repair, mortality rates are 1-8%.[9] In our case patient had to stay up to 10th POD, as he was having excessive serous drainage through chest drain tubes. Lifelong medical follow-ups are recommended in these patients, for prevention of aortic complications and transthoracic echocardiography is recommended yearly.[1,10] patient was followed up at three months, six months, one and two years, both clinically and by CT imaging (at one year, Fig-7). It revealed normal neo-aorta and improved exercise tolerance of the patient.

Conclusion:

Thoracic aortic aneurysm is a rare cause of sudden death when it is expected to have a genetic cause. Imaging is the key to diagnosis and follow-up, both before and after intervention or rupture. Many more dedicated, experienced aortic programs are required to address these patients in our country.

Acknowledgement:

All the authors would like to acknowledge Mr. Mohammed Kamal Uddin, Mr. Tanvir Ahmed for their tenacious effort during surgery, data collection and Md. Rana Masud for his untiring radiological support.

Ethical approval:
Ethical approval was taken from the institutional ethics review committee for publication of this case report.

Informed consent:
Informed consent was taken from the patient about the possible publication, and the importance of such publication was described to the patient.

Human and animal rights: Not applicable.

Disclaimer: None

References:

1. Salameh MJ, Black JH, Ratchford EV. Thoracic aortic aneurysm. Vascular Medicine. 2018;23(6):573-578. doi:10.1177/1358863X18807760
2. Clift PF, Cervi E. A review of thoracic aortic aneurysm disease. Echo Res Pract. 2019 Dec 5;7(1):R1-R10. doi: 10.1530/ERP-19-0049. PMID: 32015897; PMCID: PMC6993256.
3. Ho N, Mohadjer A, Desai MY. Thoracic aortic aneurysms: state of the art and current controversies. Expert Rev Cardiovasc Ther. 2017 Sep;15(9):667-680. doi: 10.1080/14779072.2017.1362983. PMID: 28764568.
4. Saliba E, Sia Y (2015) The ascending aortic aneurysm: When to intervene. IJC Heart & Vasculature 6:91-100. doi.org/10.1016/j.ijcha.2015.01.009
5. Brooke BS, Habashi JP, Judge DP, Patel N, Loeys B, Dietz HC 3rd. Angiotensin II blockade and aortic-root dilation in Marfan's syndrome. N Engl J Med. 2008 Jun 26;358(26):2787-95. doi: 10.1056/NEJMoa0706585. PMID: 18579813; PMCID: PMC2692965.
6. Isselbacher EM. Thoracic and abdominal aortic aneurysms. Circulation. 2005 Feb 15;111(6):816-28. doi: 10.1161/01.CIR.0000154569.08857.7A. PMID: 15710776.
7. Khoury SR, Ratchford EV. Hypertension. Vasc Med. 2018 Jun;23(3):293-297. doi: 10.1177/1358863X18764836. Epub 2018 Apr 13. PMID: 29651931.
8. Salameh MJ, Ratchford EV. Aortic dissection. Vascular Medicine. 2016;21(3):276-280. doi:10.1177/1358863X16632898
9. Mathur A, Mohan V, Ameta D, Gaurav B, Haranahalli P. Aortic aneurysm. J Transl Int Med. 2016 Apr 1;4(1):35-41. doi: 10.1515/jtim-2016-0008. Epub 2016 Apr 14. PMID: 28191516; PMCID: PMC5290913.
10. Hiratzka LF, Bakris GL, Beckman JA, Bersin RM, Carr VF, Casey DE Jr, Eagle KA, Hermann LK, Isselbacher EM, Kazerooni EA, Kouchoukos NT, Lytle BW, Milewicz DM, Reich DL, Sen S, Shinn JA, Svensson LG, Williams DM; American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines; American Association for Thoracic Surgery; American College of Radiology; American Stroke Association; Society of Cardiovascular Anesthesiologists; Society for Cardiovascular Angiography and Interventions; Society of Interventional Radiology; Society of Thoracic Surgeons; Society for Vascular Medicine. 2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM guidelines for the diagnosis and management of patients with Thoracic Aortic Disease: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines, American Association for Thoracic Surgery, American College of Radiology, American Stroke Association, Society of Cardiovascular Anesthesiologists, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society of Thoracic Surgeons, and Society for Vascular Medicine. Circulation. 2010 Apr 6;121(13):e266-369. doi: 10.1161/CIR.0b013e3181d4739e. Epub 2010 Mar 16. Erratum in: Circulation. 2010 Jul 27;122(4):e410. PMID: 20233780.

Case Report

Scattered finding of Acute Severe Aortic Regurgitation in a Child with Ventricular Septal Defect: Floating Non Coronary Cusp Due to Rupture Fibrous Strands

Mohammad Eliyas Patwary

(Bangladesh Heart Journal 2024; 39(2): 177-178)

Introduction:

Acute severe aortic regurgitation (AR) by rupture of a fibrous strands of aortic valve is a rare condition specially in child. Here we discuss a male kid of 14 months diagnosed case of ventricular septal defect (VSD) mild AR with moderate mitral regurgitation (MR), with severe pulmonary arterial hypertension (PAH) was admitted into hospital for elective surgery. Day before surgery we found severe acute AR with floating Non coronary cusp (NCC) into aorta. Peroperative findings suggested that due to rupture of the fibrous strands from aortic wall along with endothelial flap suspending NCC onto aorta.

Case presentation:

A 1year 2months boy presented with recurrent respiratory tract infection with 7 kilogram body weight, diagnosed large perimembranus VSD , mild AR , moderate MR with Severe PAH. Planned for elective open heart surgery. After admission patient diagnosis was changed with severe aortic regurgitation with suspending non coronary cusp (NCC) into aorta.

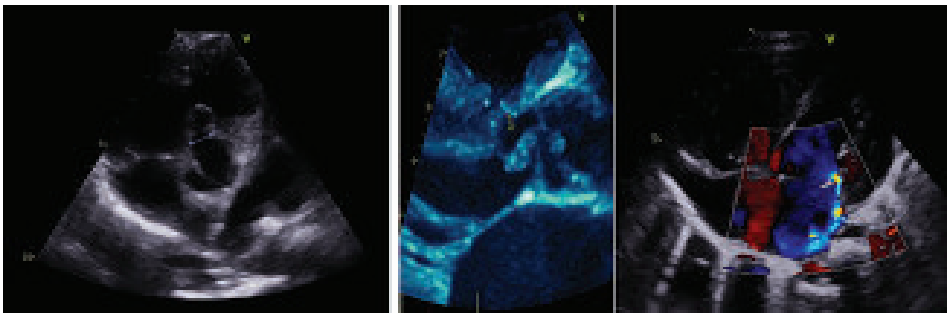

Figure 1: *Preoperative Echocardiogram*

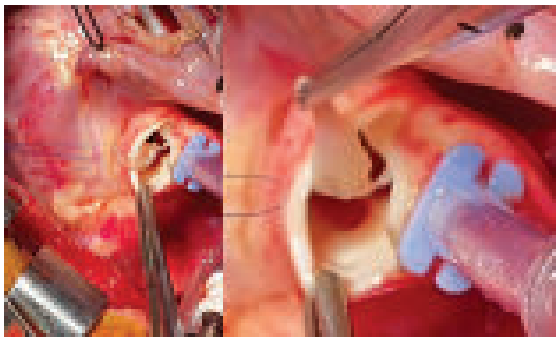

Figure 2: *Operative view of ruptured fibrous strands with floating NCC.*

Address of Correspondence: Dr Md Eliyas Patwary, Associate Prof. of Pediatric Cardiac Surgery, National heart foundation hospital. Dhaka. Mobile: 01739120984, E-mail: patwarye@yahoo.com

DOI: https://doi.org/10.3329/bhj.v39i2. 75809

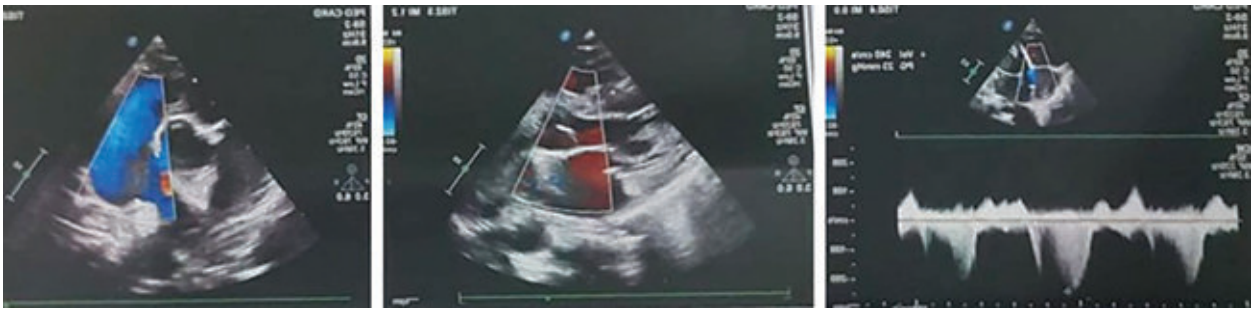

Figure 3: *Postoperative Echo after 6 month follow up.*

Discussion:

Acute severe aortic regurgitation in very early age is rare, no case yet recorded. In my case I assumed that the congenital fibrous strands arising from the aortic wall and suspending aortic valvular apparatus, suddenly ruptured by the jet of pulmonary hypertensive flow causing acute loss of leaflet support and subsequent torrential aortic regurgitation. Only one clue was the kid had history of sneeze last night, that may rise mechanical pressure on it. Echocardiography, blood parameters, clinical parameters ruled out infective endocarditis as the provocating factor.

However this type of aortic regurgitation may be found embryonic ramnants supporting aortic valve leaflets and associated with such pathology[1]. In publications, some adult cases of acute AR is caused by either infective endocarditis of the aortic valve itself or an aortic dissection, bicuspid aortic valve or in rare cases by traumatic rupture of aortic valve [2-4]. But this issue never reported into child at this age group with normal tricuspid aortic valve.

This patients was stable hemodynamics due to large VSD with moderate MR and operated with antegrade coronary cardioplegia. During repair we got small remnant attached to aortic wall that help us accommodate the torn NCC on its native place directly with 8/0 proline continuous suture good coaptation. The fibrous strands fixed at supra commissural area with multiple pledgeted 6/0 proline suture from outside of the aortic wall.

Finally, the existing fibrous strands involving suspension of coronary cusp is suitable for repair of aortic valve incompetence in children because this young patient having normal all cusp. Our patient had very good postoperative outcome at 6 month follow up.

References:

1. Abdelaziz MM, Martinelli G, Luckraz H. Chordae tendineae of the aortic valve. J Card Surg. 2016;31(5):328 329.2.
2. Yuan S, Mou R, Sun X, Mou Y. Aortic chordae tendineae strands with significant aortic regurgitation. Int Heart J. 2021;62(5):1160 1163.3.
3. Bouchachi AA, Folliguet T, Hébert JL, et al. A severe restrictive aortic regurgitation resulting from valve tenting by unusual aortic chordae tendineae strands. Circulation. 2012;126:e139 e141.4.
4. Esteve Ruiz I, López Pardo F, Lagos Degrande Ó, LópezHaldón JE,Urbano Moral JÁ. Severe restrictive aortic regurgitation due to aortic fibrous strand. Eur Heart J Cardiovasc Imaging. 2015;16:465.