BANGLADESH HEART JOURNAL

CONTENTS

**Official Journal of
Bangladesh Cardiac Society**

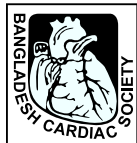*We gratefully acknowledge the contribution of the Reviewers of this issue of Bangladesh Heart Journal*

VOL. 34, NO. 2, JULY 2019

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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.htmArticle

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. HI Lutfur Rahman Khan
The Editor, Bangladesh Heart Journal
Professor of Cardiology
Room No. 458, Block B, Anwer Khan Medical College
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Papers can also be submitted via the email using the following address:

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Association of Increased Arterial Stiffness with Severity of Coronary Artery Disease in Patients with Non-ST- Segment Elevation Myocardial Infarction

A.B.M. Nizam Uddin[1], Abdullah-Al- Shafi Majumder[2], Md. Abdul Kader Akanda[2], Shahana Zaman[3], Mohammad Anowar Hossain[1], Ashiqur Rahman Khan[1], Muhammed Aminur Razzaque[1], Pinaki Ranjan Das[1], Md. Zahidul Islam[1], Kazi Ashraful Alam[4]

Abstract:

Objective: Cardiovascular diseases (CVDs) have become the single largest cause of death worldwide. The scenario is same in Bangladesh. Increased arterial stiffness has been associated with increased risk of CVD. A noninvasive assessment of arterial stiffness may serve as a useful adjunct to the cardiovascular risk stratification and risk management and it would be of value for the examination of larger populations. So, this study was designed to demonstrate the association between CVD and arterial stiffness.

Methods: This cross sectional study was conducted in the National Institute of Cardiovascular Disease, Dhaka over a period of ten months starting from January 2014. Patients were purposively selected from those who were admitted in NICVD with acute Non-ST- Segment Elevation Myocardial Infarction (NSTEMI). A total of 80 patients were included in the study. Study patients were

divided into two groups on the basis of aortic augmentation pressure (AP), augmentation index (Aix) and augmentation index corrected at heart rate 75/min (Alx@75). Assessment of coronary angiography was performed and severity was assessed by several scoring systems.

Results: Significant positive correlation was found between Alx@75 and vessel score (r= 0.70, p=0.001), Friesinger score (r=0.66, p=0.001) and Leaman score (r= 0.69, p=0.001). Logistic regression analysis showed that increased Alx@75 is significantly associated with severe Coronary Artery Disease (CAD) (OR being 5.54).

Conclusion: The results indicate that AP, Alx and Alx@75 are predictors of severity of CAD. It may be considered as a recommended test for the evaluation of cardiovascular risk.

Keywords: Arterial Stiffness; Coronary artery disease; Myocardial infarction

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Introduction:

Cardiovascular diseases (CVDs) have become the single most cause of death worldwide over the last decade. During the last century, low- and middle-income countries has been developed an alarming increase in the rates of CVD like the high-income countries[1].

An estimated 17.3 million people died worldwide from CVDs in 2008, representing 30% of all global deaths. By 2030, 23.3 million people will die from CVDs, mainly from heart disease and stroke[2]. In a WHO 2008 estimate, there were 834.4 deaths per 100,000 population due to CVDs and diabetes mellitus in Bangladesh[2].

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The prevalence of coronary artery disease (CAD) was estimated as 3.3 per thousand in 1976 and 17.2 per thousand in 1986 indicating fivefold increase of the disease by ten years[3].It is well known that smoking, hypertension, diabetes mellitus, dyslipidemia, family history of premature CAD and obesity are most important risk factors for CAD[4].

Risk is an important driver of management decisions. Accurate but simple methods of risk assessment are important for patient care, determining the prognosis and providing information for the patient[5].

Despite improvement in risk scoring, there still remain patients identified as being low risk who experience CAD events, as well as, patients deemed high risk who remain free of CAD events. This has led to a search for additional emerging risk variables[6].

Endothelium modulates arterial stiffness, which precedes overt atherosclerosis and is an independent predictor of cardiovascular events. Dysfunction of the endothelium may be considered as an early and potentially reversible step in the process of atherogenesis. As the atherosclerosis progresses, the tunica media thickens and the tunica intima becomes rigid, and this reduces the arterial elasticity[7].

Increased arterial stiffness has been associated with increased risk of MI, stroke, congestive heart failure and overall morality[8]. Increased arterial stiffness correlates with coronary risk factors as well as measures of arterial stiffness correlate with the presence of angiographic CAD[9].

Arterial stiffness determined invasively, has been shown to predict a higher risk of coronary atherosclerosis. However, invasive techniques are of limited value for screening and risk stratification in larger patient groups. Therefore, a noninvasive assessment of arterial stiffness may serve as a useful adjunct to the cardiovascular risk stratification and risk management[10].

The central aortic pressure wave is composed of a forward-traveling wave generated by left ventricular ejection and a later-arriving reflected wave from the periphery[11]. As aortic and arterial stiffness increase, transmission velocity of both forward and reflected waves increase, which causes the reflected wave to arrive earlier in the central aorta and augment pressure in late systole. Therefore, augmentation of the central aortic pressure wave is a manifestation of early wave reflection and is the boost of pressure from the first systolic shoulder to the systolic pressure peak[12] can be expressed in absolute terms (augmented pressure [AP]) or as a percentage of pulse pressure (augmentation index [AIx]). AIx, determined noninvasively, has been shown to be predictive for coronary artery disease (CAD)[9].

Recently done three studies showed significant association of CAD severity with arterial stiffness measured by non invasive pulse wave velocity (PWV) and pulse wave analysis (PWA) method[13-15].

While there are several studies from developed countries on the severity of CAD and arterial stiffness in AMI patients, there are not enough data from Bangladesh addressing PWA as an independent risk assessment tool for detecting severity of CAD.

Because a noninvasive approach clearly would be of value for the examination of larger populations, this observational study was designed to demonstrate in detail the association between CAD and aortic AIx, assessed by noninvasive PWA.

Materials and methods:
This cross sectional study was conducted in the National Institute of Cardiovascular Disease (NICVD), Dhaka over a period of ten months starting from January 2014 to October 2014. Patients were purposively selected from those who were admitted in NICVD with NSTEMI agreed to do coronary angiography. Total 80 patients (male: 66, female: 14) were included in this study. Assessment of arterial stiffness was performed noninvasively with the commercially available SphygmoCor system (The SphygmoCor Vx PWA system Model SCOR-Mx DCN: 100521 P/N:1- 00418, Rev:9.0/0-0m, SphygmoCor Software Version: 8, AtCor Medical Private Ltd) using applanation tonometry with a high-fidelity micromanometer (Millar Instruments). Patients with valvular, congenital heart disease and cardiomyopathy, suspected myocarditis or pericarditis, major non cardiovascular disorder such as severe renal impairment, uncontrolled hypertension (systolic blood pressure >160mmHg), prior PCI or CABG were excluded from the study. From where study patients were divided into two groups on the basis of aortic augmentation pressure (AP), augmentation index (AIx) and augmentation index corrected at heart rate 75/min (AIx@75). 40 patients AP, AIx and AIx@75 were normal (Group I) and 40 patients AP, AIx and AIx@75 were increased (Group II). Informed consent was obtained in accordance with the study protocol approved by the local ethical committee.

NSTEMI was diagnosed by third universal definition of Myocardial Infarction[16]. Peripheral pressure waveforms were recorded from the radial artery at the wrist, sing

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applanation tonometry. After 20 sequential waveforms were acquired, a validated generalized transfer function was used to generate the corresponding central aortic pressure waveform. AIx and AP were derived from this with the technique of PWA. The AIx was defined as the AP divided by pulse pressure and expressed as a percentage. Larger values of AIx will indicate increased wave reflection from the periphery or earlier return of the reflected wave as a result of increased PWV (attributable to increased arterial stiffness) and vice versa. Because AIx was influenced by heart rate AIx@75 was used. Only high-quality measurements was taken in the sitting position in a quiet, temperature-controlled room (22±1°C) after a brief period (at least 5 minutes) of rest, most often on the day before cardiac catheterization by a doctor not involved in performance or interpretation of the angiograms. Coronary angiography was performed by percutaneous femoral approach using standard angiographic techniques. Interpretation of coronary angiogram was done by visual estimation by two cardiologists. Severity of coronary stenosis was assessed by Vessel score, Friesinger score and Leaman score. Friesinger score 5 points was regarded as cut-off value for CAD severity (Friesinger score < 5 points – insignificant CAD, Friesinger score e"5 points – significant CAD)[17.]

The numerical data obtained from the study was analyzed and significance differences was estimated by using statistical methods. Data were presented as frequency and percents for categorical variables and as mean with standard deviation for quantitative variables. Categorical variables were analyzed by chi-square test. Quantitative variables were analyzed by t-test or ANOVA. Correlation between AIx@75 and angiographic severity was measured by Spearman's correlation test. $P<0.05$ was considered as significant. Statistical analyses were performed with SPSS, version 16.0 (SPSS Inc).

Results:
Majority of the study patients belonged to 41-50 and 51-60 years age in both groups. The mean age was found 49.6±8.5 years in Group I and 51.4±7.3 years in Group II. Male female ratio was 4.7:1. Among the risk factors hypertension, diabetes mellitus and family history of CAD were significantly higher in group II than group I (p=0.01, 0.02, 0.03). Higher the number of vessels involved, the greater is the AIx@75 with mean score in single, double and triple vessel disease being 14.43, 20.43 and 30.68 respectively. The mean vessel score for group II patients was 2.58±0.71 and that of group I patients was 0.98±0.73 and the difference was statistically significant (p=0.001). Low Friesinger score was greater in group I with statistically significant difference (p=0.001). High Friesinger score was significantly higher in group II.(p=0.001).The mean AP, AIx and AIx@75 in significant CAD was 9.13±5.28%, 27.91±14.42% and 27.85±11.51 and insignificant CAD was 4.85±4.27, 14.67±10.68 and 13.30±8.43. The differences were statistically significant (p<0.05). There is a positive correlation between AIx@75 and CAD severity in terms of vessel score (r=0.70), Friesinger score (r= 0.66, p=0.001) and Leaman Score (r=0.69). Logistic regression analysis showed that patient with increased AIx@75 had 5.54 times higher risk of having significant CAD compared with those with the normal AIx@75.

Table-I
Demographic profile of study population (n=80)

	Group 1 (n=40)	Group II (n=40)	P value
Age in years (Mean±SD)	49.6±8.5	51.4±7.3	0.30[ns]
Gender			
Male	33 (82.5%)	33 (82.5%)	1.00[ns]
Female	7 (17.5%)	7 (17.5%)	1.00[ns]
Risk Factors			
Smoking	18 (45%)	22 (55%)	0.37[ns]
Hypertension	6 (15%)	16 (40%)	0.01[s]
Diabetes Mellitus	6 (15%)	15 (37.5%)	0.02[s]
Dyslipidaemia	8 (20%)	9 (22.5%)	0.78[ns]
Family H/O of CAD	9 (22.5%)	18 (45%)	0.03[s]

s-significant, ns-not significant.

Table-II

Distribution of the study patients according to vessel score (n=80)

Vessel Score	Group I (n= 40)		Group II (n =40)		P value
	Number	%	Number	%	
Score – 0	10	25.0	1	2.5	0.003[s]
Score – 1	22	55.0	2	5.0	0.001[s]
Score – 2	7	17.5	10	25.0	0.41[ns]
Score – 3	1	2.5	27	67.5	0.001[s]
Mean ± SD	0.98±0.73		2.58±0.71		0.001[s]

s-significant, ns-not significant.

Table-III

Association between AIx@75 and number of vessels involved (n=80)

No. of vessel involved	AIx@75		P value
	Mean	SD	
None (n = 7)	13.14	8.78	
Single (n=21)	14.43	8.58	0.001[s]
Double (n=15)	20.33	13.91	
Triple (n=37)	30.68	9.67	

s-significant, ns-not significant.

Table-IV

Distribution of the study patients according to Friesinger score (n=80)

Friesinger Score	Group I (n= 40)		Group II (n =40)		P value
	Number	%	Number	%	
Normal (0)	4	10.0	1	2.5	0.18[ns]
Low (1 – 4)	21	52.5	1	2.5	0.001[s]
Intermediate (5 – 10)	14	35.0	12	30.0	0.63[ns]
High (11 – 15)	1	2.5	26	65.0	0.001[s]

s-significant, ns-not significant.

Table-V

Mean status of AP, AIx and AIx@75bpm of the study patients according to significant coronary artery disease defined by Friesinger score (n=80)

Variables	Significant CAD (Friesinger score ≥5)	Insignificant CAD (Friesinger score 0-4)	P value
	Mean ± SD	Mean±SD	
AP (%)	9.13±5.28	4.85±4.27	0.001[s]
AIx (%)	27.91±14.42	14.67±10.68	0.001[s]
AIx@75 (%)	27.85±11.51	13.30±8.43	0.001[s]

s-significant, ns-not significant.
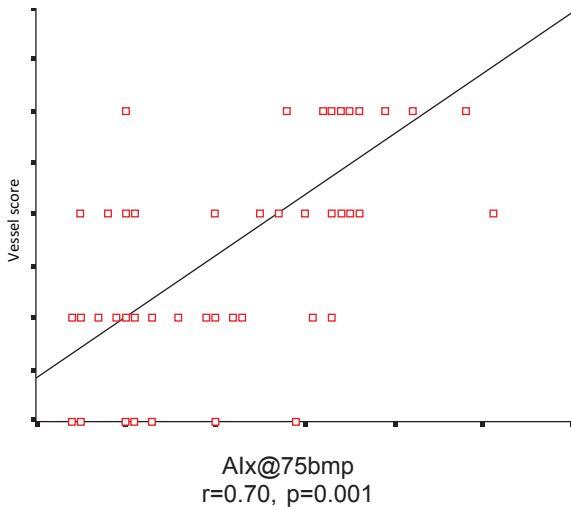
Fig.-1: *Correlation between Aix@75 and vessel score*

AIx@75bmp
r=0.70, p=0.001
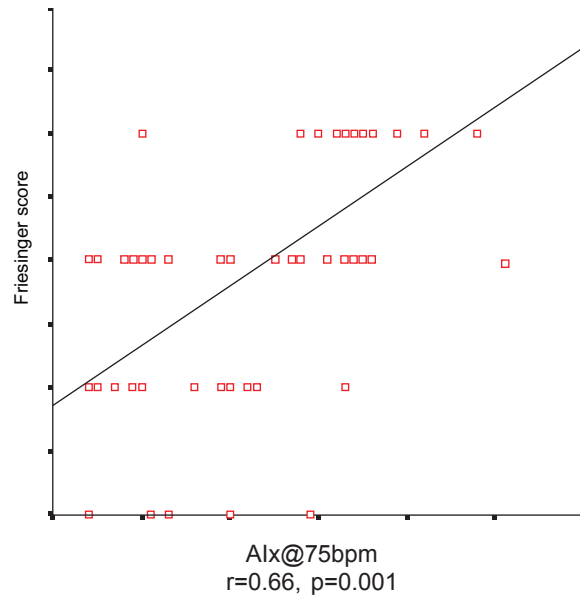
Fig.-2: *Correlation between Aix@75 and Friesinger score*

AIx@75bpm
r=0.66, p=0.001

Table- VI
Multivariate logistic regression of determinants of CAD (by Friesinger Score).

Variables of interest	,	S.E.	P value	OR	95% CI
Smoking	0.301	0.230	0.41[NS]	1.08	0.516-2.201
Hypertension	0.416	0.243	0.08 [NS]	1.45	0.415-3.934
Diabetes mellitus	0.689	0.543	0.04[S]	1.71	1.187-3.784
Increased TG	0.120	0.241	0.11[NS]	0.88	0.555-2.919
Family history of CAD	0.579	0.418	0.02[S]	2.97	1.257-5.778
Increased AIx@75	1.252	0.801	0.01[S]	5.54	1.824 – 10.201

Dependent variable: CAD; independent variables; smoking, hypertension, diabetes mellitus, increased TG, positive family history of CAD and increased AIx@75.
S = Significant, NS= Not significant.

Discussion:

The mean age of group I was 49.6±8.5 years and in group II was 51.4±7.3 years. The mean age of group II was higher than group I but the difference not statistically significant (p=0.30).

Male female ratio was 4.7:1. Similar male preponderance was found in almost all studies relating to IHD[13-15].

In group I the mean level of AIx@75 was observed 10.42±5.74% in male and 17.71±4.75% in female and in group II 32.67±2.89% in male and 41.29±6.21% in female. So AIx@75 is significantly higher in female than male. Khan, et al.[13] and Gatzka, et al.[18] showed significantly higher AIx@75 in female than male.

The distribution of common risk factors for CAD in the present study revealed that smoking habit was found in 50% followed by positive family history of premature CAD 33.8%, hypertension 27.5%, diabetes mellitus 26.2%, dyslipidaemia 21.2%. Khan, et al.[13] had shown that smoking was the highest prevalent risk factor.

The mean central systolic blood pressure was 115.5±17.2 mmHg in group I and 105.4±20.2 mmHg in group II.

The mean central diastolic blood pressure was 86.9±12.9 mmHg in group I and 75.8±9.9mmHg in group II. The mean central pulse pressure was 27.3±8.7 mmHg in group I and 32.6±8.1 mmHg in group II. The mean

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difference of the above statistic were statistically significant (p<0.05).

Uddin[19] showed increased central and brachial pulse pressure and systolic pressure was significantly associated with CAD severity.

Uddin[19] also found that compared to brachial systolic and pulse pressure, central aortic pulse pressure appears to be a better predictor of the presence and extent of coronary atherosclerosis which was similar to the findings of the present study.

In this study it was found that among group II, highest percentage was of 3 vessel score (67.5%) and 2 vessel score (25%) followed by 1 vessel score (05%). On the contrary among group I, highest percentage was of 1 vessel score (55%). 17.5% and 2.5% belonged to 2 and 3 vessel score and 25% patient had 0 vessel score.

The mean vessel score for group II patients was 2.58±0.71 and that of group I patients was 0.98±0.73 and the mean difference was statistically significant (p=0.001).

The mean AIx@75 of subjects with normal angiographic findings was 13.14±8.78 %. The mean AIx@75 of single, double and triple vessel disease were 14.43±8.58, 20.33±13.91 and 30.68±9.67 (%) respectively.

The AIx@75 increased in proportion with the number of vessels involved and the differences were statistically significant (p=0.001). Khan, et al.[13] and Das[15] also found that AIx@75 was increased in proportion with the number of vessels involved. Park, et al.[20] and Weber, et al.[21] also found that arterial stiffness index increased significantly with the increasing number of stenotic coronary vessels.

In the present study, analysis of Friesinger score revealed that normal Friesinger score (0) was found in 2.5% patients in group II and 10% patients in group I. Low Friesinger score (1-4) was found in 2.5% and 52.5% patients in group II and group I respectively. High Friesinger score (11-15) was found in 65% patients in group II and 2.5% patients in group I.

Low Friesinger score was significantly higher in Group I (p=0.001). High Friesinger score was significantly higher in group II. (p=0.001).

Khan, et al.[13] and Das.[15] also found that high Friesinger score was higher among patients with increased arterial stiffness.

The mean AIx@75 was observed 27.85±11.51% and 13.30±8.43% in significant and insignificant CAD respectively and the difference was statistically significant

(p=0.001). Weber, et al.[21] found that mean AIx@75 was observed 16.9±9.9% and 13.4±10.6% in significant and insignificant CAD respectively and the difference was statistically significant (p=0.01).

In this study there was a positive correlation between AIx@75 and CAD severity in terms of vessel score, Friesinger score and Leaman score (r=0.70, r=0.66 and r=0.69 respectively, p =0.001).

Khan, et al.[13] and Das.[15] also showed positive correlation between arterial stiffness and and CAD severity in terms of vessel score, Friesinger score and Leaman score.

The variables revealed to be significantly associated with severe CAD by multivariate analysis were increased AIx@75, positive family history of CAD and diabetes mellitus with ORs being 5.54, 2.97 and 1.71 respectively.

Conclusion:
The results presented here indicates that AP, AIx and AIx@75 measures closely related to arterial stiffness, are predictors of severity of CAD. It may be considered as recommended test for the evaluation of cardiovascular risk in addition to other routine investigation.

Limitations:
This was non-randomized study. The sample size was small and the study was carried out in one centre.

Angiography was evaluated by visual estimation, so there was chance of inter observer and intra observer variation of interpretation of the severity of the stenosis.

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Association of Serum Vitamin D with Acute Myocardial Infarction in Young Patients (≤40 Years)

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Abstract:

Background: Coronary heart disease (CHD) is the leading cause of death worldwide, with acute myocardial infarction (AMI) being the most severe manifestation. Recent evidence suggests that vitamin D deficiency (moderate/severe) is an important risk factor for coronary artery disease. Objectives: Considering paucity of the literature focusing young MI, the study was planned to assess the relation of different grades of low serum vitamin D with AMI in young patients admitted in a tertiary care hospital. Methods: This Hospital based case-control study was conducted in the department of cardiology in Dhaka Medical College Hospital (DMCH) over 1-year period. Patients with acute MI in young age (≤40 years) admitted in the CCU of DMCH were approached for inclusion in the study. Total 120 subjects (60 cases and 60 controls) were studied. Patients with acute MI were considered as cases and similar number of age and sex matched apparently healthy individual were included as controls. All study population were subjected to relevant investigations and detailed history along with socio-demographic data were collected. Serum vitamin D levels were categorized as severe vitamin D deficiency as a level <10ng/ml, moderate vitamin D deficiency at a level 10-20 ng/ml, vitamin D insufficiency as 21-29 ng/ml and a level of ≥30ng/ml was considered as normal. Serum 25(OH) vitamin D assay was performed for cases and controls using chemiluminescence immunoassay. Vitamin D status (normal/insufficiency vs moderate/severe deficiency) was studied among cases and controls. All necessary information were recorded in a pretested case record form. Statistical analyses were done by SPSS 22. Results: Mean age of cases and controls were 35.31±4.84 and 33.83±5.11 years respectively. Vitamin D deficiency (moderate/severe) was present in 86.7% cases and 46.7% controls and the difference was statistically significant (P<0.001). Among 60 cases of acute MI, 83% patients had acute ST segment elevated myocardial infarction and 17% patients had acute non-ST segment elevated myocardial infarction. Vitamin D deficient (moderate/severe) subjects were more likely to develop AMI than subjects who had normal/insufficient vitamin D levels in blood (OR 7.42, 95%CI 3.18-18.28, P<0.001). And among all the usual coronary risk factors, vitamin D deficiency (moderate/severe), Hypertension, Family history of premature CAD and smoking were significantly associated with increased incidence of acute MI (STEMI and NSTEMI) (P value<0.05 in all cases). Conclusion: Vitamin D deficiency (moderate/severe) is associated with increased incidence of acute MI in young age (≤40 years).

Keywords: Vitamin D; Myocardial infarction young

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Introduction:

Acute coronary syndrome is one of the leading causes of premature death in men and women despite unquestionable progress in the management and prevention of coronary artery disease.[1].

Hypovitaminosis D or low serum vitamin D is highly prevalent in the United States and worldwide. It has been estimated that around 1 billion people worldwide suffer from low serum vitamin D .[2] Although a consensus regarding the optimal level of serum 25(OH)D has not been established, most experts define severe vitamin D deficiency as a level <10ng/ml, moderate vitamin D deficiency as a level 10-20 ng/ml, vitamin D insufficiency as 21-29 ng/ml and a level of e"30ng/ml is considered as normal.[3] There is high prevalence of hypovitaminosis D among Indians despite the availability of abundant sunshine in large parts of India. This is true for both urban and rural populations and, in men and women, with reported population of prevalence of 70- 99%, with severe deficiency (<10 ng/ml) being reported as 62% in studies from Delhi.[4-7] Another review of vitamin D deficiency in Bangladesh showed prevalence of hypovitaminosis D in Dhaka among 16-40 years women being 12-17% and in Nandail 38-50%.[5]

Several mechanisms, direct and indirect, have been proposed for the association of vitamin D with CHD. Vitamin D could be related to CHD via increased blood pressure, impaired glycemic control or secondary hyperparathyroidism. An excess of PTH levels is known to promote atherosclerosis. PTH promotes myocyte hypertrophy and vascular remodeling. Hypovitaminosis D is known to up-regulate Renin Angiotensin Aldosterone System (RAAS) and lead to hypertrophy of smooth muscles and left ventricle, an adverse marker of cardiovascular event.[8] Consequently, low serum 25(OH) D has been associated with aberrant cardiac contractility, cardiomegaly, and increased ventricular mass due to myocardial collagen deposition.[9-10] Low serum Vitamin D also leads to endothelial dysfunction by creating a proinflammatory and prothrombotic environment. This promotes atheroma formation and atherosclerosis, the principal cause of myocardial infarction (MI).[11]

Association of hypovitaminosis D with coronary heart disease (CHD) has been reported in a large number of studies and reviews recently.[2, 12-14] There is also evidence of linking low serum vitamin D to early mortality, with vitamin D being considered as one of the possible treatable cardiovascular risk factors.[2,15-16]

However, there is no data on the association of low serum vitamin D with AMI in young (≤40 years) Bangladeshi population. We therefore studied the association of this novel and potentially treatable risk factor of acute MI in our population. We analyzed fasting serum vitamin D level in cases of newly diagnosed young acute myocardial infarction (MI) patients and age and sex matched controls, to study the association of low serum vitamin D with AMI in Bangladeshi population.

Methods:

This case - control study was conducted at the Department of Cardiology, Dhaka Medical College Hospital, Dhaka, between May'2017 to April'2018. Serum 25-hydroxy [25(OH)] vitamin D measurement was performed at blood sample collected and then stored at -70[0]c in the biochemistry laboratory of BSMMU.

Newly diagnosed Patients with acute MI(STEMI and NSTEMI) in young age (≤40 years) admitted in the CCU of Dhaka Medical College Hospital, Dhaka , within the study period who fulfilled the other inclusion and exclusion criteria were taken as cases and age and sex matched healthy subjects with no history of Ischemic heart disease (IHD) and normal ECG were taken as controls. Study subjects having previous history of myocardial infarction/Unstable angina /Percutaneous Coronary Intervention (PCI)/Coronary Artery Bypass Graft (CABG) were excluded. Controls were matched to cases by age and sex with healthy subjects (doctors, medical students, nurses, other hospital staffs and patients attendants from DMCH, Dhaka) with no history of IHD and normal ECG findings. Cases and controls with cardiomyopathy, any valvular heart disease, congenital heart disease, pericardial disease, pregnancy, known liver, thyroid, renal diseases, malabsorption or malignancy, and those who were taking vitamin D supplement were excluded.CHD in the young is defined as CHD in patients (≤40 years) of age. The sample size for this study was calculated for a two sided significance of 0.05 and study power of 90%. The calculated sample size was 60 cases and 60 controls. Serum vitamin D was measured in both cases and controls by chemiluminescence immunoassay on blood samples collected and then stored at -70p c in the biochemistry laboratory of BSMMU . The ARCHITECT 25(OH) vitamin D assay was a chemiluminescent microparticle immunoassay for the quantitative determination of 25(OH) vitamin D in human serum and plasma. Statistical analysis of the data was done by Statistical Package for Social Science (SPSS) version 22.0. Confidence interval was considered at 95% level. The qualitative variables were expressed as frequency and percentage and the quantitative variables were expressed

as mean with standard deviation. During analysis, student's t-test and chi-square test were used to analyze difference between baseline characteristics. Univariate and multivariate regression analysis were considered to evaluate the influence of potential risk factors. Risk measurement was done by odds ratio (OR). P-value <0.05 was considered statistically significant in all cases.25 (OH) vitamin D status was determined as the normal, insufficiency, deficiency and severely deficient state when the 25 (OH) vitamin D level was ≤30 ng/ml, 21-29 ng/ml, 10-20ng/ml and <10 ng/ml respectively. Multiple conditional logistic regression was used to investigate the relationship between MI and vitamin D deficiency controlling for other significant traditional risk factors including diabetes, hypertension, dyslipidaemia, tobacco use, obesity/overweight and family h/opremature CAD. Vitamin D status was taken as a binaryvariable (moderate/severe deficiency Vs normal/insufficient).

Results:

Study subjects were divided into two main categories depending on whether the patient had vitamin D level ≤ 20ng/ml (moderate/severe deficiency)or >20 ng/ml (normal/insufficiency) in blood. Vitamin D status among cases and controls and the association of different grade of serum vitamin D with AMI was studied.

Mean age of cases and controls were 35.31±4.84 years 33.83±5.11 years respectively (P>.05). There was no statistically significant difference (P >0.05) regarding the gender incidence in chi-square test. Male female ratio was 2.08:1 among the whole subjects.

In this study majority of both cases (86.7%) and controls (46.7%) had vitamin D deficiency (moderate) (Table II). Twenty percent (20%) of cases had severe deficit in vitamin D level whereas none of the control group had severe deficit of vitamin D. On the other hand, 10% of the controls had normal vitamin D level and none of the cases had normal level of vitamin D. In case group, the mean serum vitamin D level was 14.75±4.99 ng/ml, ranging from 6.00 to 26.30ng/ml. In control group, the mean serum vitamin D level was 21.05±6.00ng/ml, ranging from 11.00 – 31.00ng/ml. The difference was statistically significant (P <0.001)(Table-I). Vitamin D deficient (moderate/severe) subjects were more likely to develop AMI than subjects who had normal/insufficient vitamin D levels in blood (OR 7.42, 95%CI 3.18-18.28, P<0.001). (Table III)

Smoking, HTN, F/H of premature CAD and vitamin D deficiency (moderate/severe) were found to be significantly (p<0.05) associated with AMI in young (≤40 years) patients; other risk factors (DM, Dyslipidaemia and overweight/obese) were not found to be significantly (p>0.05) associated with AMI risk in young (≤40 years) patients. A subject with vitamin D deficiency (moderate/ severe) compared to a not deficient subject (normal/ insufficient) was 8.81 (95% CI 2.874 to 27.023) times

Table I

Comparison of serum 25(OH) Vitamin D level in cases and controls (n=120).

Serum 25-(OH) Vitamin D	Case (n=60)		Control (n=60)		P value
level (ng/ml)	n	%	n	%	
Normal (≥30)	0	0	6	10	0.01^S
Insufficient (21 – 29)	8	13.3	26	43.3	<0.001^S
Moderately deficient (10 – 20)	40	66.7	28	46.7	0.03^S
Severely deficient (< 10)	12	20	0	0	<0.001^S
Mean ±SD	14.75±4.99		21.05±6.00		<0.001^S
Range (min – max)	6.00 – 26.30		11.00 – 31.00		

Table-II

Vitamin D status (normal/insufficiency vs moderate/severe deficiency)
among cases and controls (n=120).

Serum 25-(OH) Vitamin-D Status	Case(n=60)		Control(n=60)		P value
	n	%	n	%	
Deficient (moderate/severe)	52	86.7	28	46.7	<0.001^S
Normal/ Insufficient	8	13.3	32	53.3	

Table-III

Risk measurement of serum 25(OH) vitamin D level for AMI in young (≤40 years) patients (n=120)

Serum 25-(OH) Vitamin-D Status	Case (n=60)		Control (n=60)		Odds Ratio (OR)	95% CI for OR	P value
	n	%	n	%			
Deficient (moderate/severe)	52	86.7	28	46.7	7.42	3.18-18.28	<0.001[S]
Normal/ Insufficient	8	13.3	32	53.3			

Table-IV

Risk measurement of different risk factors for AMI in young (≤40 years) patients (n=120) (Multiple logistic regression model)

Risk factors	Regression coefficient (β)	Odds Ratio (OR)	95% CI for OR	P value
Vitamin D deficiency(moderate/severe)	2.176	8.81	2.874-27.023	<0.001[S]
Smoking	1.013	2.76	1.030-7.364	0.04[S]
Dyslipidemia	0.782	2.19	0.791-6.040	0.13[NS]
HTN	1.762	5.82	1.681-20.161	0.005[S]
DM	1.268	3.55	0.974-12.969	0.06[NS]
F/H of premature CAD	1.711	5.53	1.225-25.009	0.02[S]
Overweight/Obese	0.818	2.27	0.865-5.932	0.10[NS]

more likely to have AMI.

Discussion:

This study was intended to find out the association between serum vitamin D level and AMI in young (≤40 years) patients.

Among cases 86.7% were deficient (moderate/severe) in vitamin D which is significantly more compared to controls (46.7%, P<0.001). Among control group only 10% subjects had normal vitamin D level. But, among cases there was not a single patient who had normal level of vitamin D. Till date no study has determined the vitamin D status in both young (≤40 years) adult men and women of Bangladesh. In this respect a high proportion of vitamin D deficient (moderate/severe) men (controls) in this study is a unique and important finding. A greater proportion of men among cases having hypovitaminosis D can be explained by the fact that a greater proportion of men being hospitalized for myocardial infarction than women.[17]

Several studies were carried out to determine the vitamin D level in adult women in the country,in one study vitamin D deficiency was found in 38% women and in another study vitamin D deficiency (<25nmol/l) was found in 16% female garments workers and a high prevalence of vitamin D insufficiency 88.5% was also noted .[18-19] In

this study 30% women had vitamin D deficiency.

In 2017, at Sylhet MAG Osmani Medical College a study was done regarding association of 25-hydroxycholecalciferol with acute myocardial infarction. In that studyvitamin D was found to be significantly reduced in AMI patients when compared with that of controls which were 28.50±16.68 ng/ml in cases and 38.32±16.47 ng/ml in controls, P=0.011.[20]

In an Indian study, Karur and colleagues included AMI patient from all ages and found 83.5% vitamin D deficiency or insufficiency .[21] In our study we found that all (100%) patients of young (≤40 years) AMI patients had either insufficient vitamin-D level (13.3%) or moderate/severely deficient vitamin-D level (86.7%). In the study by Roy *et al.* severe deficiency of vitamin D was found in 79.2% cases and 46.7% controls.[8] But, this study found severe deficiency in 20% cases and none of the control.

Ng et al., 2013[22] demonstrated that 74% of AMI had low vitamin D levels and 36% of them had severe deficiency. In this study 86.7% of AMI had vitamin D deficiency (moderate/severe deficiency) level and among them 20% had severe deficiency.

In this study serum 25(OH) vitamin D level in AMI was found to low in cases (14.75±4.99 ng/ml) than in controls (21.05±6 ng/ml)This findings were supported by the

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findings of Rath et al., 2016.[23]

Risk measurement of serum 25(OH) vitamin D level for AMI showed that vitamin D deficient (moderate/severe) patients had significantly higher odds of developing AMI than those who have insufficient/normal vitamin D level OR 7.42, 95%CI 3.18-18.28, P<0.001). When other risk factors were adjusted the OR increased to 8.81 (95% CI 2.874- 27.023, p <0.001). This in agreement with findings of studies done in India, Pakistan, and USA .[8,24-25]

In the multiple logistic regression analysis by taking AMI as dependent variable and risk factors for AMI as independent variable Roy et al., 2015[8], showed that vitamin D deficiency increased risk of AMI. In that study, vitamin D deficiency, obesity, DM, HTN, smoking and dyslipidaemia had odds ratio (OR) 4.5, 2.8, 2.3, 2.1, 1.9 and 1.1 respectively. In this study showed that serum vitamin D deficiency (moderate/severe), smoking, HTN and F/H of premature CAD were significantly (P <0.05) associated with AMI risk in young (d"40years) patients with Odds ratio 8.81, 2.76, 5.83 and 5.53 respectively. Whereas DM, Dyslipidaemia and overweight/obesity were not (P >0.05) (Table IV).

Vitamin D deficiency (moderate/severe) causes an increase in parathyroid hormone, which increases insulin resistance and is associated with diabetes, hypertension, and inflammation .[2] Combination of these factors contributes to the increased risk of cardiovascular events in vitamin D deficiency(moderate/severe). Therefore, large scale studies are needed to evaluate the cardiovascular benefits of vitamin D supplementation.

Conclusion:
Substantial evidence suggests that a large portion of different populations have suboptimal levels of vitamin D, which may adversely affect the cardiovascular (CV) system, and may affect the incidence of AMI. Vitamin D deficiency (moderate/severe) was significantly associated with acute MI incidence.

Limitations :
The study population was confined to the Cardiology Department of DMCH. Therefore, the results of the study may not reflect the exact picture of the country. Only one of the emerging risk factors (serum vitamin D) was studied. Follow up of the patients for longer duration was beyond scope

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Comparison of Vascular Complications in Patients with Percutaneous Coronary Intervention by Trans-radial and Trans-femoral Approach

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Abstract:

Background and Objective: Trans-radial approach of coronary catheterization has been increasingly used as an alternative to transfemoral approach due to less vascular complications, earlier ambulation and improved patient comfort. The aim of the study was to compare procedural and post procedural vascular complications in patients with percutaneous coronary intervention by trans-radial and transfemoral approach.

Methods: This observational comparative study was conducted in the National Institute of Cardiovascular Diseases between June 2015 to May 2016. A total of 180 patients were categorized into two groups according to the approach of the percutaneous coronary intervention (PCI). Group I comprising 90 patients who underwent trans-radial PCI and group II consists of 90 patients who underwent transfemoral PCI. Patients with an abnormal Allen's test, acute coronary syndrome, history of coronary artery bypass surgery, chronic renal insufficiency or older age (>75 years) were excluded.

Results: Patient demographics were the same in both groups. The mean procedural time in min (37.44±5.13 vs 34.14±4.42, p=0.004) and fluoroscopy time in min (21.62±4.11 vs 17.55±2.78, p=0.02) were more in TR-PCI group but the mean haemostasis time in min (7.58±1.11 vs 15.59±3.33, p=0.005) and ambulation time in hour (0.00±0.00 vs 15.59±3.33, p=<0.001) were more in TF-PCI group. Significant arterial spasm following puncture (6.7% vs 0%, p=0.01) were found in trans-radial group but access site bleeding during procedure (2.2% vs 8.9%, p=0.04) were more in TF-PCI group. After the procedure major hematoma (0% vs 4.4%, p=0.04), minor hematoma (5.7% vs 14.4%, p=0.04) and ecchymosis (4.4% vs 13.3%) were significant in TF-PCI group but vessel occlusion (5.7% vs 0%, p=0.02) were significant in TR-PCI group. The mean hospital stays, day (1.64±0.42 vs 2.54±0.62) were more in TF-PCI group.

Conclusion: TR-PCI is safe in respect of procedural and post procedural vascular complications. Trans-radial procedure leads to improved quality of life after the procedure and thus gives much comfort to the patient. It also shortened mean duration of hospital stay. So, trans-radial approach is an attractive alternative to conventional transfemoral approach.

Key Words: Vascular complications, TR-PCI, TF-PCI.

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Introduction:

Coronary artery disease (CAD) is a major cause of mortality globally and this health problem is reaching pandemic in both developed, as well as in developing countries[1]. Percutaneous coronary intervention (PCI) is the standard treatment for ischemic heart disease and the use of PCI in appropriate patients reduces morbidity and mortality across the spectrum of risk[2]. Considerable evidence suggests that post-PCI bleeding is associated with an adverse prognosis[3]. Clinical trials evaluating new pharmacological strategies have focused on reducing this risk[4]; however, absolute reductions in bleeding risk have been modest across most studies.

Coronary interventions have been traditionally performed using the femoral approach for arterial access since its inception by Gruntzig[5] in 1977 to till date due to the fact that its size makes arterial cannulation and catheter manipulation easy. Despite these advantages, femoral access has several limitations. The femoral artery is relatively deep, especially in obese patients, and its proximity to the femoral vein and nerve is a potential source of iatrogenic injury. For this reason, transfemoral PCI is associated with bleeding complication rates of up to 10% in the elective setting[6]. Especially under conditions of aggressive anticoagulation and antiplatelet treatment, vascular bleeding complications at the femoral puncture site can result in increased morbidity and duration of hospitalization[7]. Trans-radial approach represents another way to reduce vascular & bleeding complications that make it an attractive alternative to brachial or femoral approaches[8].

The radial artery is easily compressible; thus, bleeding is controllable and haemorrhagic complications are significantly reduced and improved clinical outcomes compared with trans-femoral approach in both young and elderly patients[9].

The trans-radial PCI is associated with a lower risk of access site bleeding and hematoma, early patient ambulation, shorter length of hospital stays, and lower hospital costs. Moreover, no major veins or nerves are located near the artery, minimizing risk of injury to these structures. Finally, post procedure bed rest is not required, permitting immediate ambulation, more comfort and early discharge which improve quality of life of patients and reduced hospitalization cost[10].

The trans-radial PCI may be routinely attempted, with some exceptions and is to be preferred in those patients at high risk of local vascular complications (such as the elderly, the obese, patients with aorta iliac diseases or those receiving anti-thrombotic and anti-platelet drugs). To date, many studies have confirmed the findings of the early pioneers of this technique. Today, 10 years after the first trans-radial PCI, it has found its place among the more conventional catheterization routes. The technique has spread all over the world and its popularity is increasing steadily. Therefore, the rationale for the trans-radial PCI is the intention to reduce access site bleeding complications, earlier ambulation, and improved patient comfort[11].

Methods:

A total of 180 patients were studied in this comparative study in the Department of Cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka from June 2015 to May 2016who underwent elective PCI. The patients were divided into two groups according to the approach of the PCI. The group-I consisted of 90 patients who underwent trans-radial approach and the group- II consisted of 90 patients who underwent trans-femoral approach. Absence of radial artery pulse, Absence of functional collaterals between the radial and the ulnar artery – judged by Modified Allen's Test, Patient with Acute Coronary Syndrome (ACS), Prior coronary artery bypass surgery (CABG), peripheral vascular disease (e.g. Raynaud's phenomenon.), severe co morbidity (CKD, CVD, COPD) were excluded from the trans-radial PCI group.

Baseline clinical characteristics such as age, sex, occupation and risk factors including smoking, hypertension, diabetes mellitus and dyslipidemia were noted. Baseline investigations like RBS, serum creatinine, serum lipid profile, coagulation profile and screening blood tests for PCI were carried out for each of the patients. Procedural and post procedural vascular complications were compared in both groups

Statistical analysis was performed by using SPSS (Statistical Package for Social Science) statistical software (Version 19, SPSS Inc., Chicago, Illinos, USA). Data were expressed in percentage, frequencies and means and standard deviation. Continuous variables were compared through the Student's t-test and for the categorical variables the chi-square test was done. P value of less than 0.05 was considered as significant.

Results:

The mean age was found 50.18±9.35years in Group I and 49.94±8.17 years in Group II. The mean age difference was insignificant (p=0.86) between two groups. Male patients were predominant in both groups. The Study compares the common risk factors for coronary artery

diseases between two groups. Smoking was found 60 (66.7%) in the group I and 57 (63.3%) patients in the group II). Hypertension was found 55 (66.1%) and 56 (62.2%) in the group I and group II respectively. Diabetes mellitus was found 27 (30%) and 30 (33.3%) in the group I and group II respectively. Dyslipidemia was found 62 (68.9%) in the group I and 58 (64.4%) in the group II. Family history of CAD had found 28 (31.1%) and 25 (27.8%) in group I and group II respectively. Mean pulse rate was found 78.3±5.6/min in group I and 80.6±7.8/min in group II. The mean systolic blood pressure was 126.6±16.6 mmHg in group I and 129.3±16.6 mmHg in group II. The mean diastolic blood pressure was 79.0±8.8 mmHg in group I and 79.5±9.2 mmHg in group II. All baseline characteristics were statistically insignificant in both groups.

Mean bleeding time was 3.42±0.33 min in group I and 3.56±0.30 min in group II. The mean of clotting time was 6.48±0.6 min and 6.78±0.5 min in group I and group II respectively and both were statistically insignificant difference.

The patients with chronic stable angina were 41 (45.6%) and 38 (42.2%), NSTEMI were 12 (13.3%) and 10 (11.1%) and STEMI were 37 (41.1%) and 42 (46.7%) in the group I and group II respectively. The differences between two groups were statistically identical (p>0.05) on the basis of clinical diagnosis (Fig.-1).

The mean procedural time was 37.44±5.13 min in group I and 34.14±4.52 min in group II with statistically significant differences (p=0.004). The mean fluoroscopy time was 21.62±4.11 min and 17.55±2.78 min in the group I and group II respectively with the statistically significant differences (p=0.02). The mean haemostasis

time was 7.58±1.11 min and 15.59±3.33 min in group I and group II respectively with the statistically significant differences (p=0.005).

The ambulation time was 0.00±0.00 hour in group I and 15.84±4.89 hour in group II with the statistically significant differences (p=<0.001) (Table-I).

Among the total procedural complications, the number of the patients noticed arterial spasm following puncture was 6 (6.7%) in the group I and none in group II with the statistically significant difference (p=0.01). Considering access site bleeding 2 (2.2%) and 8 (8.9%) study subjects experienced that in the group I and group II respectively and the difference was statistically significant (p=0.04). The number of catheter non-engagement was 3 (3.3%) and none was observed in group II respectively with the statistically insignificant differences (p=0.08) (Table-II).

In the group I, 0 (0.0%) and 4 (4.4%) in the group II had major hematoma with statistically significant differences (p= 0.04). There was 5 (5.7%) and 13 (14.4%) minor hematoma in group I and group II with statistically significant differences (p=0.04). There was also ecchymosis in group I subjects 4 (4.4%) whereas 12 (13.3%) patients in group II with statistically significant differences (p=0.03). The vessel occlusion was 5 (5.7%) in group I and none in group II with statistically significant differences (p=0.02).

Artery-venous fistula and limb ischemia were not found in both groups (Table-III). The mean hospital stay for trans-radial approach was 1.64±0.42 days while in transfemoral approach it was 2.54±0.62 days with the statistically significant differences (p=0.01). (Table-IV).

Table I

Comparison of procedural characteristics of the study population (n=180).

Procedural Characteristics	Group I (n= 90)	Group II (n= 90)	pvalue
	Mean ± SD	Mean ± SD	
Procedural time (min)	37.44±5.13	34.14±4.52	0.004[s]
Fluoroscopy time (min)	21.62±4.11	17.55±2.78	0.02[s]
Haemostasis time (min)	7.58±1.11	15.59±3.33	0.005[s]
Ambulation time (hr)	0.00±0.00	15.84±4.89	<0.001[s]

Table-II

Comparison of procedural complications between two groups (n=180).

Procedural complications	Group I (n = 90)		Group II (n = 90)		p value
	Number	%	Number	%	
Arterial spasm following puncture	6	6.7	0	0.0	0.01[s]
Access site bleeding	2	2.2	8	8.9'	0.04[s]
Catheter non-engagement	3	3.3	0	0.0	0.08[ns]

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Table-III
Comparison of post procedural complications between two groups (n=180).

Post- procedural complications	Group I (n = 90)		Group II (n = 90)		p value
	Number	%	Number	%	
Major hematoma	0	0.0	4	4.4	0.04[s]
Minor hematoma	5	5.7	13	14.4'	0.04[s]
Ecchymosis	4	4.4	12	13.3	0.03[s]
Vessel occlusion	5	5.7	0	0.0	0.02[s]
Artery-venous fistula	0	0.0	0	0.0	
Limb ischemia	0	0.0	0	0.0	

Table-IV
Distribution of the study patients by duration of hospital stay after procedure (n=180).

Duration of hospital stay after procedure (days)	Group I (n = 90)		Group II (n = 90)		p value
	Number	%	Number	%	
< 2	50	55.6	0	0	
2 – 3	30	33.3	60	66.7	
> 3	10	11.1	30	33.3	
Mean ± SD	1.64±0.42		2.54±0.62		0.01[s]
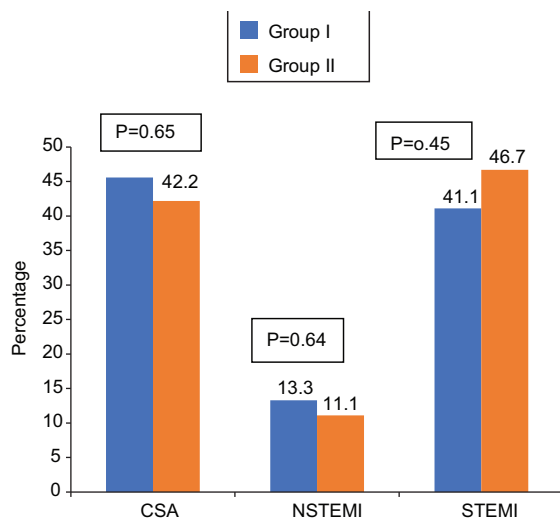
Fig.-1: *Clinical diagnosis of the study population.*
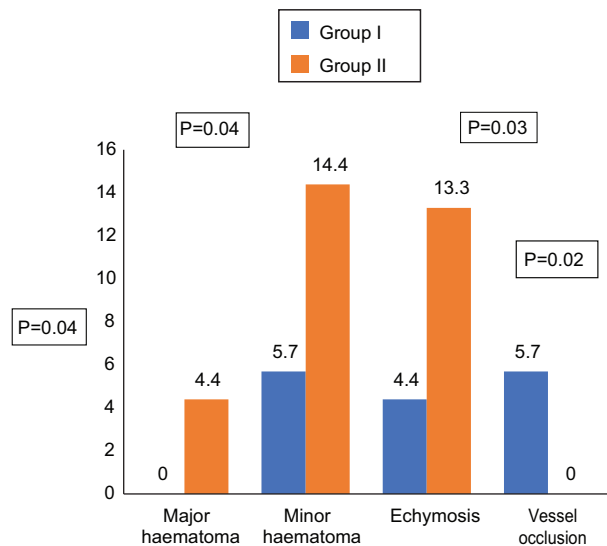
Fig.-2: *Post-procedural complications between two groups in percentage.*

Discussion:

This observational study was conducted in the department of cardiology of National Institute of Cardiovascular Diseases (NICVD), Dhaka during the period of June 2015 to May 2016 to evaluate vascular complications of trans-radial percutaneous coronary intervention compared to the transfemoral percutaneous coronary intervention in CAD patients. A total of 180

patients with coronary artery disease (CAD) who were admitted for elective percutaneous coronary intervention (PCI), were studied. The patients were divided into two groups according to the approach of the percutaneous coronary intervention (PCI). In the group I patients underwent trans-radial percutaneous intervention and, in the group II, patients underwent transfemoral percutaneous coronary intervention. Each group was comprised of 90patients.

In our study, the mean age, sex and common risk factors for coronary artery disease were not significantly different between two groups. The clinical parameters like Pulse and BP and bio-chemical parameters like RBS, Creatinine, Lipid profile were observed almost identical in both groups of patients. Regarding coagulation profile and clinical diagnosis no significant difference were found between two groups.

We found that, the mean procedural time was more in trans-radial group (Group-I) than in trans-femoral group (Group-II) which was statistically significant. Brueck M. et al (2009)[12] described in their study of more mean procedural time in trans-radial PCI group than in trans-femoral PCI group. We also found that, Regarding the mean fluoroscopy time was more in trans-radial group (Group-I) than in trans-femoral group (Group-II) with statistically significant value. It resembling a study done by Ibebuogu UN et al (2012)[13] where total fluoroscopy time was longer in the trans-radial access group compared to the transfemoral access group.

In terms of the haemostasis, the mean time was less in trans-radial group (Group I) than the trans-femoral group (Group II) with statistically significant differences. The result is very much consistent with the mean haemostasis time found by Patwary et al (2009)[14] in their study.

Among the procedural complications, arterial spasm following puncture was found only in trans-radial PCI group with the statistically significant differences. Considering access site bleeding, it was less in trans-radial group than in trans femoral group which was statistically significant. There were no vascular complications in the trans-radial access group compared to the trans-femoral access group observed by Ibebuogu UN et al (2012)[13] in their study. Dehghani P et al (2009)[15] showed in their study, access site bleeding, access site hematoma and radial artery spasm which were the predictors of failed trans-radial PCI. We also found a little number of cases who were shifted to trans-femoral approach due to failed catheter engagement through trans- radial approach.

In our study, post procedural complications were more in trans-femoral PCI group (Group-II) than in trans-radial PCI group (Group-I) and the difference was statistically significant. Among them no major hematoma was found in trans-radial PCI group. Minor hematoma was also less in trans-radial group (Group-I) than in trans-femoral group (group-II). The difference was statistically significant. Ecchymosis was less in trans-radial group (Group-I) than in trans-femoral group (Group-II) with statistically significant difference. Finally, the vessels occlusion was found only in trans-radial PCI group (Group-I). Following transfemoral PCI patients would have to confine in the bed for at least 6 hours when they can't move the leg where as in case of trans-radial PCI patients can even walk just after the procedure. For first couple of hours this group patient was advised to raise and not to move their operated hand. For this reason, urinary retention and low back pain is common in transfemoral PCI. There was no artery venous fistula, pseudo aneurysm, limb ischemia, and nerve injury's observed. The mean hospital staying was more in trans-femoral PCI group with statistically significant differences than in trans-radial PCI group. It resembles with the mean hospital stay observed by Triantafyllou K et al (2010)[14].

Conclusion:
This study was conducted to evaluate the vascular complications of trans-radial percutaneous coronary intervention compared to the transfemoral percutaneous coronary intervention in CAD patients. The present study concluded that TR-PCI is safe in respect of procedural and post procedural vascular complications. More importantly, trans-radial procedure leads to improved quality of life after the procedure and thus gives much comfort to the patient.

Study limitations:
The study was done in a single center. The sampling method was non-randomized. Hemostasis was achieved by using manual pressure in most of the patients and the study and follow up period was short.

Recommendations:
The study recommends that vascular complications of trans-radial PCI was lower than the transfemoral PCI except in two aspects, arterial spasm following puncture and occlusion of radial artery was more than that of transfemoral PCI. Apart from these two aspects trans-radial PCI is safer as well as more convenient. However, the result of this study in context of Bangladesh needs further confirmation in a randomized large scale multicenter prospective cohort study.

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Early Outcome of Coronary Artery Bypass Graft Surgery in Patients with Preoperative Elevated Level of HbA1c with Diabetes Mellitus

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Abstract:

Introduction: Diabetes mellitus has been associated with an increased risk of adverse outcome after coronary artery bypass graft surgery. HbA1c is a reliable measure of long-term glucose control. It is unknown whether adequacy of diabetic control, measured by hemoglobin A1c, is a predictor of adverse outcomes after coronary artery bypass grafting. The predictive role of HbA1c on short term outcomes after coronary artery bypass graft surgery has not been evaluated. Diabetes mellitus has become a major health issue and contributes to morbidity and mortality from coronary artery disease. The purpose of this study is to determine the predictive role of preoperative elevated HbA1c on post-operative outcome in CABG patients.

Objectives: This study evaluates the early postoperative outcomes of CABG in terms of mortality and major post-operative morbidities like deep sternal wound infection, sepsis, stroke, renal failure, bleeding, arrhythmia, and mediastinitis in patients with preoperative elevated level of HbA1c.

Methods: This prospective study was done in National Institute of Cardiovascular Diseases (NICVD). Patients of coronary artery disease (CAD) with DM referred for CABG were enrolled for the study. Total 60 patients were allocated into two groups. Among them 30 patients with preoperative HbA1c of <7% and another 30 patients with preoperative HbA1c of > 7 % underwent CABG surgery from January, 2009 to December, 2010. The early postoperative outcomes were compared between two groups. Both groups were matched with no significant difference that could influence the postoperative outcome.

Results: In-hospital mortality was high in patients with preoperative elevated level of HbA1c. An elevated hemoglobin A1c level predicted in-hospital mortality after CABG surgery. Our study revealed that HbA1c greater than 7 % was associated with increase in mortality. For each unit increase hemoglobin A1c , there was a significantly increase risk of myocardial infarction and deep sternal wound infection. By using receiver operating characteristic value thresholds, renal failure, cerebrovascular accident and deep sternal wound infection occurred more commonly in patients with elevated hemoglobin A1c. Morbidity, infections and the composite outcomes occurred more commonly in patients with elevated HbA1c.

Conclusion: Elevated HbA1c is strongly associated with adverse events after coronary artery bypass graft surgery. Preoperative HbA1c measurement may allow for more accurate risk stratification in patients undergoing coronary artery bypass graft surgery.

Key Words: HbA1c, Diabetes Mellitus, CABG

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Introduction:

Diabetes mellitus is a clinical syndrome characterized by hyperglycemia due to absolute or relative deficiency of insulin.[2] Diabetes mellitus and its associated complications are a

major threat to public health globally. Worldwide prevalence of type 2 diabetes was 4.0% in 1995, and it is expected to rise to 5.4% by the year 2025, representing a 170% increase in the number of affected adults in developing countries. It is estimated that by the year 2025, there will be approximately 228 million adult diabetes in developing countries.[3] Hyperglycemia may be defined as elevated random plasma glucose level >11.1 mmol/ L. Hyperglycemia is commonly present in the perioperative period in patients undergoing cardiac surgery in both diabetic and non diabetic patients, even during administration of insulin.[4]

Hyperglycemia contributes to excessive urine output from an osmotic diuresis, impair wound healing, increases the risk of infection and may impair blood pressure regulation.[5] A 20 mg/dl increase in blood glucose level was associated with more than 30% increase in adverse effects.[6] Intraoperative hyperglycemia increases the risk of postoperative outcome following open heart surgery more in diabetic patients than non-diabetic patients.[7] Hyperglycemia in the immediate post operative period remains an independent risk predictor of and may be a causal factor in deep sternal wound infection.[8] Diabetes mellitus has long been recognized as an independent risk factor for the development of coronary artery disease (CAD).[9] The prevalence of CAD in patients with type-2 diabetes ranges between 13% and 43%[9] and 20% to 30% of patients undergoing coronary artery bypass grafting surgery (CABG) have DM.[10] Type-2 diabetes is often asymptomatic in its early stages and remains undetected for several years before it is diagnosed. In undiagnosed diabetic population, asymptomatic hyperglycemia has been reported to predict increased risk of cardiovascular death and morbidity and mortality after cardiac surgery.[11]

Therefore, early detection, diagnosis, and treatment of type-2 DM are of utmost importance to prevent diabetic complications, and to improve short and long-term outcomes in patients undergoing CABG.[12]

The most widely used tests for the diagnosis of DM include fasting plasma glucose (FPG) and oral glucose tolerance test (OGTT). A multitude of reports have indicated that up to 50% patients with DM who were diagnosed by OGTT criteria would have been missed by FPG criteria.[13]

Despite being the diagnostic gold standard for DM, OGTT is costly, time consuming, and labor intensive and is impractical for diabetes screening. Therefore, an additional, simple, cost-effective, efficient, and patient-friendly method for detecting these diabetic subjects would be highly desirable. Another suggested measure for clinical screening of DM is hemoglobin A1c (HbA1c).[14] The HbA1c test, measures average blood glucose levels for a period of up to 3 months. HbA1c as a faster, easier test does not require fasting. An A1c level of approximately 5% indicates the absence of diabetes, and according to revised evidence-based guidelines, an A1c scores of 5.7% to 6.4% indicates prediabetes, and an A1c level of 6.5% or higher indicates the presence of diabetes.[15] HbA1c is not only used for therapeutic monitoring or as an alternative test for screening but also has been reported to be useful in predicting both early and late outcomes after CABG operations. A normal nondiabetic HbA1c is 3.5% to 5.5%, and each 1% increase in HbA1c corresponds to an increase in mean plasma glucose level of approximately 35 mg/dl, (2 mmol/L).[16]

HbA1c levels greater than or equal to 7% were associated with a significant increase in in-hospital mortality, renal failure, neurologic complications, and the composite index of infection compared with patients with and HbA1c of less than 7%.[1]

The prevalence of DM is expected to increase in developing countries. The patients undergoing CABG surgery constitute the high-risk group for DM. Mainly because of socioeconomic reasons, most of these patients are not aware of their disturbed glucose metabolism. These ignorance leads to adverse consequences with regard to prognosis in the short and long term after surgery.HbA1c measurements for patients who are undergoing CABG surgery may be useful and should be included in routine preoperative workup.[12]

Methods & materials:

This prospective, non-randomized clinical study was conducted in the department of cardiac surgery, NICVD, from January, 2009 to December, 2010. The study was carried out on patients with coronary artery disease who were scheduled for CABG with or without high preoperative HbA1c were included in the study. Patients with emergency CABG, redo CABG, history of myocardial infarction within 3 months, any surgical procedure for non-cardiac cause within 3 months, combined CABG and valve or other congenital heart diseases were excluded from the study.

After hospital admission all patients of coronary artery diseases with diabetes mellitus were assessed by

taking complete history and clinical examination, and then we measured HbA1c from biochemistry department of NICVD. Biochemistry department used konelab 60i analyzer to measure HbA1c. Normal value of HbA1c was 4.2 to 6.2% with this machine. According to serum level of HbA1c patients were divided into two groups. Patients with HbA1c <7% was considered as Group A and patients with HbA1c >7% was considered as Group B. Then evaluation of risk factors and co-morbid factors were done as per standard protocol. From history and preoperative investigations we collected data of age, sex, BMI, positive family history of CAD, angina status (CCS class), NYHA functional class, smoking habit. We also recorded some important co-morbid conditions including hypertension, arrhythmia, MI, COPD, dyslipidemia, renal dysfunction. From echocardiogram we recorded ejection fractions (EF %) , LV dysfunction in both groups. From CAG we recorded number of double vessel disease, triple vessel disease in both groups. We also did some necessary investigations including serum creatinine, blood urea, RBS, in study population. We collected intraoperative data of total operative time, number of grafts required in both groups. Postoperatively in the ICU we recorded total ventilation

time, how many patients developed atrial fibrillation, low cardiac output syndrome, post-operative MI, non-sternal wound infection, deep-sternal wound infection, CVD, renal failure, pulmonary complications. Postoperatively in the ICU we routinely did serum creatinine, blood urea, RBS, ABG, serum electrolytes in both groups, and all necessary data collected and recorded in data sheet from both groups for comparison and evaluation. During follow-up of the patients we examined sternal wound site and leg wound site for presence of any infection. We did echocardiography to determine ejection fractions (EF %). We also evaluate NYHA class and CCS class of all follow up patients. All data were analyzed by computer based SPSS (statistical program for social science) program.

Result:

The present study aimed at predicting the outcome of coronary artery bypass graft surgery (CABG) in patients with elevated hemoglobin A1c included a total of 60 patients of diabetes who underwent CABG. Based on the level of hemoglobin A1c, the patients were divided into two groups. The patients with hemoglobin A1c < 7% (Group-A) was considered as normal while patients with hemoglobin A1c ≥7% (Group-B) was considered as elevated. The findings of the study obtained from data analysis are documented below.

Age distribution:

Age distribution of the patients showed that 63.3% of patients in Group-A were between 50 – 60 years old as opposed to 33.3% of patients in Group-B. However, in Group-B all the patients were identically distributed among the three age categories. Although, the mean age was somewhat higher in Group-B compared to Group-A, but there was no significant difference between groups (p = 0.269).

Sex distribution:

There were 27(90%) male and 3(10%) female patients in Group-A and 25(83.3%) male and 5(16.7%) female s in Group-B.

Body Mass Index (BMI): Our study shows that 56.7% of patients in Group-A was of normal weight compared to 36.7% in Group-B. Overweight and obese patients were found higher in Group-B than that in group-A (63.3% vs. 43.3%). There was no significant difference between groups with respect to body mass index (p = 0.121).

NYHA class:

NYHA functional class demonstrates that NYHA class-II was 53.3% and class-III was 46.7% of patients in Group-A. In Group-B, 3.3% of patients belonged Class-I, 40.1% Class-II, 54.3% Class-III and another 3.3% Class-IV. The Chi-square (χ^2) analysis revealed that distribution of NYHA functional class between Group-A and Group-B was almost similar (p=0.439).
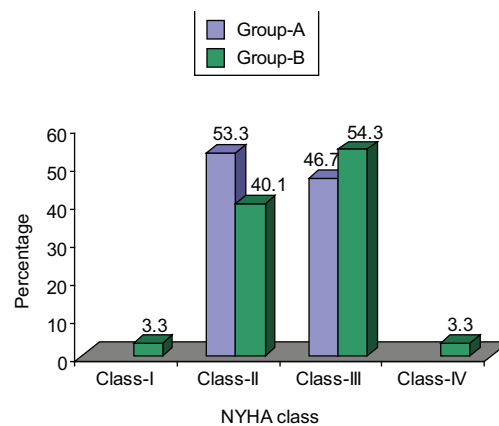

Fig.-1: *Comparison of NYHA class between groups*

CCS class:

Study result shows that CCS class – II was 70% in Group-A compared to 66.7% in Group-B. Class-III was observed in 26.7% of patients of the former group and in 30% of the later group. The groups were homogeneously distributed with respect to CCS class (p = 0.555).

Preoperative variables:
Smoking habit, hypertension, PVD, past myocardial infarction, dyslipidemia, left main disease and COPD were higher in Group-B than those in Group-A (73.3% vs. 56.7%; 90% vs. 73.3%; 23.3% vs. 13.3%; 56.7% vs. 43.3%; 40% vs. 33.3% and 36.7% vs. 13.3% respectively). However, patients with arrhythmia was two-times higher in Group-A compared to Group-B (13.3% vs. 6.7%). The blood urea, serum creatinine and RBS were almost similar in distribution between groups (30.9±6.2 vs. 30.5±5.8 mg/dl, p = 0.767; 0.9±0.2 vs. 1.0±0.2 mg/dl, p = 0.318 and 9.5±2.1 vs. 9.9±2.7mg/dl, p = 0.503 respectively) (Table I).

Intra-operative outcome:
In Group-A, 70% of the patients required 3 grafts and 16.7% needed 2 grafts, while in Group-B, 56% of the patients needed 3 grafts and in 36.7% needed 2 grafts.

However, no significant difference was observed between the groups in terms of number of grafts needed (p = 0.299). The total operative time was significantly higher in the Group-B than that in Group-A (p < 0.001) .

Postoperative outcome:
After CABG 20% patients in Group-B developed atrial fibrillation as opposed to 6.7% in Group-A (p = 0.127). Blood urea and serum creatinine were significantly raised in Group-B than those in Group-A (p < 0.001 and p = 0.037 respectively). Average ventilation time, length of ICU stay and hospital stay were higher in the Group-B than those in Group-A (p < 0.001 and p = 0.006 and p < 0.001 respectively). The incidences low cardiac output syndrome and renal failure were observed to be significantly higher in the former group than those in the latter group (p = 0.038 and p = 0.044 respectively).

Table-I
Comparison of preoperative variables between groups

Preoperative variables	Group		χ^2/t	df	p-value[#]
	Group-A (n = 30)	Group-B (n = 30)			
Smoking habit[#]					
Present	17(56.7)	22(73.3)	1.832	1	0.176
Absent	13(43.3)	8(26.7)			
HTN[#]					
Present	22(73.3)	27(90.0)	2.783	1	0.095
Absent	8(26.7)	3(10.0)			
PVD[#]					0.317
Present	4(13.3)	7(23.3)	1.002	1	
Absent	26(86.7	23(76.7)			
Past MI[#]					0.302
Present	13(43.3)	17(56.7)	1.067	1	
Absent	17(56.7)	13(43.3)			
Dyslipidemia[#]					
Present	11(36.7)	13(43.3)	0.278	1	0.598
Absent	19(63.3)	17(56.7)			
Left main disease[#]					
Present	10(33.3)	12(40.0)	0.287	1	0.592
Absent	20(66.7)	18(60.0)			
Arrhythmia*					
Present	4(13.3)	2(6.7)	0.741	1	0.335
Absent	26(86.7)	28(93.3)			
Blood urea[§]	30.9 ± 6.2	30.5 ± 5.8	0.298	58	0.767
Serum creatinine[§]	0.9 ± 0.2	1.0 ± 0.2	0.659	58	0.318
RBS[§]	9.5 ± 2.1	9.9 ± 2.7	0.674	58	0.503

Table-II

Comparison of postoperative outcome between groups

Postoperative outcome	Group		χ^2	df	p-value[#]
	Group-A (n = 30)	Group-B (n = 30)			
Atrial fibrillation*					
Present	2(6.7)	6(20.0)	3.158	1	0.127
Absent	28(93.3)	24(80.0)			
Blood urea§	34.7 ± 6.3	52.0 ± 20.7	4.349	58	< 0.001
Serum creatinine§	1.27 ± 0.73	1.79 ± 1.13	2.133	58	0.037
Low cardiac output syndrome*					
Present	2(6.7)	8(26.7)	4.356	1	0.038
Absent	28(93.3)	22(73.3)			
Local infection*					
Present	2(6.7)	4(13.3)	0.741	1	0.335
Absent	28(93.3)	26(86.7)			
Non-sternal infection*					
Present	2(6.7)	3(10.0)	0.218	1	0.500
Absent	28(93.3)	7(90.0)			
Deep sternal infection*					
Present	0(0.0)	1(3.3)	1.017	1	0.500
Absent	30(100.0)	29(96.7)			
Hospital stay§	10.1 ± 1.7	13.4 ± 3.3	4.891	58	<0.001
Early mortality*					
Present	1(3.3)	2(6.7)	0.351	1	0.500
Absent	29(96.7)	28(93.3)			
Renal failure*	1(3.3)	6(20.0)	4.231		0.044
Present					
Absent	29(96.7)	24(80.0)			
CVA*					
Present	1(3.3)	2(6.7)	0.351	1	0.500
Absent	29(96.7)	28(93.3)			
Ventilation time§ (min)	6.8 ± 0.7	14.2 ± 0.9	14.24	58	<0.001
Length of ICU stay§ (hours)	32.4 ± 4.7	40.3 ± 5.8	4.616	58	0.006
Pulmonary complications*	3(10.0)	5(16.7)	1.531	1	0.353
Present					
Absent	27(90.0)	25(83.3)			

Data were analyzed using χ^2 Test. * Fisher Exact Test was done to analyzed the Data.
Data were analyzed using Student's t-Test and were presented as mean ± SD.

NYHA functional class, 3 months after CABG:

Evaluation of patients by NYHA functional class, 3 months after CABG shows that 90% of the patients of Group-A and 80% of Group-B had NYHA functional
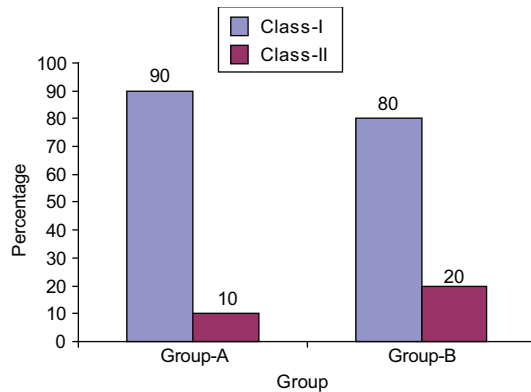

Fig.-2: *NYHA functional Class 3 months after CABG*

CCS class, 3 months after CABG:

Evaluation of patients by CCS class, 3 months after CABG revealed that that 93.3% of the patients in Group-A and 83.3% in Group-B fell in CCS Class-I.
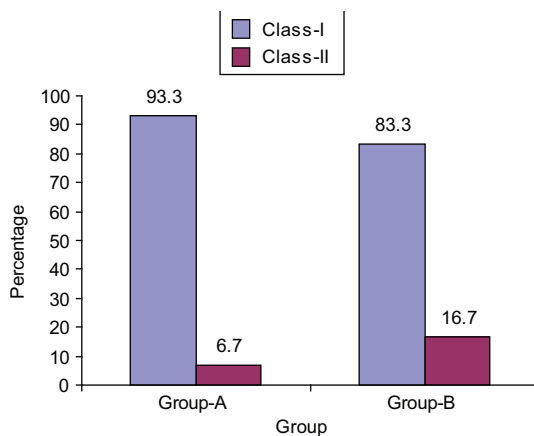

Fig.-3: *Distribution of CCS Class, 3 months after CABG*

Discussion:

The predictive role of hemoglobin A1c on short-term outcomes after coronary artery bypass graft surgery has not been evaluated in our country. It has been reported hemoglobin A1c is useful in predicting both early and late outcomes after CABG operations. Diabetes mellitus has become a major health issue and contributes to morbidity and mortality from coronary artery disease. Despite lifestyle changes and medications that have

been shown to decrease complications and death, many persons have poor glycemic control. This study evaluates the early post operative outcomes of CABG surgery in terms of mortality and major post-operative morbidities like deep sternal wound infection, sepsis, stroke, renal failure in patients with preoperative elevated level of HbA1c.

Data of different preoperative, peroperative and postoperative variables were collected by interview schedule, investigations, hospital records and were put in questionnaire and entered into computer.

The data obtained from the study were analyzed by computer based SPSS (statistical program for social science) programme and tested by Chi-square (χ^2) Test, Fisher Exact Test, and Student's t- Test.

Pre operative data shows Smoking habit, hypertension, PVD, past myocardial infarction, dyslipidemia, left main disease and COPD were higher in Group-B than those in Group-A (75.9% vs. 56.7%; 90% vs. 73.3%; 23.3% vs. 13.3%; 56.7% vs. 43.3%; 40% vs. 33.3% and 36.7% vs. 13.3% respectively).

The blood urea and serum creatinine were almost similar in distribution between groups (30.9±6.2 vs. 30.5±5.8 mg/dl, p = 0.767; 0.9±0.2 vs. 1.0±0.2 mg/dl, p = 0.318 S)

Pre operative data shows there was no significance of difference between two groups that can hamper result.

Per operative and post operative result data shows most of the patients required 3 grafts in both groups, total mean operative time was 261.3±32.4 minutes in group-A and 298.5±36.2 minutes in group-B. Operative time was significantly higher in group-B (p<0.001).

Blood urea and serum creatinine were significantly raised in Group-B (p<0.001, P=0.037). Average ventilation time, length of ICU stay and hospital stay were higher in the Group-B than those in Group-A.

Two patients developed low cardiac output syndrome in group-A and 8 patients in group-B (p=0.038) it was significant in group-B.

One patient developed renal failure in group-A and 6 patients in group-B it was significantly higher in group-B (p=0.044).

Our study demonstrates early outcome of CABG surgery in patients with preoperative elevated level of HbA1c with DM. Post-operative blood urea, serum creatinine and renal failure were significantly higher in patients with preoperative elevated HbA1c. Period of mechanical ventilation, ICU and hospital stay all were significantly

higher in patients with preoperative elevated HbA1c. There was significant difference between groups so, null hypothesis is rejected and alternative hypothesis is accepted.

From this study it can be concluded that preoperative elevated HbA1c is predictive of worse post operative outcome in patients with DM undergoing CABG surgery.

Conclusion:

This was a prospective observational study done in NICVD from January 2009 to December 2010. Sample size was 60, and sample was selected purposefully . among the 60 patients with coronary artery disease with DM 30 patients with preoperative HbA1c < 7% (group: A) underwent CABG surgery and the rest 30 patients with preoperative HbA1c > 7% (group:B) underwent CABG surgery. Data of different preopective ,peroperative and postoperative variables were collected by interview schedule and checklist. They were analyzed by spss programe and tested by Chi-square ((Ç2) test , Fisher Exact Test, and Student's t-test. Our study demonstrates early outcome of CABG surgery in patients with preoperative elevated level of HbA1c with DM . Pulmonary complications ,infective complications and arrhythmias were more common among patients with elevated HbA1c. Postoperative blood urea , serum creatinine and renal failure were significantly higher in patients with preoperative elevated HbA1c . Period of mechanical ventilation , ICU stay and hospital stay all were significantly higher in patients with preoperative elevated HbA1c .

From this study it can be concluded that preoperative elevated HbA1c is predictive of worse postoperative outcome in patients with DM undergoing CABG surgery.

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Association of Risk Factors with Coronary Angiographic Findings of Female Patients with Acute Myocardial Infarction at a Tertiary Hospital of Bangladesh

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Abstract::

 Background: Coronary artery disease (CAD) is the leading cause of mortality and morbidity of women in developed and developing country. Although women in low and middle income countries have worse situation they are least studied. Cardiovascular risk factors assessment and their correlation with angiographic severity in female patients is essential to take preventive strategy and timely intervention.

Aim: The aim of this study was to evaluate the major risk factors of coronary artery disease and to study the relation of those cardiovascular risk factors with coronary angiographic findings in female patients with AMI .

Methods: This was a cross-sectional observational study carried out in the department of Cardiology, Chittagong Medical College Hospital (CMCH) from January 2017 to December 2017. One hundred and fifty consecutive female patients diagnosed as acute myocardial infarction (AMI) who subsequently underwent coronary angiography (CAG) during the study period were included in the study. Data regarding demographic, clinical & laboratory features were recorded. Severity of CAG findings was assessed by Gensini score.

Results: The mean age of the study population was 53.19(±10.71) years. Hypertension was the commonest cardiovascular risk factor (78%) in this study followed by obesity (68%), dyslipidaemia (62%) and diabetes mellitus (57.3%). About 80% patients had clustering of ≥3 risk factors. Proportion of patients having ST-segment elevation myocardial infarction (STEMI) and non ST-segment elevation myocardial infarction (NSTEMI) were 47% and 53% respectively. Thrombolytic was the most frequently used treatment modality for the management of STEMI patients. Double Vessel Disease, type B lesion with Gensini score ≥20 were the most common CAG findings. Triple vessel disease and severe CAD (Gensini score ≥20) were more in women with three or more risk factors. A significant (p<0.05) linear correlation was found between Gensini score and age, triglyceride level and total cholesterol level. Other factors, including, obesity, family history, hypertension, diabetes mellitus, menopausal status were found to be more prevalent among severe coronary artery disease on CAG but the differences were not statistically significant (p>0.05).

Conclusion: The present study showed a significant relation of having multiple cardiovascular risk factors with developing more aggressive angiographic findings. It also revealed that Bangladeshi female patients of AMI had clusters of cardiovascular risk factors and presence of multiple risk factors is a predictor of severe coronary artery disease.

Key words: Acute myocardial infarction; cardiovascular risk factors; female patients; Gensini score.

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Introduction:

Cardiovascular disease is the leading cause of mortality for women in the United States and globally. Coronary artery disease (CAD) afflicts 6.6 million women of United States annually and remains the leading morbidity and mortality threat in women[1]. Women in low and middle income countries also have worse situation than men, experiencing higher proportion of CAD related deaths than men. South Asians are unduly prone to develop CAD. Of all South Asian countries, Bangladesh probably has the highest rates of cardiovascular disease (CVD) and yet is the least studied; in the global combat against CVD[2].Women and men with coronary artery disease tend to differ in their presenting symptoms, access to investigations, treatment and overall prognosis[3]. Women with acute coronary syndrome (ACS) are generally older with more clustering of risk factors and

higher risk of mortality than men. Certain risk factors are more prevalent in women. These include type 2 DM, hypertension, obesity, depression, and other psychosocial risk factors. Diabetes mellitus is a stronger CAD risk factor in women than in men. Hypertension is associated with a two to threefold increased risk for CAD in women. In women, low levels of high density lipoprotein are strong predictors of higher CAD risk than high levels of low density lipoprotein. Obesity is a major risk factor for AMI in women and increases their risk almost 3-fold.The risk of AMI associated with metabolic syndrome is higher in women[4]. Almost 50% of women have a clustering of ≥3 metabolic risk factors for ischemic heart disease[5.] The pathophysiology of CAD varies between women and men. An interesting observation is that women with ACS have less extensive obstructive and more diffuse coronary artery disease compared with men, but the event rate in non obstructive coronary artery disease seems to be higher in women[6-8.] Despite the lack of obstructive CAD visualized on cardiac catheterization at the time of acute coronary syndrome (ACS), the prognosis of these women is not benign. Over one-half of symptomatic women without obstructive CAD continue to have signs and symptoms of ischemia and to undergo repeat hospitalization and coronary angiography[9,10]. Recently, disorders of the coronary microvasculature and endothelial dysfunction have been implicated in the occurrence of non-obstructive CAD in women[11]. Historically fewer women than men have been included in studies on CAD[12]. Till date few data are available on coronary artery disease in female of our country as well. The consequence is that evidence base for several treatments is less firm. Closing this research gap sex-specific evaluation of coronary pathophysiology,

optimum diagnostic strategies, effective lifestyle, pharmacological, and invasive interventions are required. So this study was designed to determine the major risk factors and their association with angiographic severity of coronary artery disease in female patients presenting with acute myocardial infarction.

Materials and Methods:

This is a hospital based cross-sectional observational study carried out in the department of Cardiology, Chittagong Medical College Hospital (CMCH) from January 2017 to December 2017. One hundred and fifty consecutive female patients diagnosed as acute

myocardial infarction (AMI) according to third universal definition of myocardial Infarction[13], who subsequently underwent coronary angiography (CAG) within 4 wks of AMI during the study period were included in the study. Patients with history of PCI or CABG, patients with valvular heart disease, patients unsuitable for coronary aniography and those refusing consent were excluded from the study. An informed written consent was taken from each study patient.

Demographic profile of the patient including age, occupation, economic status and major risk factors like hypertension, diabetes, dyslipidaemia, history of smoking/ tobacco abuse, family history of CAD and post menopausal status were recorded. Data regarding weight, height was recorded, BMI was calculated. Patients having BMI ≥25 Kg/m^{2} were considered as obese according to World Health Organization (WHO)[14] criteria. Smoker were those who gave history of previous or current smoking of cigarettes, cigars, pipes and chewing tobacco[15]. Patients who gave family history of any direct blood relatives (parents, siblings, children) having either angina, MI or sudden cardiac death without obvious cause at age <50 yrs for men and <55 yrs for women were recorded as having positive family history[15].

Blood pressure was measured twice in sitting position in both arms and higher one was taken as recorded blood pressure. Patients who were previously diagnosed as hypertensive and taking antihypertensive or those with raised blood pressure ≥140/90 mm of Hg measured twice were considered as hypertensive according to The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure [16.] Random plasma glucose and lipid profile within 24 hrs of AMI were measured. Fasting blood glucose, 2 hrs post prandial blood glucose and Hb A1C were done on the following day. Diabetic patients were those who met American Diabetic Association(ADA)

criteria[17] or those already on antidiabetic drug. Dyslipidaemia was diagnosed according to National Cholesterol Education Program (NCEP) criteria[18] or those on lipid lowering agent. Other routine hematological (complete blood count) and biochemical investigation (serum creatinine) and echocardiography were done.

Coronary angiography was performed through standard femoral or radial artery approach. Angiographic data was collected by analyzing the angiogram. The origin and course of three major vessels and their branches were analysed in at least two different planes. Coronary artery disease, defined as epicardial coronary segment with stenosis >50% was diagnosed visually and confirmed in multiple projections and orthogonal views. Patients was grouped as having single vessels disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) according to the number of vessel involvement. Patients were also grouped according to the type of lesions involved. Atherosclerotic lesion complexity was categorized according to the Joint American College of Cardiology/American Heart Association (ACC/AHA) taskforce classification system[19] (type A, type B, type C).

Severity of stenosis was assessed by Gensini score [20]; It grades narrowing of the lumen of the coronary artery and scores it with numerical values with the following method; score 1 for 1–25% narrowing, 2 for 26–50% narrowing, 4 for 51–75%, 8 for 76–90%, 16 for 91–99%, and 32 for a completely occluded artery.This score is then multiplied by a factor that represents the importance of the lesion's location in the coronary artery system: 5 for the left main coronary artery; 2.5 for the proximal left anterior descending coronary artery or proximal circumflex artery; 1.5 for the mid left anterior descending coronary artery; 1 for the right coronary artery, distal left anterior descending coronary artery, obtuse marginal artery or posterior lateral artery; and 0.5 for other stenosis. The severity of disease is expressed as the sum of the scores for the individual lesions. By definition, a Gensini score of 20 or more was considered to be severe CAD. Measurement data was repeated twice by the same operator and the mean value was the final data. Shimadzu Bransist alexa was the fluoroscopic machine used in our cathlab.

Statistical analysis

The statistical analysis was carried out by using Statistical Package for Social Sciences (SPSS -23). Quantitative or continuous variables were described as mean ± standard deviation. Comparison between means of two groups was done by using Student's t-test.

Qualitative or categorical variables were described as frequencies and proportions. Proportions were compared using chi-square. Correlation analysis was done by Pearson's correlation coefficient test. Correlation of anthropometric variables and severity of angiogram findings in different groups was determined using correlation coefficient and linear regression analysis. Logistic regression analysis was performed to determine the independent predictor of CAD. Statistical significance and confidence interval were set at $p<0.05$ and 95% level respectively.

Results:

Among 150 female patients mean (±SD) age of the study women was 53.19 (±10.71) years and majority of them were >40 years of age. Demographic characteristics of the study population are described in Table I.

The prevalence of different CAD risk factors among the study population are descrived in Table II. Mostly prevalent risk factor was hypertriglyceridaemia, followed by hypertension, obesity (by BMI), DM and postmenopausal state.

Coronary angiogram findings of the study population are summarized in Table: III with respect to number of coronary vessel involved, location and type of involved vessel and the severity category by Gensini score.

Table IV shows the association of different risk factors with the number of coronary vessel involved. Double vessel disease was more frequent among the study population followed by single vessel and triple vessel disease.

Clustering of the conventional CVD risk factors (smoking, hypertension, family history of CAD, DM, dyslipidaemia, and obesity) among the study population are presented in Figure:1. It shows that seventy percent of patients had
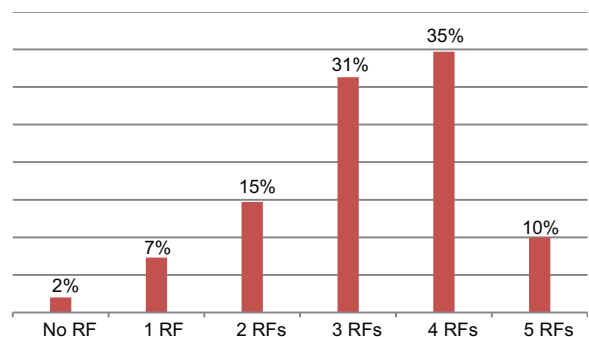
Fig.-1: *Clustering of risk factors among the study population*

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Table-I

Demographic characteristics of the study subjects

Characteristics	Frequency (n)	Percentage (%)
Age, years		
Mean ±SD	53.19 ±10.71	
≤55 years	75	50
>55years	75	50
BMI, kg/m^2		
Mean ±SD	24.49 ±2.94	
Normal weight (18.5-22.9)	48	32.0
Over weight (23-24.9)	37	24.7
Obese (>25)	65	43.3

Data are presented as frequency (n) and percentage (%) or mean ± SD

Table-II

Distribution of the study subjects by risk factors of CAD

Risk factors	Frequency (n)	Percentage (%)
Hypertension		
Yes	117	78.0
No	33	22.0
Diabetes[c&]		
Yes	86	57.3
No	64	42.7
Menopause		
Postmenopausal	85	56.7
Premenopausal	65	43.3
BMI ≥25kg/m^2		
Yes	102	68.0
No	48	32.0
Dyslipidemia*		
Yes	93	62.0
No	57	38.0
Total Cholesterol mg/dl		
Normal (< 200mg/dl)	96	64.0
Hypercholesterolaemia (e"200mg/dl)	54	36.0
Triglyceride, mg/dl		
Normal (< 150mg/dl)	6	4.0
Hyper TG (≥150mg/dl)	144	96.0
High density lipoprotein level, mg/dl		
Low HDL (< 40mg/dl)	91	60.7
Normal HDL (≥40mg/dl)	59	39.3
Low density lipoprotein level, mg/dl		
Normal (< 130mg/dl)	132	88.0
High LDL (≥130mg/dl)	18	12.0

Data are presented as mean ± SD or frequency (n) and percentage (%)

[c&]H/O DM or having IGT; * H/O dyslipidaemia or having abnormal Cholesterol/LDL/HDL

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three or more risk factors. The more commonly occurred risk factors in cluster were hypertension, dyslipidaemia, diabetes and obesity in different combination. Only three patients (2%) were free from all of the above mentioned risk factors. Two third of the study population (70%) had three or more risk factors.

Table: V shows that triple vessel disease and severe CAD (Gensini score ≥20) were significantly more prevalent among the women with three or more risk factors (p<0.05).

Association of different CVD risk factors with type of involved coronary artery lesions in CAG are described in Table VI.

Irrespective of the type of risk factors Type B lesion was the most prevalent lesion type. However, statistically significant difference was found only with smoking and type of lesion (p<0.05). Severity of coronary artery disease was done by Gensini score. Score <20 was considered as not severe CAD and score ≥20 as severe CAD.

Table VIII presents the association between Gensini score and risk factors. It revealed that odds of having severe CAD increased among the subjects who had risk factors. But, statistically significant difference (p<0.05) was present for smoking, age more than 55years and dyslipidaemia.

Spearman's correlation analyses were performed for variables- age, RBS, TG, total cholesterol, HDL-c, LDL-c and BMI. BMI and HDL-c showed negative correlation and other risk factors showed positive correlation with Gensini score (Table VIII).

Some of the variables proved to have association with the severity of CAG findings (Gensini score ≥20) are included as independent variables in the logistic regression analysis demonstrated in Table IX. The result revealed that age, and dyslipidaemia are working independently on development of severe CAD finding by Gensini score.

Table-III
Nature and severity of CAG findings

Parameters	Frequency (n)	Percentage (%)
No. of vessel involved		
Single vessel	52	34.7
Double vessel	62	42.7
Triple vessel	34	22.6
Location of vessel involvement		
LAD	27	18.0
LCX	11	7.3
RCA	10	6.7
LAD+RCA	39	26.0
LCX+RCA	6	4.0
LAD+LCX+RCA	34	22.7
OM 2	4	2.7
LAD + Rami	4	2.7
Lt main+LAD	5	3.3
LAD+LCX	10	6.7
Type of lesion		
Type A	26	17.3
Type B	104	69.3
Type C	20	13.3
Gensini score		
Non critical CAD (<20)	37	24.7
Severe CAD (≥20)	113	75.3

Data are presented as frequency (n) and percentage (%)

Table-IV
Risk factors in relation to number of coronary artery involved

Risk factors	Single vessel		Double vessel		Triple vessel		P value
	(n)	(%)	(n)	(%)	(n)	(%)	
Age, >55 years	31	41.3	37	49.3	7	9.3	0.001*
H/O Smoking	2	18.2	6	54.4	3	27.3	0.454[†]
Family H/O CAD	13	28.3	24	52.2	9	19.6	0.292[†]
Postmenopausal	26	30.6	35	41.2	24	28.2	0.155[†]
Hypertension	32	27.4	52	45.3	32	27.4	0.001*
DM	31	36.0	31	36.0	24	28.0	0.69[†]
Dyslipidaemia	31	33.3	37	39.8	25	26.9	0.248[†]
Obesity	34	33.2	40	39.2	28	17.5	0.118[†]

Data are presented as frequency (n) and percentage (%);
*Significant by Chi-square test;
[†]Not significant by Chi-square test

Table-V
Relation of risk factors clustering with CAG findings of study population

Characteristics	<3 R. F.		≥3 R. F.		P value
	(n)	(%)	(n)	(%)	
Subtypes of MI					
NSTMI (n=79)	23	29.1	56	70.9	0.122[†]
STMI (n=71)	13	18.3	58	81.7	
Inferior MI	6	15.8	32	84.2	0.552[†]
Anterior MI	7	21.2	26	78.8	
No. of vessel involved					
Single vessel	12	23.1	40	76.9	
Double vessel	22	34.4	42	76.5	0.001*
Triple vessel	2	5.9	32	94.1	
Type of lesion in involved vessels					
TypeA	8	30.8	18	69.2	
Type B	26	25.0	78	75.0	0.239[†]
Type C	2	10.0	18	90.0	
Gensini score					
Non critical CAD (<20)	14	37.8	33	62.2	0.023*
Severe CAD (≥20)	22	19.5	91	80.5	

Data are presented as frequency (n) and percentage (%);
*Significant by Chi-square test;
[†]Not significant by Chi-square test

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Table-VI

Type of coronary artery lesion with respect to risk factors

Lesion type

Risk factors	Type A		Type B		Type C		P value
	N	%	N	%	N	%	
Smoking	0	0.0	11	100	0	0.0	0.012*
Hypertension	20	17.1	81	69.2	16	13.7	0.968†
DM	15	17.4	55	64.1	16	18.6	0.080†
F/H of CAD	8	17.4	36	78.3	2	4.3	0.092†
Postmenopausal	14	16.5	59	69.4	12	14.1	0.961†
Age >40 years	22	16.4	94	70.1	18	13.4	0.692†
Dyslipidaemia	18	15.4	81	69.2	18	15.3	0.241†

Data are presented as frequency (n) and percentage (%);

*Significant by Chi-square test; †Not significant by Chi-square test.

Table-VII

Association between Gensini score and risk factors

Risk factors	Non critical CAD (score <20)		Severe CAD (Score ≥20)		Odds ratio	P value
	(n)	(%)	(n)	(%)		
Age, >55 years	11	14.7	64	85.3	3.08	0.004*
H/O Smoking	0	0.0	11	100.0	6.51	0.040*
Family H/O CAD	11	23.9	35	76.1	1.09	0.18†
Postmenopausal	21	24.7	64	75.3	0.99	0.99†
Hypertension	25	21.4	92	78.6	2.10	0.078†
DM	18	20.9	68	79.1	1.59	0.218†
Dyslipidaemia	15	16.1	78	83.9	9.39	0.002*
Obesity	21	20.6	81	79.4	1.93	0.09†

Data are presented as frequency (n) and percentage (%);

*Significant by Chi-square test;

†Not significant by Chi-square test.

Table-VIII

Spearman's correlation analysis for Gensini score with independent variables

Independent variables	R (Correlation coefficient)	P value
Age in completed years	0.307	<0.001*
Random blood glucose, mg/dl	0.128	0.118†
Total cholesterol level, mg/dl	0.195	0.017*
Triglyceride level, mg/dl	0.221	0.007*
High density lipoprotein level, mg/dl	-0.099	0.228†
Low density lipoprotein, mg/dl	0.159	0.053†
BMI, kg/m^2	-0.048	0.562†

*Indicate significant correlation at .05% level.

†: Not significant at 0.05% level

Table-IX

Multivariate analysis (logistic regression) with severity of CAD (Gensini score ≥ 20) as dependent variable and other risk factors of CAD as independent variables

Variables	Adjusted odds ratio	95% confidence interval	P value
Age	1.15	1.045-1.89	0.001*
Hypertension	1.88	0.68-516	0.221[†]
Diabetes mellitus	1.02	0.427-2.43	0.967[†]
Family H/O CAD	0.52	0.189-1.41	0.196[†]
Post menopausal status	2.86	0.099-5.45	0.101[†]
Dyslipidaemia	3.66	1.416-9.45	0.007*
Obesity	2.14	0.869-5.28	0.098[†]

*Indicate significant association at .05% level.

[†]Not significant

Discussion:

Women's heart health is not solely a medical issue but also involves economic, psychosocial, cultural, environmental, community, health system, political and public policy issues locally and globally. Cardiovascular disease is the number one killer of women in both developed and developing countries. Like other South Asian countries prevalence of coronary artery disease is increasing in Bangladesh. There is few data regarding coronary artery disease in our country and study among female patients with coronary artery disease is scarce. In our study we wanted to explore whether the traditional CAD risk factors in female patients with MI, like Diabetes mellitus, hypertension, smoking/ tobacco abuse, advancing age, dyslipidaemia, obesity, family history of coronary artery disease correlate with the severity of coronary atherosclerosis detected by coronary angiography as they are well recognized for their association with clinical events and acute coronary syndromes. A number of scores have been described in the past for grading the severity of coronary artery disease on angiography like Genisini score, Jenkins score and Friesingers score. We used the Genisini scoring system for assessing the coronary atherosclerotic disease burden. We chose this because of its simplicity and Genisini score is widely accepted as a CAD burden marker and its prognostic value has been demonstrated in different clinical situations. We included female MI patients only and divided the study population into two groups depending upon the Gensini score, score <20 and score ≥20. Traditional cardiac risk factors are highly prevalent in women of our study and clustering of CAD risk factors is positively associated with severe coronary artery disease as assessed by Gensini score.

The mean age of the study population was 53.19(±10.71) years. A Global case-control study of risk factors for cases of acute myocardial infarction reported that the mean age (51.9 years) for the occurrence AMI among Bangladeshi population was the lowest amongst all South Asians and it was 6 years lower compared with non-South Asians (58.8 years) [21]. In a Hospital based study in India the demographic profile of the study population (Female patients with acute myocardial infarction) revealed the mean age 62.74 ± 13.6 years, which is higher than our study [22]. Western studies have reported mean age higher as compared to other studies conducted in this region such as study by Chang et al. (73 years) [23]. Age was recorded through direct interviewing of the patient without

cross checking any certificate and vital statistics recording system in Bangladesh is weak. So, this demographic data might be lack of some internal and external validity. Logistic regression shows that age is working on CAD severity independently from others factors including in the model. Women with severe CAD (Gensini score ≥20) tend to be older with mean age 54.74 years in our study. Many studies are in line with our results and showed that advancing age is a risk factors of CAD in women[24].

Out of 150 female patients Diabetes was present in 86(57.3%) patients, hypertension was present in 117(78%) patients, dyslipidaemia in 93(62%), obesity in 102(68%), family history of IHD was present in 46(30.7%) and 11 (7.3%) patients were smokers.

Among the conventional CAD risk factors, smoking was distinctly very low and it is in agreement with other study held in our neighboring country[6.] Cultural disapproval

prohibits women from smoking in Bangladesh. In our study significant association was seen between the smoking/tobacco abuse and severity of coronary artery disease.

Prevalence of hypertension and diabetes was very high in our study population. The same finding was reported by Wenger where prevalence of hypertension was 65% [4]. Diabetes mellitus is the most important risk factor for CAD, the presence of diabetes in women increasing CAD risk by 3 - 7 folds compared to 2 - 3 folds increase in diabetic men [17]. In our study, diabetes was four times higher in women with severe CAD (Gensini score ≥20) compared with less severe CAD. In addition, different study showed that women with diabetes have a greater than threefold increase in CAD risk than non-diabetic women, and CAD mortality in women is 3 - 5 times higher in diabetic compared to non-diabetic and 3-fold higher relative risk for all cardiovascular mortality in women compared with men [26]. These two risk factors were found in Palestinian study in 2013 in patients with CAD that showed high prevalence of hypertension and diabetes in women 74.3%, 65.7% respectively [27].

Regarding the obesity, the majorities of our study population (43.3) are obese and has BMI more than 25 kg/m^2, and obese women are at higher risk for severe CAD than overweight but the differences were not statistically significant. Many studies are in line with our results and showed that obesity increased the risk of CAD. In United state (USA), 22% to 37% of women are obese (BMI > 30), and 7% having a BMI ≥40 kg/m2, increase weight is positively associated with increase CAD risk and mortality in women [28]. In the Framingham heart study, obesity increases the risk of CAD by 64% in women, as opposed to 46% in male [6].

Family history of CAD was present in 46 patients. Similar finding was observed in other studies . A family history of premature IHD in a sister carries 12fold higher risk for IHD in comparison to six fold for a brother and three fold for a parent [15].

Risk factors which is unique for women such as menopause; our data showed that 56.7% of study population was menopaused and the prevalence of severe CAD was higher this

group. Controlling for age by logistic regression reduces the role of menopause as risk factors for CAD and kept age as the main risk factor.

Evaluation of the frequency of cardiovascular risk factors in the study population revealed that hypertension, obesity, dyslipidaemia and diabetes were the most prevalent risk factors (78%, 68%, 62% and 57.3% respectively). Hypertension, dyslipidaemia, diabetes and obesity were the more commonly found risk factors in cluster. High TG was the most common abnormality found in this study (96%). The frequency of patients with HDL-c and LDL-c in the dyslipidaemic range was 60.7% and 12% respectively. Thirty six percent patients had hyprecholesterolaemia. Dyslipidaemia as a risk factor was higher when compared with the finding of Chang et al. (18.7%) [23].

 We demonstrated a significant linear correlation between severity of coronary artery disease as assessed by Gensini score and age, TG level and cholesterol level, suggesting that as the age, TG level and total cholesterol level increases, the severity of coronary artery disease will increase with multiple and complex lesions. Regarding the type of CAG findings in relation to number of risk factors, there was a statistically significant difference between patients having < 3 risk factors and those having ≥3risk factors in relation to number of vessel involved (p < 0.05). Triple vessel disease, diffuse character of lesions, and left ventricle dysfunction were mostly evident in patients having ≥3 risk factors. This result means that these severe angiographic characters are clearly linked to multiple & clustering risk factors. Gera S et al.[29] showed that there is a positive association of two and three vessels disease with having ≥3 risk factors similar to our study findings.

Limitations:

This study had the limitations that study was conducted in a single center, study population was relatively small, study was observational non-randomized and might be subjected to selection bias and major traditional risk factors were seen here, other possible emerging risk factors were not looked for.

Conclusion:

This study showed a significant relation of having multiple cardiovascular risk factors with developing more aggressive angiographic findings in female. It also revealed that Bangladeshi female patients of AMI had clusters of cardiovascular risk factors and presence of multiple risk factors is a predictor of severe coronary artery disease. Further large scale studies are needed to verify our results and to determine the independent influences of individual risk factor and to investigate the role of other hidden risk factors in Bangladeshi female patients with myocardial infarction.

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Original Article

Frequency and Predictors of Radial Artery Occlusion after Coronary Procedure through Transradial Approach: A Vascular Doppler-guided Study

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Abstract:

Background: Although transradial approach (TRA) has better outcome and reduced vascular complications, radial artery occlusion (RAO) is now a major concern as it limits future radial artery use for further TRA, for use as a conduit during CABG, for invasive hemodynamic monitoring and for creation of arteriovenous fistula for hemodialysis in CKD patients. Vascular doppler study is the most accurate method for evaluation of RAO and yet this is not practiced in our population. **Objectives**: To detect the frequency and identify the predictors of RAO after coronary procedure through TRA. **Methods**: This cross-sectional analytical study was done in the department of cardiology, NICVD from July-2015 to June-2016 by including a total 125 patients undergoing coronary procedures (CAG and/or PCI) through TRA. Vascular doppler study of the radial artery were performed before and one day after the procedure. RAO was defined as an absence of antegrade flow and monophasic flow on doppler study. Univariate and multivariate logistic regression analysis were done to evaluate the predictors of RAO. **Results**: On the day after the

procedure, radial artery vascular doppler examination revealed RAO in 12 (09.6%) patients. On univariate analysis female gender (p= 0.038), diabetes mellitus (p= 0.024), prolonged hemostatic compression for more than 02 hours after sheath removal (p= 0.003) were identified as predictors of RAO. Interestingly hypertension, low BMI, smaller radial artery diameter and use of reprocessed sheath were not identified as predictors of RAO. On multivariate analysis diabetes mellitus (p= 0.016), prolonged hemostatic compression for more than 02 hours after sheath removal (p= 0.004) were found as independent predictors for RAO. **Conclusion**: Frequency of RAO was 09.6% after coronary procedure through TRA. Diabetes mellitus and hemostatic compression after sheath removal for more than two hours were identified as independent predictors of RAO. Strategies should be taken from patient selection for TRA to end of hemostatic compression removal to prevent RAO.

Keywords: Radial artery occlusion, Transradial approach, Coronary procedure.

Introduction:

Cardiovascular diseases account for more than 17 million deaths globally each year contributing 30% of all

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deaths. 80% of those occur in low-income and middle-income countries. Coronary artery disease (CAD) alone caused 07 million deaths worldwide in 2010[1]. Coronary angiogram (CAG) is the gold standard method for the diagnosis and for establishing treatment strategies. CAG can be performed via femoral, radial and ulnar arteries. Till now the most common access site is transfemoral approach (TFA) for any interventional procedure. However, vascular access site complications such as bleeding, hematoma, arteriovenous fistula and pseudoaneurysm

are quite common after procedures through TFA[2]. The reduction of ischemic events and complications after PCI has increased the focus on non-ischemic complications particularly vascular access site complications[3]. Due to less vascular complications TRA for coronary procedure is gaining momentum as an alternative to the TFA. But TRA is technically more challenging than TFA and it requires longer learning curve. Through the TRA the first CAG was performed by Lucian Campeau in 1989[4] and the first PCI was performed in 1992 by Ferdinand Kiemeneij [5].

Worldwide an estimated 22% procedures are performed by this route[6]. The radial artery has become the preferred choice due to its easy compressibility, distance from major veins and nerves, and accompanying blood flow through the ulnar artery to the palmar arch. This approach is preferred by both patient and physician, because this approach results in improved time to ambulation, additional comfort to patients, shorter hospitalization duration, lower hospital expenses, reduces potentially life-threatening complications and improve clinical outcomes[7, 8]. TRA is an attractive options for same-day or outpatient procedure, with the data supporting its safety, efficacy and potential financial savings. That's why In the STEMI-RADIAL trial, the radial and femoral approaches were compared in patients with STEMI and radial access was associated with an 80% reduction in the incidence of complications at the puncture site and local bleeding[9]. Considering these results, the ESC Guidelines of management of STEMI[10] and NSTE-ACS[11] has given priority to TRA over TFA. Beside of these advantages TRA has some additional transradial specific vascular complications, such as spasm, radial artery perforation, compartment syndrome and radial artery occlusion (RAO) [6].

Radial artery occlusion (RAO) appears to be a silent enemy after radial artery catheterization. RAO is mostly asymptomatic but can cause serious complication like hand ischemia[12]. The incidence of this complication evaluated shortly after the procedure varies widely in the literature, ranging from 2% to 18%[13]. RAO can be evaluated by radial pulse method, Barbeau's test (plethysmographic evidence) and vascular doppler study. In a study by Huang et al,[14] showed the rate of immediate occlusion was 4.7% by radial pulse method (absent pulse), and 10.7% by vascular doppler study.

RAO depends on a number of demographic, clinical and periprocedural factors. Low body weight[15], female gender[16], use and dose of anticoagulant[17], the diameter of the radial artery, sheath size, the number of catheters, procedure duration, type and duration of access site compression after the procedure are some of the factors associated with RAO[18, 19]. Recently in India in a study by Garg et al,[20] showed lower BMI, diabetes mellitus, preprocedural radial artery diameter d" 2.5 mm, low

preprocedural peak systolic velocity and radial artery to sheath ratio <1 were the additional predictors of RAO. Kim et al,[21] described a direct pathophysiological factor of RAO is a thrombus which is due to damage to the endothelium, arterial smooth muscle contraction and slow-flow/no-flow of the blood stream creating a favorable environment for the formation of thrombi. The material aspirated from the artery in histopathological evaluation proved to be a thrombus[13]. The use of reprocessed sheaths can cause microstructural physical changes which predisposes to thrombosis. By understanding the patho-physiological mechanism and growing appreciation of the importance of the problem, a reduction in the incidence of RAO has been observed. This is due to recognition and implementation of effective prevention methods[22].

As only presence of palpable radial artery is not sufficient to exclude RAO, this study was undertaken to detect the frequency and to identify the predictors of RAO in patients undergoing coronary procedure through TRA by vascular color doppler study.

Methods:
This cross-sectional, analytical study was conducted in department of cardiology, National Institute of Cardiovascular Diseases (NICVD), Dhaka, Bangladesh from July 2015 to June 2016. All patients undergoing CAG and/or PCI through transradial approach in NICVD during the specified period of time were considered for the study. Total 125 patients were studied after selecting by purposive non-random sampling method. Patients with age more than 18 years undergoing coronary procedure with positive Allen's test and normal radial arterial blood flow by vascular doppler study were included and patient with negative Allen's test, prior CABG surgery using radial artery, history of radial and/or ulnar artery injury and having arterio-venous fistula or planned for making arterio-venous fistula were excluded from this study. Meticulous history was taken, detailed clinical examination was performed. Pre-procedural vascular doppler assessment of radial artery was done. Procedural characteristics were recorded during the procedure. After the procedure patients were followed for 24 hours, than post-procedural vascular doppler assessment of radial artery was done for detection of radial artery occlusion (RAO). After detection of RAO, patients were grouped in two groups: without RAO (group-I) and with RAO (group-II). Analysis was done for identification of predictors of RAO. The Statistical Package for Social Sciences (SPSS) version 19 software was used for data analysis. Continuous variables were expressed as mean and standard deviation and compared through the unpaired t-test. Categorical variables were expressed as absolute number and percentages and were compared through the Pearson's chi-square test and Fisher's exact test. Univariate and multivariate logistic

regression analysis was done to identify the predictors of RAO. P-value of less than 0.05 was considered statistically significant.

Ethical issue: The study protocol was approved by the ethical review committee of NICVD. Informed written consent was taken from each patient or near relatives. Confidentiality was maintained strictly and the patient had the right to withdraw himself/herself from the study at any time during the study period. Data was collected in an approved data collection form.

Results:
Among 125 patients with coronary artery disease undergoing coronary procedures through TRA were studied by vascular color doppler study for development of RAO after TRA. 113 (90.4%) patients did not develop RAO after TRA and belonged to group-I and 12 (09.6%) patients developed RAO after TRA and belonged to group-II. Mean age of study population was 50.47±9.38 and 49.67±8.96 years in respectively in group I & II. Male patients were predominant (84.1% vs 58. 3%) in both groups. Hypertension was the commonest risk factor of CAD in both groups (41.6% vs 66.7%) followed by smoking (38.1% vs 41.7%) and diabetes mellitus (31.9% vs 66.7%). Mean pre-procedural radial artery diameter was 2.51±0.33

vs 2.40±0.25 mm in group I and group-II. Mean pre-procedural peak systolic velocity of radial artery was 52.6±019.5 vs 41.1± 12.9 cm/sec in group I and group-II.

In univariate analysis shows female gender (OR, 3.770; CI, 1.076-13.202; $p=0.038$), diabetes mellitus (OR, 4.278; CI, 1.209-15.138; $p=0.024$), and hemostatic compression time more than 02 hours (OR, 37.333; CI, 3.515-396.252; $p=0.003$), were found to be significant predictors of postprocedural radial artery occlusion (RAO). On multivariate logistic regression analysis shows diabetes mellitus (OR, 7.348; CI, 1.460-36.989; $p=0.016$), hemostatic compression time more than 02 hours (OR, 63.076; CI, 3.890-1022.636; $p=0.004$), were independent predictors of post-procedural radial artery occlusion (RAO).

Table-III demonstrates comparison of the procedural and post-procedural characteristics. Reprocessed sheath was used in 66(58.4%) and 08 (66.7%) patients respectively in group I and group II. Hemostasis was done by conventional haemostatic method in 102 (90.3%) patients in group I but in all patients in group II. Majority of the patients were also given haemostatic compression for 02 hours or less time (99.1% in group-I and 75% in group-II).

Univariate logistic regression analysis shows female gender, diabetes mellitus and hemostatic compression

Table I

Frequency of study population according to radial artery occlusion (n=125)

Study populations	Number	%
Without radial artery occlusion (group-I)	113	90.4
With radial artery occlusion (group-II)	12	09.6
Total	125	100

Table-II

Demographic and clinical characteristics of study population (n=125)

Demographic and clinical characteristics	Group I (n=113)	Group II (n=12)
Age in years (Mean ± SD)	50.47±9.38	49.67±8.96
Gender, n (%)		
Male	95 (84.1)	07 (58.3)
Female	18 (15.9)	05 (41.7)
Smoking	43 (38.1)	05 (41.7)
Hypertension	47 (41.6)	08 (66.7)
Diabetes mellitus	36 (31.9)	08 (66.7)
Dyslipidaemia	43 (38.1)	06 (50.0)
Family history of CAD	39 (34.5)	43 (38.1)
BMI (Mean ± SD)	24.54±3.09	24.63±3.87
Clinical diagnosis, n (%)		
STEMI	23(20.3)	2(16.7)
NSTEMI	25(22.1)	3(25)
UA	38(33.6)	4(33.3)
CSA	27(23.9)	3(25)
Preprocedural radial artery diameter in mm (Mean±SD)	2.51±0.33	2.40±0.25
Preprocedural peak systolic velocity (Mean±SD)	52.6±19.5	41.1±12.9

Table-III

Procedural and postprocedural characteristics of study population (n=125)

Procedural and postprocedural characteristics	Group I (n= 113)		Group II (n= 12)	
	Number	%	Number	%
Types of procedure				
CAG	59	52.2	08	66.7
PCI	54	47.8	04	33.3
Types of sheath used				
New	47	41.6	04	33.3
Reprocessed	66	58.4	08	66.7
Types of haemostatic method				
Conventional method	102	90.3	12	100
Patent haemostatic method		09.7	00	00
Haemostatic compression time				
02 hours or less	112	99.1	09	75.0
More than 02 hours	01	0.91	03	25.0

Group-I: Study population without RAO, Group-II: Study population with RAO

Table-IV

Univariate logistic regression analysis of predictors of radial artery occlusion (n=125)

Variable	Odds Ratio	95% CI	p value
Female gender	3.770	1.076-13.202	0.038[s]
Hypertension	2.809	0.799-09.873	0.107[ns]
Diabetes mellitus	4.278	1.209-15.138	0.024[s]
BMI (kg/m^2)	1.009	0.837-1.217	0.924[ns]
Preprocedural radial artery diameter <02 mm	0.438	0.112-1.704	0.233[ns]
Use of reprocessed sheath	1.424	0.405-5.007	0.581[ns]
Procedure time	0.972	0.936-1.008	0.128[ns]
Hemostatic compression time >02 hours	37.333	3.515-396.252	0.003[s]

CI= Confidence interval, ns = Not significant (p>0.05), s = Significant (p d"0.05)

Table-V

Multivariate logistic regression analysis of predictors of radial artery occlusion (n=125)

Variable	Odds Ratio	95% CI	p value
Female gender	1.853	0.405-8.473	0.426[ns]
Diabetes mellitus	7.348	1.460-36.989	0.016[s]
Hemostatic compression time >02 hours	63.076	3.890-1022.636	0.004[s]

CI= Confidence interval, ns = Not significant (p>0.05), s = Significant (p d"0.05)

time more than two hours were found to be significant predictors of postprocedural radial artery occlusion (RAO).

Multivariate logistic regression analysis shows diabetes mellitus, hemostatic compression time more than two hours were independent predictors of post-procedural radial artery occlusion (RAO).

Discussion:

In this study, comparable with previous studies, TRA has high procedural success, low complication rates, and presents a low economic burden in experienced hands in the diagnosis and treatment of CAD. Failure of puncture of the radial artery, spasmodic or anatomical barriers

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such as radial arterial loop, and failure of coronary artery engagement are the most common causes of procedural failure via TRA[23]. In a study conducted by Dehghani et al,[24] the causes of procedural failure via TRA were radial arterial spasm, subclavian tortuosity, inadequate catheter support, failure of radial artery canulation, radial arterial dissection and radial arterial loop. In our study, one patient had radial artery loop and another patient had subclavian artery loop but those were successfully passed. Several studies demonstrated that with increasing operator experience, radial procedural failure dropped below 5%[24].

One of the significant complication of TRA is RAO, the incidence of which is very much variable from study to study. However, in some studies using doppler, the incidence of RAO is higher than only using absent pulse as a criterion of RAO. Sa' et al,[25] conducting a study on Brazil found incidence of early RAO (within 07 days) was 10.5%. Another vascular doppler guided study in India conducted on patients undergoing transradial coronary angioplasty found that RAO was 15.2% one day after the procedure[20]. Results of our study in which RAO was determined by vascular doppler study showed that frequency of RAO were 09.6% which is less than the previous studies.

In our study, mean radial artery diameter was found 2.49 ± 0.32mm (range, 1.87 to 3.22). Our finding is in accordance with the previous studies done in other Asian country populations (2.6 ± 0.3 mm in Korea[26] and 2.5 ± 0.4 mm in Japan[27]. In our study, mean radial artery diameter was 2.40±0.25 mm in patients who had developed RAO. In our study, five patients with radial artery diameter <2 mm (mean 1.94 ± 0.05 mm) were undergone coronary procedures with 6F catheter (radial artery to sheath ratio <1). RAO rate was 20% in patients with radial artery to sheath ratio <1 as compared to 9.8% if the ratio was e"1. This finding has importance, as Saito et al,[28] demonstrated that a radial artery diameter/sheath-diameter ratio <1 is associated with a reduction in distal flow. Larger sized sheaths have been increased chance of development of RAO, because of more intimal damage and favoring thrombus formation.

On univariate logistic regression analysis, in our study female gender, diabetes mellitus, hemostasis compression time more than two hours were found to be the predictors of radial artery occlusion. Garg et al,[20] also found female gender, diabetes mellitus as predictors of RAO on univariate regression analysis. Females have relatively smaller average radial artery diameters, and are much more susceptible to vascular spasm and could

be the reason for higher RAO in females. In our study females are also had relatively smaller radial artery diameter (2.38± 0.33 mm) in comparison to male (2.51± 0.26 mm); females were also had more development of spasm 04(13%) in comparison to male 05(4.9%). Deftereos et al,[29] also reported that females were more prone to develop radial artery spasm. Patients with long-term diabetes mellitus have the propensity to develop arteriopathy and accelerated atherosclerosis[30, 31]. Another risk factor for RAO is prolonged compression of the radial artery. Tight prolonged hemostatic compression creates stasis and favorable environment for occlusive thrombus formation. Thrombus formation appears to be involved in the pathophysiology of early RAO[18]. However, in our study hypertension, BMI, use of reprocessed sheath, amount of heparin used, procedure duration and types of procedure (CAG or PCI) were not predictor of RAO on univariate logistic regression analysis. Sa' et al,[25] conducting a study on Brazil also did not find any association of RAO with use of reprocessed sheath. Heparin therapy is necessary for the prevention of RAO[27, 32]. In our study, minimum 5000 IU heparin was used during CAG and maximum 17,500 IU of heparin (according to ACT) during PCI.

Finally in multivariate logistic regression analysis, our study had shown that diabetes mellitus and prolonged hemostasis compression for more than two hours were the significant independent predictors for RAO. In a retrospective study conducted to see the effect of duration of hemostatic compression on RAO after TRA revealed incidence of RAO was 12% when hemostatic compression time is six hours after completion of the procedure and 5.5% when hemostatic compression time is two hours and prolonged occlusive compression was the independent predictor of RAO[19]. This finding of our study are also in accordance with the recently published meta-analysis of RAO by Rashid et al,[33] as they mentioned shorter compression time in patent hemostasis setting is associated with less chance of development of RAO.

Conclusion:
This study was conducted to detect the frequency and identify the predictors of radial artery occlusion (RAO) after coronary procedures through transradial approach (TRA). Radial artery occlusion (RAO) occurred in significant number of patients (09.6%). Diabetes mellitus and prolonged hemostatic compression time more than two hours after removal of vascular access sheath were emerged as independent predictors of RAO from this study. Strategies should be taken from patient selection

for TRA to end of hemostatic compression removal to prevent RAO.

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Pattern of Non-Communicable Diseases among the Admitted Patients in a District Level Hospital of Bangladesh

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Abstract

Background: Non-communicable Diseases (NCD), particularly cardiovascular diseases, cancer, diabetes and chronic respiratory disease, have emerged as the leading threat to mankind worldwide. Likewise in Bangladesh, an increasing trend of incidence of NCDs has been observed and already they have become major public health concern. Hence, we aimed to study the pattern of NCDs among the admitted patients at an Upazila Health Complex (UHC) in Bangladesh.

Methods: In this retrospective study, data of in-hospital patients admitted from January 2018 to June 2018 in UHC, Chhagalnaiya, Feni was analyzed. Data on age, gender, occupation, hospital admission/discharge and diagnosis of disease was obtained from the hospital register. Diseases were categorized into NCD or communicable disease using the World Health Organization's International Classification of Diseases (ICD) coding system.

Results: 1,367 adult patients with different diseases were admitted into the medical ward over the study period of six months (mean age 57.4 ± 17.9 years; 61.3% male and 38.7% female). There were 904 cases of various NCDs constituting 66.1% of total admissions. The number of cases of NCDs was two times more compared to CDs (ratio 2:1). In all six months, admissions due to NCDs were significantly higher compared to communicable diseases CDs (p = 0.0001). Among the admissions due to NCDs, more than half (51.3%) were aged between 50 to 69 years. In terms of pattern of disease, cardiovascular diseases were the number one cause for hospital admission followed by endocrine disorders.

Conclusion: This study found that the burden of NCDs has increased among the admitted patients in an UHC. These findings could be useful to draw the attention of health authorities to adopt preventive strategies against NCDs even at Upazila level.

Keywords: Non-communicable Diseases, Upazila Health Complex, Bangladesh.

Introduction:

Non-communicable diseases (NCDs) are considered as the leading cause of morbidity and mortality globally[1].

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It is estimated that 40 million people die in each year because of NCDs, approximating 70% of all deaths worldwide. Among the NCDs, cardiovascular diseases account for 17.7 million deaths annually, followed by cancers (8.8 million), chronic respiratory diseases (3.9 million), and diabetes (1.6 million). These four groups of diseases account for over 80% of all premature NCD deaths[2].

The epidemic of NCDs poses catastrophic health consequences for individuals, families and

communities, and threatens to triumph over health systems. The economic burdens associated with NCDs make the prevention and control of these diseases a major development issue for the 21st century. Most of these premature deaths from NCDs are attributed to modifiable behavioral risk factors like tobacco use, unhealthy diet, physical inactivity and harmful use of alcohol, and metabolic risk factors like raised blood pressure, overweight/obesity, hyperglycemia and hyperlipidemia are also attributed to NCDs[1].

Burden of NCDs and its mortality is observed to be more in lower and middle income countries. Available data demonstrate that nearly 80% of deaths due to NCDs occur in low and middle income countries[2]. In recent years, an epidemiological shift in morbidity and mortality from infectious diseases or malnutrition to NCDs has occurred in many low and middle income countries, including Bangladesh. NCDs, particularly cardiovascular diseases, cancer, diabetes, and chronic respiratory disease have already become major public health concern in Bangladesh[3]. Both NCDs and their risk factors are showing an increasing trend. These risk factors are tobacco use, low intake of fruits and vegetables, physical inactivity, obesity, raised blood pressure, and raised blood glucose and cholesterol[3]. Evidence shows that the detection and treatment rate of diabetes mellitus and hypertension is also inadequate among Bangladeshi population[4,5]. Most important fact is that NCDs and their risk factors are prevalent in both urban and rural areas of Bangladesh[6].

Considering the increasing burden of NCDs in Bangladesh, this is the high time to adopt preventing strategies. In this regard, the data on NCDs are very important. However, only limited data are available limited from tertiary level hospitals. Hence, we aimed to study the pattern of NCDs among the admitted patients at an Upazila Health Complex (UHC) in Bangladesh.

Methods:
This is a retrospective study. The data of in-hospital patients admitted from 1st January 2018 to 30th June 2018 in UHC of Chhagalnaiya was analyzed. This UHC mainly caters the patients from Chhagalnaiya and surrounding areas. Chhagalnaiya is an Upazila of Feni District in the Division of Chittagong. It has a population of 170,524 (males 49.79% and females 50.21%).

All patients aged more than 18 years of both sexes admitted during this period were included. Children and adolescence patients aged <18 years were excluded. Data on age, gender, occupation, hospital admission/discharge and diagnosis of disease was obtained from the hospital register. Diseases were categorized into NCD or communicable disease (CD) using the World Health Organization's International Classification of Diseases (ICD) coding system.

There were two objectives of this study - to find out the ratio between NCDs and communicable diseases (CDs) and to study the pattern of NCDs. All analyses were done using Statistical Package for the Social Sciences (SPSS) software version 18 (Chicago, IL, USA). Comparison of variables was performed using the two-tailed paired t-test. $p < 0.05$ was considered statistically significant.

Results:
1,367 adult patients with different diseases were admitted into the medical ward over the study period of six months. The mean age of the admitted patients was 57.4 ± 17.9 years. Percentage of male patient was more compared to female patients (61.3% male and 38.7% female).

During the study period, there were 904 cases of various NCDs constituting 66.1% of total admissions. The number of cases of NCDs was two times more compared to CDs (ratio 2:1). The ratio was the highest in February. In all six months, admissions due to NCDs were significantly higher compared to CDs (p = 0.0001). The total result is summarized in Table-I and presented in Figure-1.

Table-I

Admissions due to non-communicable and communicable diseases

Month	NCDs		CDs		Total	NCD/CD
	n	%	n	%	admissions	Ratio
January	130	66.0%	67	34.0%	197	1.9
February	118	69.0%	53	31.0%	171	2.2
March	131	62.4%	79	37.6%	210	1.7
April	173	66.0%	89	34.0%	262	1.9
May	190	67.4%	92	32.6%	282	2.1
June	162	66.1%	83	33.9%	245	2.0
Total	904	66.1%	463	33.9%	1,367	2.0

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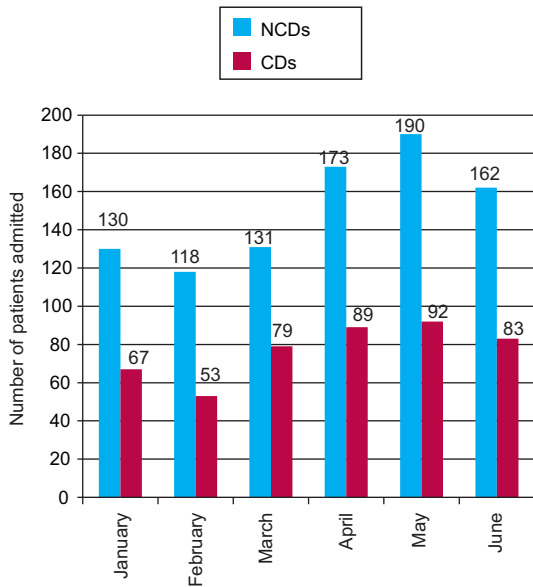
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Fig.-1: *Comparison of admissions due to non-communicable and communicable diseases*

There were several findings regarding the pattern of NCDs. Among the admissions due to NCDs, more than half (51.3%) were aged between 50 to 69 years (Table-II and Figure-2). In terms of pattern of disease, cardiovascular diseases were the number one cause for hospital admission followed by endocrine disorders (Figure-3).
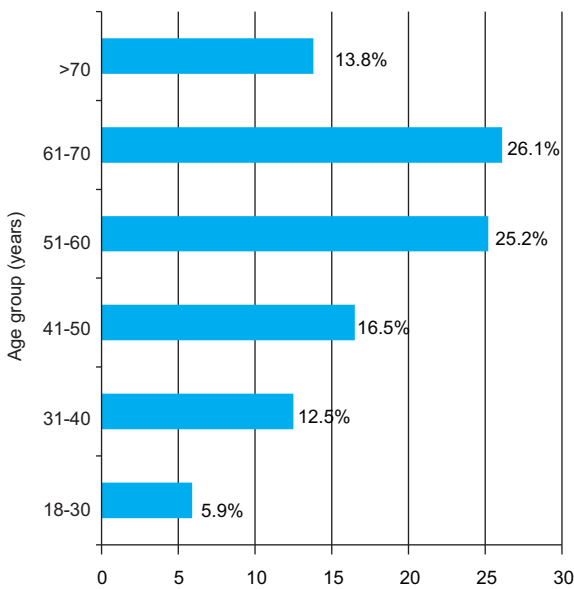

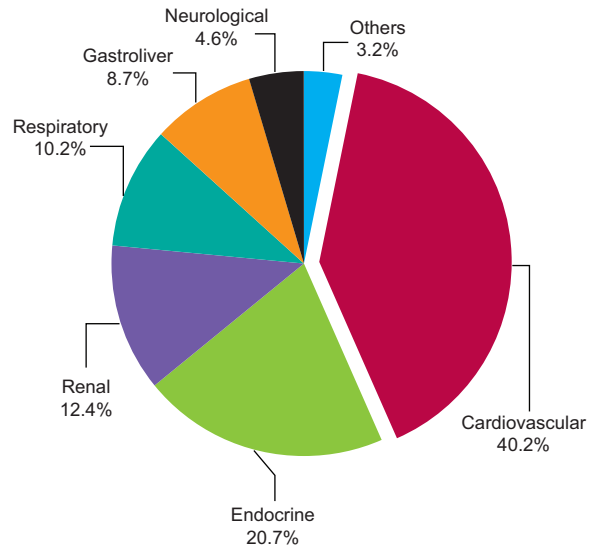**Fig.-2:** *Percentage of patients admitted due to non-communicable diseases by age groups*

Fig.-3: *Percentage of patients admitted due to types non-communicable disease*

Discussion:

This single-center, retrospective study found that NCDs account for 66.1% of total admissions and the number of cases of NCDs was two times more compared to CDs (ratio 2:1). A number of studies performed in low and middle income countries have also reported similar findings[7-11]. Kujur et. al. reported 56.5% admission cases due to NCDs in a tertiary care hospital of Ranchi, Jharkhand, India[7]. Whereas, Ogunmola et. al. found 68.4% NCDs admissions in the medical wards of a tertiary health center in a rural community of Ekiti State, Nigeria[8]. Excessive tobacco use,low intake of fruits and vegetables, physical inactivity,obesity, hypertension,high blood glucose, dyslipidemia all these factor are creating this huge burden of NCDs either isolated or in combination.

Advancing age is a strong non modifiable risk factor for most NCDs. In our study, more than half (51.3%) of admitted NCD patients were aged between 50 to 70 years. One study performed in Faridpur Medical College Hospital by Tarafder BK et al. also revealed similar findings[12]. So, the combination of longer lives and greater burden of NCDs is demanding new schemes and policy to mitigate the upcomjng outbreak.

Cardiovascular diseases were the largest contributor to NCDs in this study accounting for 40.2% of all the NCDs reported. Endocrine and renal diseases together constituted about a third of all NCDs in this study. Previously, Akubudike et. el. did a retrospective study in

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the medical ward of a tertiary center in Nigeria and reported same trend[13]. Again, evidences show that the detection and treatment rate of DM and HTN is inadequate among bangladeshi population .[14] So lack of awareness may contribute to this huge statistical data.

This study has some limitations. Notably, this is a single-center study and performed in an Upazila level hospital. So the results can not be generalized to the whole population of Bangladesh.The tenure of the study was also limited and as it was a retrospective study, there might be some patient selection bias . So Nationwide and large-scale studies are required to obtain more information regarding this matter.

Conclusion:

NCDs diseases account for significant cause of admissions in Upazila Health Complex, Chhagalnaiya, Feni and it appears to have an upward trend. Cardiovascular, endocrine and renal systems are the most affected systems. Though this study is a snapshot of NCDs, these findings could be useful to draw the attention of health authorities to adopt preventive strategies against NCDs even at Upazila level.

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Role of Exercise Tolerance Test in the Screening of Suspected Myocardial Ischemia in Bangladeshi Patients

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Abstract:

Background: Ischemic Heart Disease (IHD) is preventable and reversible if early screening and elimination of the risk factors like life style modification and dietary intervention can be done. Exercise Tolerant Test (ETT) has become an important diagnostic tool to evaluate patient with suspected or known case of ischemic heart disease.

Objective: To determine the frequency of IHD among subjects who presented with chest pain and to identify the common indications for ETT.

Methodology: It was a cross-sectional study; the data was collected from ETT Unit of Mugda Medical College Hospital, Dhaka, Bangladesh using standard Bruce protocol.

Result: Out of 200 patients, there were 124(61%) male and 78(39%) female who presented in the cardiology department for ETT. Common indications for ETT were evaluation of chest pain 180(90%), followed by general check-up 14(7%), post-PCI evaluations 4(2%) and post-CABG evaluation 2(1%).Presenting complaints were typical angina 12(6%), shortness of breath 56(28%), non-specific chest pain 82(41%), chest compression 46(23%) and others 4(2%). Exercise ECG showed no ST changes in 138(69%) patients. The most common risk factors were hypertension, diabetes, smoking and obesity. Majority of the subjects 136(68%) were test negative whereas 42 (21%) were test positive and 22(11%) were test equivocal.

Conclusions: It is concluded that most of the subjects presenting with the suspected symptoms of myocardial ischemia were negative for IHD, and so why we advocate the use of ETT as a screening tool in patients who presents with features simulating angina. This will prevent unnecessary hospital admission.

Key Words: Exercise tolerance test, myocardial ischemia, and angina.

Introduction:

Coronary artery disease (CAD) is a global health problem reaching an epidemic in both developed and developing countries and is the leading cause of mortality and morbidity world-wide[1,2]. The South Asian countries have among the highest incidence of coronary artery disease globally[3]. The prevalence of IHD is 6.8% in Pakistan and United States of America[4]. In the last three decades, the prevalence of CAD has increased from 1.1% to about 7.5% in urban population of Delhi, India and from 2.1% to 3.7% in rural population[5]. Data related to different

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aspect of CAD in Bangladesh are inadequate but it is highly prevalent in Bangladesh[6].The IHD is preventable and reversible if early screening and elimination of risk factors like life style modification and dietary intervention can be done[7]. ETT has become an important diagnostic tool to evaluate patient with suspected or known cases of heart disease[8].It is one of the least costly of all non-invasive investigation for the screening of IHD[9]. However, because of low sensitivity and specificity, it just provides a basis for further planning and clinical decision making regarding coronary angiography. The aim of this study was to determine the indications for ETT and to find out the frequency of subject with positive test for ischemia and angina.

Methodology:

This prospective observational study was carried out in the Department of Cardiology, Mugda Medical College Hospital, Dhaka, Bangladesh. Total 200 subjects were enrolled for the study from 1st January 2018 to 31st December 2018. The standard Bruce protocol was used to evaluation of ischemia and angina. The result was considered positive if horizontal or descending ST-segment depression was >=1mm or ST-segment elevation or inotropic failure appeared i.e fall of systolic arterial blood pressure>10mmHg. Similarly, test was considered negative if the sub- maximum heart rate (85% of the maximum expected rate for age) was achieved without angina or definite ischemic changes. The test result was considered equivocal when there was only minimum T-inversion without ST changes and no definite angina. Data were analyzed using SPSS software V17. Descriptive analysis was carried out for both continuous and discrete data. Basic clinical and procedural characteristics were analyzed.

Results:

Among total 200 patients, there were 122(61%) males and 78(39%) were females with age range from 28 to 85years (mean-46.84±10.56). Chest pain was the commonest indications (Table-1) and obesity was the commonest risk factor (Table-2). Baseline ECG was mostly normal with sinus rhythm (Table-3) and study of ECG changes during exercise reveal, no ST-changes in 90(45%) and acute ST-changes seen in 50(25%) (Table-4). Result of the ETT are summarized as following, ETT negative 136(68%), ETT positive 42(21%), ETT equivocal 22(11%) (Fig.2). Limiting factors during ETT performance mostly were THR achievement or SOB (Fig: 1). Most ST-changes are seen in lead II, III, aVf & V4-V6 (Table-IV) and no significant arrhythmia seen other than few

premature atrial 20(10%) and ventricular 10(5%) ectopic. All the ETT positive cases 42(21%) underwent for coronary angiography. Among them 32(16%) had significant coronary artery disease involving left main stem or left anterior descending artery whereas 10(5%) had normal coronary angiogram.

Table-I
Indications of ETT

Indications	Number	Percentages
Evaluation of chest pain	180	90%
Post-PCI evaluation	04	02%
Post-CABG evaluation	02	01%
General check-up	14	07%
	Total-200	Total-100%

Table-II
Known Risk factors

Risk factors	Number	Percentages
Hypertension	74	37%
Diabetes	60	30%
Dyslipidemia	40	20%
Smoking	50	25%
Obesity	104	52%
Family history	48	24%

Table-III
Resting ECG findings

Variables	Frequency	Percentages
Normal ECG	130	65%
Nonspecific T-changes	32	16%
T-inversion in leads II, III, aVf and V4-V6	04	02%
T-inversion in leads V1-V6	02	01%
RBBB	06	03%
PVCs	16	08%
PACs	08	04%
Others	02	01%
	Total-200	Total-100%

Table-IV

ECG changes during exercise

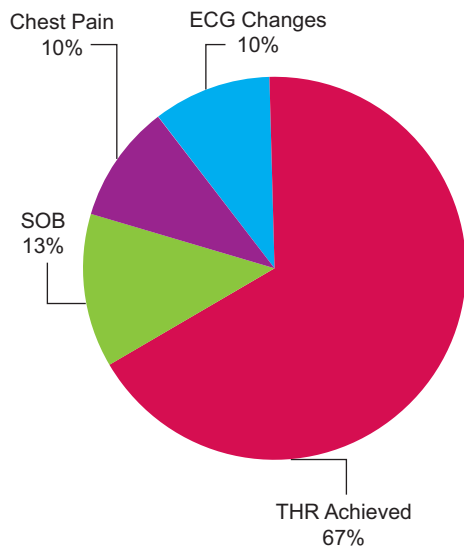| Variables	Frequency	Percentages
No ST changes	90	45%
Acute changes	50	25%
STchanges(significant/borderline):		
In lead II,III,aVf and V4-V6	28	14%
In lead I,aVl and V4-V6	10	05%
In lead V4-V6	06	03%
In lead I, aVl, V1-V6	06	03%
In lead I,aVl,II,III,aVf and V4-V6	10	05%
	Total- 200	Total-100%

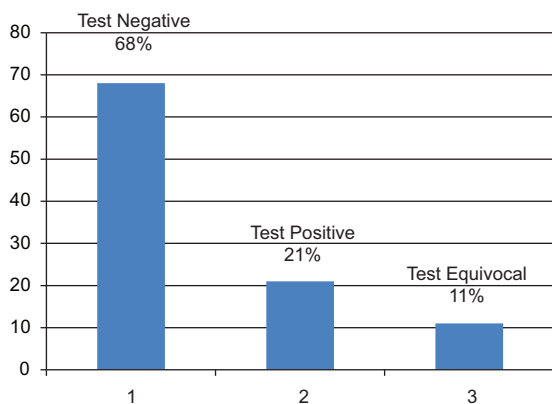**Fig.-1:** *Criteria for Termination of Tests (Limiting Factors)*

Fig.-2: *Impression of ETT*

Discussion:

Stress testing has been used since late 1920s as a convenient, non-invasive way to asses for exercise induced myocardial ischemia[10]. Stress testing with exercise or imaging has the greatest value in patient with a pretest intermediate risk for CAD. Stress testing can be performed with several modalities that can provide different type of information regarding diagnosis and prognosis. Several studies may be considered, including coronary calcium calcification (CAC) scoring, coronary computed tomography angiogram (CCTA), stress testing with and without an imaging modality, and catheterization (not usually the initial screening test).An ETT can be used to assess tolerance of increased activity with continuous ECG monitoring, as well as hemodynamic response and symptoms. This test is well established, inexpensive, and easily available. In addition to providing information regarding exercise-induced ischemia, ETT also offer information regarding exercise capacity and functional status. The stress portion of the test can be conducted with exercise or medical therapy, and imaging modality may be appropriate for some patients. Exercise testing has a sensitivity of 78% and specificity of 70% for coronary artery disease detection and cannot be therefore be used to rule in and rule out IHD unless the probability of coronary artery disease is taken into account. In a low risk population, like men less than aged 30years and women less than 40,a positive test result probably is a false positive than true negative and add little new information. In a high risk population, like those aged over 50 years with typical angina symptoms, a negative result cannot rule out IHD, though the results could also be of some prognostic value[11].Exercise induced chest discomfort without associated ECG changes may be the only signal that obstructive coronary artery disease is present[12]. It was noticed that changes in ECG like ST-segment depression or T wave inversion also affect the test result. A completely normal ETT has been reported to be a good prognostic indicator in diabetic patients[13]. The leading cause of mortality in patients with diabetes is cardiovascular disease (CVD), when it does occur, CVD in diabetic patients is more severe, more complex, and results in higher complication rate than in patients without diabetes[14]. In our study, diabetes was present in 60(30%) patients. Compared with such imaging procedures as CCTA, echocardiography, and stress single photon emission computed tomography (SPECT) myocardial perfusion imaging, the ETT is very cost effective. Although it remains controversial to screen asymptomatic patents, screening patients with limited functional status is

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probably a reasonable approach for people moderate to high risk of underlying CAD. An ETT can be safe and effective initial screening test in patients who can exercise and have a normal baseline ECG. The ETT is preferable to a pharmacological stress test because it represents better cardiac strain with daily cardiac activity and thus depicts the heart's actual workload. Also patients have the advantage not to get exposed to ionizing radiation and contrast. The more recently developed non-invasive, multi-slice CT-angiography is still recommended to rule out coronary artery disease, but has the associated risk of high radiation exposure and is not cost effective[15]. An estimated 1 in 270 women who underwent CT coronary angiography at age 40 will develop cancer from radiation exposure during that CT, compared with an estimated 1 in 8100 women who had a routine head CT scan at the same age[16]. This was the reason, we chose the ETT as a screening tool in our study. It is also very popular as a screening test for IHD in the other countries of this sub-continent. In a study done in Pakistan by Imran Khan et al [19] showed that out of 200 patients majority of the subjects 148 (74%) were test negative for IHD and angina, whereas 36 (18%) had test positive for ischemia and angina. The finding is very similar to the result of our study. In 1988 ADA Consensus Development Conference on the diagnosis of coronary artery disease in people with diabetes recommended performing stress screening for coronary disease in asymptomatic patients with 2 or more cardiovascular risk factors (smoking, arterial hypertension, hypercholesterolemia, family history of premature CAD, microalbuminuria)[17]. However, recent studies have shown that the presence of traditional risk factors did not help to identify asymptomatic with a higher prevalence of coronary artery disease[18]. We did ETT in all patients regardless of age and risk factors that can be a limiting factor in our study.

Conclusion :

An exercise stress test would help to better assess exercise tolerance, a strong predictor of mortality, as well as hemodynamic response to activity. Our study concludes that most of the subjects presenting with symptoms simulating myocardial ischemia were negative for ischemic heart disease and angina. So our recommendation is that, to prevent unnecessary hospital admission, ETT must be done on patients presenting with signs and symptoms simulating angina.

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Original Article

Use of Suture tightening automated device COR-KNOT® for minimally invasive heart valve surgery: Our initial experience in Bangladesh

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Abstract:

Background: COR-KNOT® (LSI Solutions, New York, NY, USA) is an automated suture securing device has not been well known. We report a case series for first automated knotting device used for minimally invasive heart valve surgery in Bangladesh.

Method and Results: To overcome the challenge of knot securing via a Key-Hole surgery we have used COR-KNOT®. The newest device is capable of remotely and automatically secure sutures and simultaneously can cut and remove the excess suture tails. We covered the spectrum of heart valve surgery: There was one case of bioprosthetic aortic valve replacement, one case of mitral valve repair, one case of bioprosthetic mitral valve replacement, one case of failed mitral valve repair with COR-KNOT® explantation followed by mechanical mitral valve replacement and one case of redo-mitral valve replacement. Average length of hospital stays was 5 ± 1days. There was one reopening, one post-operative atrial fibrillation. No wound infection and no 30day mortality.

Conclusion: We conclude, COR-KNOT® is a safe and effective tool to reduce the duration of operation. Clinical outcome of heart valve surgery with COR-KNOT® is comparable with other methods of suture tying methods.

Keywords: COR-KNOT, Minimally invasive heart valve surgery

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Introduction:

One of the basic skills of a surgeon is suturing and knot tying. To perform knot tying however, can be a tedious and time-consuming especially in minimally invasive heart valve surgery. This difficulty is largely related to the limited working space, limited degree of freedom for movement of surgical instruments. Hence, suture fixation is the main hindrance for surgeons in minimally invasive heart valve surgery[1].

Usually during a heart valve repair or replacement surgery, a swing ring or band is stitched and secured around the annulus. In most of the commercially available prosthetic heart valve, there is an incorporated swing ring. Commonly, surgeons takes 12 to 15 pledgeted braided interrupted mattress stitches around the ring of the valve and then fasten the sutures by hand-tying knots. Especially in minimally invasive heart surgery, where access is difficult, surgeons hand cannot reach the operation site. A knot-pusher instrument is used if the operative field is beyond the reach of the surgeon's hand, which requires more time to secure the knots.

COR-KNOT® is an automated suture fastener recently proposed for valvular surgery. The COR-KNOT® device is designed to make suture fixation faster and to save operation time[2]. A titanium occluder remotely and automatically secures sutures with a single squeeze of the built-in lever. At the same time the device also trims the excess suture tails[2].

The COR-KNOT® is a relatively new device developed to replace suture tying with a faster procedure during surgery. Preclinical studies confirmed the safety and security of COR-KNOT® use[3], but there is not enough clinical studies have described the safety of COR-KNOT® as a suitable alternative to conventional hand-tied knots. Most of the initial reports on COR-KNOT® were addressing its potential disadvantages like bioprosthesis leaflet perforation[4], Paravalvular leakage[4] and delayed distal embolization[5]. Only a few addressed the potential benefits like time savings in cardioplegic arrest and cardiopulmonary bypass[6].

Limited number of clinical studies presented the ergonomic advantages COR-KNOR® during minimally invasive cardiac surgery. Here we report a series of cases with the very first use of COR-KNOT® in Bangladesh.

Method:

Case Selection: The cases were initially selected according to the following: 1) Elective cases for minimally invasive single heart valve surgery, 2) Valvular intervention and candidacy were determined by ESC/EACTS guidelines[7], 3) All concomitant cardiac surgery patients were excluded from the study 4) All patients was evaluated preoperatively by a Heart team consisting of Cardiac Surgeons, Cardiac Anesthesiologist, Interventional Cardiologist and Cardiac Radiologist team. All information was collected retrospectively from patient's medical record and over phone interview. Therefore, there was a 6 months to one year follow up of each patient. An informed consent was obtained from each patient.

Thansthoracic and Transesophageal Echocardiography: All patients underwent standard preoperative 2D and colour Doppler transthoracic echocardiography (TTE) and all parameters were measured according to American Society of Echocardiography guideline[8]. Routine transesophageal echocardiography was done per-operatively in all cases by using Philips® Affinity 50 ultrasound system with S7-3t TEE probe in 7-3MHz frequency by the cardiac anesthesiologist.

CT Scan of Chest: CT scan of thorax, abdomen and pelvis with the upper part of the thigh was done routinely. CT images were acquired in a dual-source 64 slice CT scanner (Siemens® Healthcare, Germany) and evaluated by a radiologist blinded towards the study. CT images were evaluated preoperatively for decision making regarding the surgical approach and femoral vessel assessment for Cardiopulmonary bypass cannulation strategy.

Statistical Analysis: Continuous variables were assessed by Mean ± Standard Deviation and categorical data were presented as the number and percentage. All analysis was performed using SPSS 16.0.

Technique:

Five patients had different pathology mostly having rheumatic heart disease. All the mitral valve were approached through a mini left thoracotomy and cannulated via right femoral vessels using EOPA® and multistage Medtronic® femoral venous cannula. The Aortic valve was approached an upper-J mini-sternotomy and central cannulation technique. Mitral valve cases were ventilated with one lung ventilation (OLV) using double lumen endotracheal tube. The right lung was selectively isolated during the procedure. Cardioplegia was delivered through MiAR™ aortic root cannula. All patients received DelNido long acting cardioplegia for myocardial protection.

Our first patient has an isolated chordal rupture with prolapsed P2 resulting in severe mitral regurgitation. Triangular resection, artificial chordoplasty with ePTFE 4/0 suture and mitral ring annuloplasty was done successfully. 28mm Physio-II Mitral annular ring was

secured with 12 interrupted braided sutures. Out of these 10 were secured with COR-KNOT® device with automated metallic clips (Figure-1) and rest were hand-tied with knot pusher.

Fig.-1: *Automated metallic clips at mitral ring delivers via COR-KNOT® device.*

The Second patient had an A2 segment prolapse with rheumatic subvalvular changes. A mitral valve repair was attempted with artificial chordoplasty and mitral ring annuloplasty with a Physio-II ring. Initially, 9 COR-KNOT® were used to secure the ring at mitral annulus. Peropertive Transesophageal Echocardiography showed moderate residual leakage was identified. Re-exploration and COR-KNOT® explantation was done. Mitral valve replacement was carried with a 29mm SJM mechanical prosthesis in this young lady. This time 4 COR-KNOT® were used to secure the valve in place and rest other pledgeted stitches were hand-tied by using knot-pusher.

The 3rd case was of severe calcified mixed aortic stenosis and regurgitant. He had a mini sternotomy and Trifecta™ bioprosthetic heart valve replacement. He had 9 COR-KNOT® clips in aortic annulus and rest 3 hand-tied knots at the three aortic commissures. The subsequent case was an elderly lady with severe mitral stenosis due to rheumatic heart disease. We replaced the mitral valve with a SJM Epic™ 29mm stented tissue valve. In this case 12 COR-KNOT® were used to secure the heart valve, rest 4 were hand-tied sutures tied with knot-pusher device.

The last case was a Redo-Mitral valve replacement in a rheumatic mitral re-stenosis patient. This lady had an open mitral commissurotomy done 20years ago. With a similar fashion we approached in this case, replaced the mitral valve with a 29mm SJM mechanical prosthesis. Here 10 COR-KNOT® automated clips were used and rest were hand-tied. The biggest hurdle in such case was to mobilize the cardiac apex, which remain stuck with the pericardium and defibrillation via the small thoracotomy. Hence, we recommend the use of external defibrillator pads to be used in such case.

Results:

First 5 patients with valvular heart disease who underwent valve repair or replacement surgery in a minimally invasive fashion with a Key-hole approach where the knot security were ensured by using automated knotting device - COR-KNOT®. First 2 cases were done at National Heart Foundation Hospital & Research Institute, Dhaka on 3rd December 2015 and subsequent 3 cases were carried out at Ibrahim Cardiac Hospital & Research Institute, Dhaka on 5th & 6th February 2017. Total 54 shots of metallic automated knots were used in 5 different cases delivered via COR-KNOT® delivery system. Patient demographics and preoperative baseline characteristics are shown in Table-1.

Overall, preoperative CT (Thorax, abdomen and pelvis) showed valvular calcification. Ascending aorta and femoral vessel were also assessed for safe cannulation strategy. Preoperative Transthoracic Echocardiography (TTE) was a part of routine test which was confirmed an on table high resolution Transesophageal Echocardiography (TEE). The result of both the echo was comparable, but the postoperative TEE was much helpful in assessing the repaired heart valve and confirmation of de-aeration of the cardiac chambers.

In all cases a serial documentation of the peri-operative and early postoperative data was done, which is displaced on Table-2 along with the postoperative complications. In this case series there was no use of IABP or any other supporting device. Only one patient developed postoperative new onset atrial fibrillation which didn't require any additional anticoagulation. All

cases 2 chest tubes were inserted; for mitral valve cases one on the right pleural space and the other used to drain mediastinum. Whereas for the aortic valve case we used both mediastinal drains.

Table-I
Preoperative baseline characteristics

Preoperative characteristics	N=05
Age (yrs)	53 ± 6
Women (%)	3 (60)
Body mass index (kg/m2)	24.3 ± 3
NYHA classiûcation III/IV (%)	3 (60)
Diabetes mellitus (%)	1 (20)
Hypertension (%)	4 (80)
Dyslipidaemia (%)	1 (20)
Previous MI (%)	0 (0)
Previous cardiac surgery (%)	1 (20)
Peripheral artery disease (%)	1 (20)
Previous stroke (%)	1 (20)
Permanent Pacemaker (%)	0 (0)
COPD (moderate/severe) (%)	0 (0)
Haemoglobin level (g/dL)	11.3 ± 1
eGFR (mL/min/1.7m2)	46 ± 13
Antiplatelet	2 (40)
Anticoagulant	4 (80)
Beta-blocker	3 (60)
Transthoracic echocardiography (TTE)	
Ejection fraction (%)	52.3 ± 10
LVIDd (mm)	59.1±4.35
LIVDs (mm)	48.21 ±4.2
PASP (mm Hg)	39 ± 10

NYHA = New York Heart Association; MI = Myocardial infraction, COPD = Chronic obstructive pulmonary disease; eGFR = estimated glomerular ûltration rate, PASP = Pulmonary systolic artery pressure

All patients were discharged as they improved and there was no wound related complication and no death was reported in 30 days. We reviewed the entire patient in postoperative follow up clinic with a TTE at 1month, 6months and one year. There was no paravalvular leak; no treatable pericardial effusion and no prosthesis damage were noted. One patient was readmitted at 3 months follow up due to high INR and discharged after a better titration achieved. One patient in the series died after one and half year due to pregnancy related complication.

Table-II
Perioperative variables and complications

Peri-operative characteristics	N=05
Cross-clamp time (min)	78 ± 9.6
CPB time (min)	110 ± 15.6
AV block (%)	0 (0)
Need for PPM (%)	0 (0)
Wound Infection (%)	0 (0)
Stroke (%)	0 (0)
TIA (%)	0 (0)
New onset AF (%)	1 (20)
Re-exploration for bleeding (%)	1 (20)
Major vascular complication (%)	1 (20)
Peri-operative MI (%)	0 (0)
Acute Renal Failure (%)	0 (0)
Prolong ventilation (>12hr)	1 (20)
Amount of blood loss (ml)	180 ± 32
Length of ICU stay (day)	2.1 ± 0.9
Length of Hospital Stay (day)	5 ± 1
Readmission for pleural drainage	0 (0)
Deep Vein Thrombosis	0 (0)
Mortality (30 days)	0 (0)

CPB = Cardiopulmonary Bypass, AV = Atrio ventricular, PPM = Permanent pace maker, TIA = Transient Ischemic attack, AF = Atrial Fibrillation, MI = Myocardial infraction, ICU = Intensive Care Unit

Discussion:

The purpose of this case series to access the clinical characteristics and outcome of automated metallic occluder delivered via COR-KNOT® device. The safety and efficacy of COR-KNOT® was questioned[9] in some cases of heart valve replacement surgery; especially with the use of bioprosthesis. In our series we didn't experience such complications up to one year postoperative follow up. The present study population although minimum but covered most of the spectrum of heart valve surgery. These cases were selected prospectively to comply with the learning curve and as a part of the preceptorship program lead by a team from National University Hospital, Singapore. And the cases were selected on basis of the incremental difficulty; however the outcome was excellent and suggested the feasibility to introduce new technology in Bangladesh.

The use of COR-KNOT® was proven in Ex-vivo model[10] in terms of its sutures security, strength, and consistency and it was found faster than manually tied knots while anchored and tested in mitral ring annuloplasty. COR-KNOT® in our cases was clearly able to reproduce the equal outcome compared to hand-tied knots. Some

more, it exhaled the use of knot-pusher. We made a mix of the use of knot-pusher, hand-tired knot and COR-KNOT® in all cases for two reasons. Firstly to keep the attending surgeons to learn the different ways to knot security in Key-Hole heart valve surgery. Secondly, different knot security was clinically evaluated by transthoracic echocardiographic assessment in the same patient at the same time.

However, variable distribution of pathological lesions in our series lead to a different range of surgical accomplishment. It proved the efficacy of COR-KNOT® for heart valve repair, replacement and redo cases. The use of combination of CT scan and preoperative-peroperative-postoperative follow up echocardiography was useful to unravel the clinical outcome of the prosthesis. Nonetheless, this first study in Bangladesh depicts the successful clinical outcome of the COR-KNOT® in heterogeneous rheumatic heart valve patients.

Looking at the duration of operation and hospital stay was not more than the conventional cases of heart valve surgery in our study. Candice et al. has shown a clear benefit of titanium fastener use[10]. They reported shorter knotting time, aortic crossclamp time, cardiopulmonary bypass time, shorter duration of operation with fewer intraoperative complications in a randomized clinical trial in open aortic valve replacement.

Conclusions:
We conclude, COR-KNOT® is a safe and effective tool to reduce the duration of operation. This device is a time-saving secret in heart valve surgeries, especially in minimally invasive settings. Clinical outcome of heart valve surgery with COR-KNOT® is comparable with other methods of suture tying methods.

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Robert H. Goetz: A Heritage of Coronary Artery Bypass Surgery

Md. Anisuzzaman[1], Nazmul Hossain[2]

Abstract:

Robert H. Goetz performed the first successful clinical coronary artery bypass operation on May 2, 1960. He used a nonsuture technique to connect the right internal mammary artery to the coronary artery by means of a modified Payr's cannula made of tantalum. The patency of the anastomosis was demonstrated angiographically and the patient remained free of angina pectoris for 1 year. It was an important and brave step forward, a step that was far ahead of its time. But unfortunately, his pioneering work was not appreciated properly.

Keywords: Coronary artery; Heritage bypass surgery

Introduction:

Coronary artery bypass operation is one of the most significant surgical achievements of the 20th century. Many surgeons put their efforts for successful implementation of the procedure. The names of Carrel, Vineberg, Kolesov, Favaloro, DeBakey are well known for their contribution. But, Robert H. Goetz, Professor of surgery at the Albert Einstein college of Medicine (Bronx, New York) who performed the world first successful coronary artery bypass surgery.[11] Only few know this fact, and even fewer know the fascinating biography of life of Dr. Goetz.[1]

Early history to improve myocardial blood supply:

On May 5, 1910, Alexis Carrel described the first attempt of coronary artery bypass in dog using a segment of the carotid artery.[14] Carrel's attempt was to be fulfilled first by Demikhov in experiment and then by Goetz in clinic. In 1945, Arthur Vineberg first used internal thoracic artery as a conduit in experiment and implanted directly into myocardium to improve myocardial perfusion.[9,13]

In the beginning of the 1950s many surgeons attempted experimentally to anastomose ITA to the coronary artery and success was achieved simultaneously and independently by Vladimir Demikhov in Russia[10] and Gordon Murray in Canada.[12]

On July 29, 1953, Demikhov performed the first successful coronary artery bypass with Payr's cannula. Four dogs survived more than 2 years and patency was demonstrated in each.[8] However, Goetz was not aware of Demikhov's work.

In late 1950s Dr. Goetz begin his experiments and it was encouraging. Then he determined to perform the first successful coronary bypass operation in a patient. It is interesting to describe the journey of Dr. Goetz life that prepared him for this success.[11]

Journey of Dr. Goetz:

Robert Hans Goetz was born in Frankfurt on April 17, 1910, into the family of sculptor Johan Konrad Goetz and his wife Emilie. He spent the years of the first world war with his grandparents in a small village in the black forest, the school of which consisted of one room and a teacher for all grades. He easily passed an examination and was accepted to Helmholtz Ober real Schule upon his return to Frankfurt after the war. After matriculation in 1929, he started to study medicine at the university of Frankfurt and got highest grade in first semester. In the second semester under Dr Albrecht Bethe, Professor of

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physiology, studying the peripheral circulation using arm plethysmograph (Fig 1). Goetz struggled sometimes with the device then come up with a better device- a digital plethysmograph with optical recording. And with this device he could accurately record changes of peripheral blood flow with each heartbeat. Still a student he published the method, at the urging of Professor Bethe, in the Klinische Wochenschrift, one of the most prestigious German medical journal in 1935, the article was accepted as his thesis for his MD degree. Though Goetz passed the MD exam, he did not get his medical diploma because the Nazi minister of the interior declared him politically unreliable. The diploma was issued to Goetz in 1997, exactly 62 years later.

Fig.-1: *Robert H. Goetz in Bethe's laboratory in 1932.*

At the end of 1933, his dream of studying medicine came to an abrupt end. The Nazi bosses took over by means of decrees and regulations, all intended to make it impossible for Jews and other undesirables to continue to study medicine. At that time all the students were forced to join the National Socialist Student Organization. In September 1934, Goetz passed the final examination. The first he did was to resign from NS student Organization. And then the minister of the interior declared him politically unreliable and refused to grant him both medical license and medical diploma. He felt that it was better for him to get out of Germany and left for Switzerland with ten marks in pocket and no papers to show that he was a qualified physician. Luckily his former Professor Dr. Hans Bluntschli, who had been thrown out of Germany by Nazis, knew him and gave him a job as assistant in

his department and working there to study placental circulation. The results of this study were accepted for thesis for the MD degree. When his research found its way into the 1936 edition of Starling's Textbook of Physiology, it opened the door to join the Department of Physiology at the Edinburgh University for one year. And joined at Professor De Burg-Daly's department in Edinburgh and began investigations into the control of the circulation of the intestine. As the year in Edinburgh was coming to an end, he saw just by chance on the blackboard at the dean's office an advertisement by the University of Cape Town, South Africa offering a research fellowship in the department of surgery. And his application was accepted and joined in October 1937. In 1938, Groote Schuur hospital was opened. By 1940, Goetz got a vascular laboratory there. Goetz did not have access to the patients. The South African Medical Council did not recognize his German or Swiss degree. In 1944, he passed the exam (MB, ChB, Cape Town) and finally become licensed physician. By 1945, Dr Goetz received a fully blown Unit of Vascular Diseases. When South Africa joined the WW-II at the side of England, Goetz suddenly became an enemy alien and his movements were severely restricted and he had to report regularly to police. In the meantime, Cape Town appointed him Associate professor of surgical Research, got his own department and unit for Vascular Diseases at Groote Schuur Hospital.

In 1940s, there was an intense interest in the cause of hypertension. Goetz studied the physiology of giraffe and his team undertook two expeditions in 1954 and 1956. The result was presented at the International Congress of Physiology in Brussels, earned the Vesalius medal.[4]

In 1950s ,Goetz become an internationally recognized authority in the field of circulation. His various studies were published in the British Journal of surgery, the American Heart Journal, and The Lancet. Goetz lectured extensively and his contributions to the field were diverse, from Raynaud's phenomenon to heart transplantation. By 1945, Goetz seen unusual number of Raynaud's phenomenon with scleroderma with visceral lesions not reported in the literature. The heart, the lungs, intestine, kidneys were all affected. It was in the Goetz laboratory that Lionel Opie worked up the pulmonary changes in progressive systemic sclerosis(PSS) with special reference to pulmonary hypertension. Dr Opie's paper own the top prize in a competition organized by the American College of Chest Physicians and earned him a trip to Oxford that started him on his scientific career.[4] After Goetz's appointment in Groot Schuur Hospital, he established Peripheral Vascular Clinic there in 1946. The

whole world knows the name of Christiaan Barnard (Fig 2), who performed the first human heart transplantation at Groot Schuur Hospital in 1967 and became the world's hero overnight. Yet, only few know Goetz, a man who worked hard to bring academic surgery at Groot Schuur hospital up to the highest possible level. However, it was Goetz's work on coronary artery bypass surgery that assured immortality for his name (Fig 3).

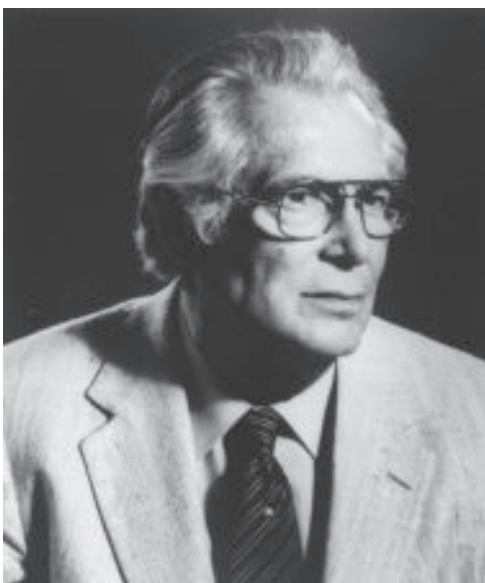**Fig.-2:** *Robert H. Goetz and Christiaan Barnard in 1962.*

The First Successful Clinical Coronary Artery Bypass Operation:

The world saw the beginning of vascular surgery in early 1950's. It was also the time Goetz came to America and became Associate Professor of Surgery at the Albert Einstein College of Medicine in 1957 and a full Professor and attending surgeon at Bronx Municipality Hospital in 1961. He held both positions until his retirement in 1982.[1]

At that time, it seemed to him that everyone was engaged in searching for methods to improve myocardial blood supply. Their cardioplegia did not guarantee dog's survival, so chose to carry out the operation on the beating heart. At this stage, Dr. Stephen Rosenak, one of his general surgical staff suggested to use Payr'sring and they did it in dogs and patency of anastomosis proved on angiography after six months.[11]

What followed next was the world's first successful clinical coronary artery bypass operation. In his experimental study published in 1960, Goetz described the technique in much detail. When the article was submitted for publication, a coronary mammary anastomosis between the right mammary and right coronary artery using tantalum ring successfully performed on a 38 year old patient, who was a cab driver at Van Etten Hospital, Bronx Municipal Hospital Center, New York, on May 2, 1960. (Fig 4)[1,7]
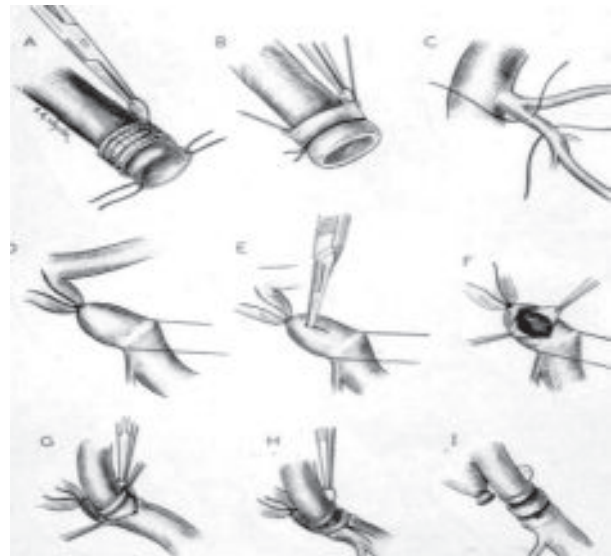

Fig.-3: *Robert H. Goetz in 1989*

Fig.-4: *Technique of nonsuture coronary-mammary anastomosis by Dr, Goetz in May 2, 1960.*

Table-I
The First Clinical Coronary Artery Bypass Operations

Date	Surgeon	Graft	Technique	Follow-Up
May 2, 1960	Goetz	RITA	Tantalum ring	No angina at 1 year
				Pt. died of AMI 1.5 years later
April 4, 1962	Sabiston	SV	Suture	Pt. died 3 days later
				(This case first reported in 1974)
Feb 25, 1964	Kolesov	LITA	Suture	No angina at 3 years follow-up
Nov 23, 1964	Garrett	SV	Suture	No angina at 7 years follow-up
	Dennis			(This case first reported in 1973)
	DeBakey			
March 22, 1967	Kolesov	LITA	Stapling	No angina at 3 years follow-up
May 9, 1967	Favaloro	SV	Suture	Successful
Feb 29, 1968	Green	LITA	Suture	Successful

AMI-acute myocardial infarction,LITA-left internal thoracic artery, RITA-right internal thoracic artery, SV-saphenous vein

Before operation, the patient needed 70 to 90 tablets of nitroglycerine tablets. The operation was carried out through midsternotomy incision. The stented anastomosis was constructed within 17 seconds but it took Dr. Goetz 50 years to arrive to this point. Angiography performed on 14th postoperative day showed the patency of stented anastomosis.

Between May 6, and June 12, 1961, he was treated for recurrent angina pectoris and congestive heart failure at New York Cardiac Home, Yonkers, NY, and discharged with improvement and the cardiologist who examined the patient mentioned that, "the patient had had coronary artery surgery on May 2, 1960, but the exact procedure which was performed can only be guessed." The patient died at Jacobi Hospital, Bronx, NY, on June 23, 1961, of a posterior myocardial infarction.[3]

Ironically, it was not only the first clinical coronary artery bypass of Dr Goetz, but also the only, and the last one. Goetz was far ahead of his time. The introduction of coronary bypass operation created a great deal of anxiety. As it happened with most new procedure like that of me in 2009, when I wanted to operate a case of atrial septal defect closure through RVIAT (Right Vertical Infra-Axillary Thoracotomy) and some of my senior Professors strongly against the procedure. But they congratulated first than the others, when I completed the procedure. I must thank my Professor Dr. Golam Kibria in this regards to support me at that time. But Dr. Goetz could not proceed due not only to violent prohibition of his medical collegue Dr. Jordan but also his chairman who told him to concentrate on vascular surgery and appointed a cardiac surgeon without consulting him. Goetz pioneering work is remarkable, particularly when it is remembered that it took almost 4 years until Kolesov performed a successful coronary artery bypass operation in Russia[7,8], and 7 years before Favaloro[2] and 8 years before Green did so in America (Table 1)[6]. In 1962, Sabiston performed an unsuccessful coronary bypass and this case was reported in 1974. In 1964, Garrett, Dennis, and DeBakey performed a successful coronary bypass and did not report this until 1973.[5]

The world was reluctant to accept the new operation even in the end of the 1960s. Favaloro also encountered many difficulties with more conservative colleagues. Resistance was not unique in USA, when Kolesov reported his results in 1967 to the cardiology society of Russia, the society accepted a resolution that "The surgical treatment of coronary artery disease is impossible and has no prospects in the future". Thus Goetz's operation performed in 1960 seemed unthinkable.

Conclusion:

The coronary bypass operation has evolved from the procedure that "can only be guessed" to one of the most frequently performed operation today. Goetz had a remarkable ability to stay focused on his work. He did what he believed was right, honorable, and of benefit to humanity.

It might be a pleasant surprise for German surgeons to learn that the first coronary bypass operation done by a German. Many American surgeons might be happy to know that it was carried out in America. South Africans might think that they have one more country man of whom to be proud. However, above all, it is gratifying for all of us to see in Goetz a great example of creativity, bravery, and

integrity, the qualities that every academic surgeon should emulate.

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Peripheral Vascular Disease: A Contemporary Review

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Abstract:

Peripheral Vascular Disease (PVD) is an emerging public health problem in Bangladesh that has tremendous social and economic implications. Unfortunately, there is a general lack of adequate understanding about this disease among primary care physicians and common people. This is why patients present late to vascular care which poses significant difficulties in the treatment and increases cost burden. Late presentation also increases the rate of limb loss. Treatment of PVD is rapidly evolving with the advent of endovascular modalities. The article provides a review of the basic aspects of PVD as well as the present status of care.

Keywords: Peripheral vascular Disease; Vascular; Endovascular

Background and Epidemiology:

Peripheral Vascular Disease (PVD) refers to narrowing (stenosis/occlusion) of peripheral arteries of the body. This includes arteries of essentially all areas of the body except those in the heart and brain. The terms Peripheral Arterial Occlusive Disease (PAOD) and Peripheral Arterial Disease (PAD) are used synonymously for the same disease condition. PAD is closely related to advancing age and there is a male preponderance which means it is more likely to affect elderly male. The prevalence of PAD- as defined by an ankle brachial index (ABI) of <0.90 ranges from 2.5% in the age group 50-59 years to 14.5% in subjects >70 years.[1-3] According to a recent study based on outpatient data, the prevalence of PAD in the US population more than 65 years of age is 11.8% and the incidence 22.4 per 1000 person-years.[4] A recent epidemiological study from Sri Lanka reported the incidence of PAD among general population aged between 40-74 years at 3.6% with no significant gender difference [5]. Worldwide, the disease affects nearly 2% of general population over the age of 40 years. No epidemiological data on PAD is available for Bangladeshi population. However, unpublished data from the National Institute of Cardiovascular Diseases (NICVD), Dhaka suggest that one in every 3 patients seen at the vascular outpatient department suffer from PAD. It is estimated that nearly 50% of the patients suffering from Coronary Artery Disease (CAD) also suffer from PAD and *vice versa*.

Clinical Features:

PAD may remain asymptomatic or may be associated with subtle, non-specific symptoms. Physical examination may reveal subclinical disease in these patients. Earliest manifestation of PAD is intermittent claudication that is patients experience pain in the leg on walking which is relieved by rest. Symptoms like rest pain and tissue loss such as non-healing ulcer ad gangrene are manifestations of more advanced disease. Severity of PAD has been described according to two well-known classifications. Rutherford classification divides the disease spectrum in to 6 stages while Fontaine classification describes the same in 4 categories[6,7,8].

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Fontaine and Rutherford stages of PAD:

	Fontaine	Rutherford		
Stage	Clinical	Grade	Category	Clinical
Stage I	Asymptomatic	0	0	Asymptomatic
Stage IIa	Mild claudication	I	1	Mild claudication
(Intermittent claudication after >200 meters of PFWD)		I	2	Moderate claudication
IIb	Moderate to severe claudication	I	3	Severe claudication
(Intermittent claudication after <200 meters of PFWD)		II	4	Ischemic rest Pain
Stage III	Ischemic rest pain	III	5	Minor tissue loss
Stage IV	Ulcers/gangrene	IV	6	Ulceration or gangrene

PFWD: Pain free walking distance

Critical Limb Ischemia (CLI):

Critical Limb Ischemia (CLI) also known as Chronic Limb Threatening Ischemia (CLTI) refers to severe ischemia of the limb manifested by rest pain and or tissue loss. Such cases belong to stages 4 through 6 of Rutherford classification and stages 3 and 4 of the Fontaine classification. Natural history of claudicants over 5 years includes worsening of claudication in 20% patients and development of critical limb ischemia in 5-10%; 5-10% of patients will die because of cardiovascular problems. In CLTI patients, however, 30% end up with amputation, 20% die and only 40% patients will be alive with both limbs intact at 1 year. [9,10]. Estimated annual incidence of CLTI is 220-3500 cases per 1 million persons with a prevalence of 1-2%. Among known PAD patients, prevalence of CLTI may be as high as 11%. In fact, 5-10% of asymptomatic PAD patients or those with claudication will progress to CLTI over a period of 5 years. Unless urgently intervened, the rate of limb loss is as high as 40% in this group of patients [8]. According to a German registry involving 40,000 PAD patients, two-thirds of those belonging to CLTI had their limb amputated within 4 years after diagnosis.[11,13]. In Bangladesh, most of the PAD patients present in advanced stages of CLTI with features of tissue loss (Figure 1).

Etiology and Risk Factors of PAD:

Major risk factors for PAD are the same as those for CAD. They are; Hypertension, Diabetes Mellitus, Dyslipidemia and Smoking. Additionally, factors like male sex, age, hypercoagulability, hyperhomocystinemia, chronic renal failure also play important role.

Hypertension is associated with a two to three-fold increased risk of PAD. Current recommendations of target BP is less than 140/90 mm Hg in high risk group. For those with diabetes and renal insufficiency, the target is even lower- less than 130/80[14].

The association between DM and PAD is well known. Study has shown that there is a 28% increase in the risk of atherosclerotic PAD for each incremental 1% increase in glycosylated hemoglobin. Current guidelines from American Diabetes Association recommend a hemoglobin A1C level less than 7% with a goal to maintain glucose level close to normal[14].

Serum total cholesterol level higher than 200 mg/dl especially in combination with a low high-density lipoprotein (HDL) fraction (<40 mg/dl in male and <50 mg/dl in female) has been shown to be associated with increased risk of cardiac-related events.

Smoking is arguably the most important risk factor for lower extremity ischemia. Progression of claudication to CLTI is delayed with cessation of smoking. Nicotine inhalation has been shown to reduce HDL cholesterol, promote platelet aggregation, decrease prostacyclin and promote vasoconstriction- thus contributing to progression of atherosclerotic disease. Studies on patients with peripheral arterial revascularization have shown that the incidence of graft failure is three-fold higher in those who failed to quit smoking.

Increased serum homocysteine level has been postulated as a risk factor for atherosclerotic cardiovascular diseases particularly those with early onset advanced atherosclerosis in the absence of conventional risk factors. Since homocysteine metabolism is partly regulated by vitamin B, a low level of vitamin B and folate is associated with an increased risk of PAD. Though recent studies failed to show the beneficial effect of vitamin B and folate supplements on cardiovascular end points reduction, serologic evaluation is still recommended in young patients with family history of thrombotic cardiovascular events.[14].

Diagnosis of Peripheral Arterial Disease:

History and Physical Examination:

A careful history to elicit the symptom of intermittent claudication is the key to early diagnosis of PAD. The patient will typically report leg pain on walking which is relieved by rest. Patients presenting with more advanced disease will have more obvious features like rest pain and tissue loss to speak for themselves. Pain may sometimes be absent or less in intensity in patients with long-standing diabetes mellitus because of neuropathy. When there is ulcer, differentiation from venous or neurotrophic ulcer may be possible on the basis of location of the ulcer and its characteristics.

In physical examination, careful inspection reveals characteristics features of ischemia. Shiny appearance of the limb with loss of hair and muscle bulk may provide early evidence of PAD even in the absence of tissue loss. An ischemic limb typically feels cold on palpation compared with the normal side (may sometimes remain warm in presence of infection). An increased capillary filling time is also an important physical finding. Absence of peripheral pulses constitutes the most important physical evidence of limb ischemia. The quality of the pulse should always be compared with the unaffected side. A lot of cases are missed only because of the fact that pulses are not carefully examined. Peripheral pulse is also the best way to differentiate PAD from other causes of limb pain such as musculoskeletal or neurological. A palpable distal pulse virtually excludes significant PAD.

Ankle-Brachial Pressure Index:

Measurement of Ankle Brachial Pressure Index (ABPI or ABI) is a very handy tool to assess disease severity.

Values above 0.9 are normal and decreasing value indicates more severe disease. (Mild 0.8-0.89, Moderate 0.5-0.79, Severe <0.5). Nowadays, dedicated tools are available to measure ABI. Unfortunately, they are not universally available in Bangladesh. The problem, however, can be largely overcome by utilizing hand-held Doppler machine.

Thrombo-Angitis Obliterans (TAO):

Extremity ischemia in young patients with history of smoking should always give rise to the clinical suspicion of Thromboangiitis Obliterans (TAO). Also called Buerger's disease, TAO is a nonatherosclerotic, segmental, inflammatory disease that usually affects the small and medium-sized arteries and veins of the extremities[15-17]. TAO is histologically characterized by occlusive luminal thrombus that has high cellular and inflammatory contents with relative sparing of the blood vessel wall[18]. Patients are young smokers who present with distal extremity ischemia, ischemic digit ulcers, or gangrene[19].

Prevalence:

TAO is most prevalent in the Mediterranean, Middle East, and Asia [20,21], the reason being the high tobacco use in these areas. In North America, the prevalence of TAO has declined over the past 30 years due to a decline in smoking [21,22]. In other parts of the world, the prevalence of this disease among patients with arterial occlusive disease varies widely, ranging from 0.5 to 5.6 percent in Western Europe to as high as 45 to 63 percent in India [22].Men are more commonly affected than women, and the typical age of onset is 40 to 45 years. However, there are reports of increasing prevalence of

Fig.-1: *Manifestations of advanced Peripheral Arterial Occlusive Disease*

TAO in women, possibly due to the increasing tobacco consumption by women[23].

Risk Factors:

The use of tobacco is essential for the initiation and progression of TAO [21-23]. Most patients are heavy cigarette smokers. In one study, patients diagnosed with TAO smoked an average of 23 years [23]. TAO has also been reported in cigar smokers, marijuana users (cannabis arteritis), and those who use smokeless tobacco such as chewing tobacco and snuff [24, 25].Chronic anaerobic periodontal infection may also play a role in the development of TAO. Nearly two thirds of patients with TAO have severe periodontal disease. In one study, DNA fragments associated with anaerobic bacteria were found within both the arterial lesions and oral cavities of patients with TAO[26,27].

Diabetic Foot:

Diabetic foot represents a distinct subset of PAD patients who often present with advanced ischemia of the foot with varying degrees of tissue loss and deformity. Besides arterial insufficiency, factors like peripheral neuropathy, infection, osteoarthropathy and metabolic abnormality are implicated in the disease progression of diabetic foot. A careful history and meticulous physical examination can elicit vascular component of diabetic foot. Patients may give history of previous intermittent claudication or rest pain and pedal pulses may be absent or diminished in volume. Though a reduced ABI value is generally expected in diabetic foot patients having arterial insufficiency, it may sometimes be falsely high because of reduced vessel compressibility resulting from vessel wall calcification.

Work-up for PAD:

Vascular Duplex Study:

Vascular Duplex study done in expert hands can establish the diagnosis of PAD. Understanding of Doppler principles is key to vascular Duplex ultrasound examination. A triphasic spectral waveform on pulsed wave Doppler indicates normal flow while biphasic and monophasic patterns indicate varying severity of stenosis in the proximal arterial segment. Turbulence with velocity acceleration is a sensitive marker of hemodynamically significant localized stenotic disease while absence of Doppler signal indicates occlusion of that segment (Figure 2).
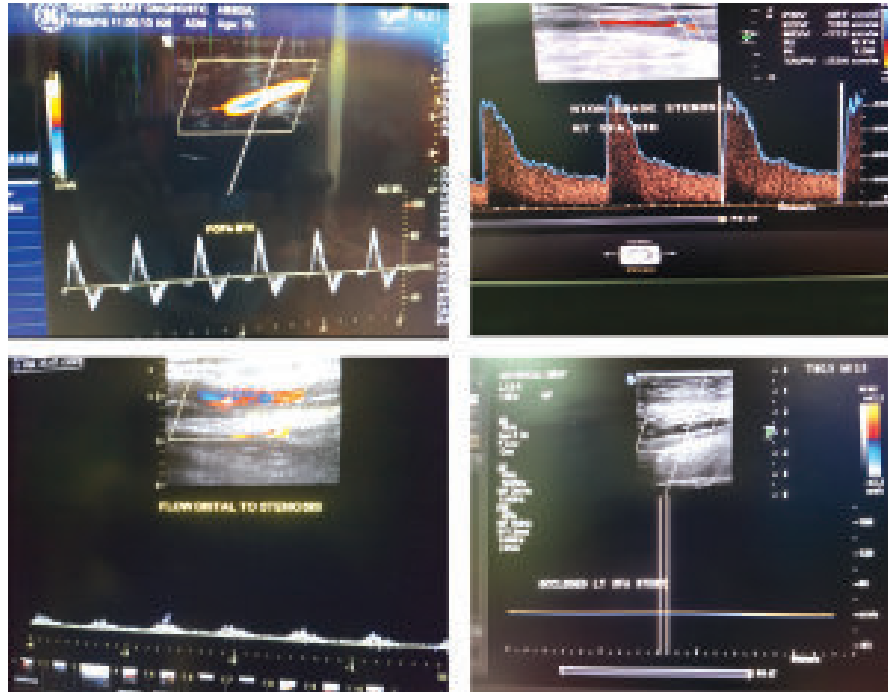

Figure 2: *A. Normal triphasic arterial flow. B. Turbulence with velocity acceleration at the point of arterial stenosis. C. Dampened low pulsatile monophasic flow distal to arterial stenosis. D. Totally occluded artery with absence of Doppler signal*

Angiography:

Angiography is rarely needed for diagnosis and is mainly reserved for planning revascularization strategy. There are 2 basic types of angiography; Computed Tomographic Angiography (CTA) and Catheter angiography (Figure 3). In both modalities, contrast agent is used to visualize the arterial tree. However, catheter angiography is a more invasive technique than CTA. The main advantage of catheter angiogram is that digital subtraction angiography (DSA) can be utilized which facilitates better visualization of the arteries. This is particularly useful for distal vessels. In catheter angiography, carbon di oxide is sometimes used instead of contrast agents for patients with renal insufficiency. Magnetic Resonance Angiography (MRA) without the use of contrast agent is also used at some centers.

Management of PAD

Lifestyle and Risk Factor Modification:

The goal in the treatment of PAD is reduction of pain (claudication or rest pain), improve quality of life and limb salvage. Treatment must begin with risk factor and lifestyle modification. This is applicable for patients of all categories of PAD. In early stages of PAD, aggressive risk factor and lifestyle modification not only helps in improving symptoms but also prevents progression of

disease severity. The treatment goals for hypertension, DM and dyslipidemia has been discussed above. Cessation of smoking can be partly achieved by extensive counselling. Besides structured smoking cessation program, a number of pharmacologic agents such as Bupropion and more recently Varenicline are now available in the US and European markets to aid smoking cessation. Despite their encouraging early results, the fact remains that Nicotine addiction is a notoriously recurring behavioral problem which needs to be dealt with a combination of mental strength of the individual, knowledge and relentless social campaign.

Supervised Exercise Therapy:

The benefit of structured exercise protocol in improving pain-free walking distance has been documented in may studies. In fact, exercise therapy has been termed the best initial treatment for intermittent claudication. A recent Japanese study shows that supervised exercise therapy resulted in 5-year cardiovascular event-free survival of 80.5% in patients with PAD, compared with 56.7% in untreated matched controls [14]. The current ACC/AHA guidelines recommend supervised exercise therapy as a level IA recommendation for the treatment of intermittent claudication. The guideline recommends that exercise training in the form of walking- which may be treadmill walking or track walking should be performed for a

Fig.-3: *A. Computed Tomographic Angiogram (CTA) showing aorto-iliac occlusion. B. Catheter Angiogram showing occlusion of distal Superficial Femoral Artery.*

duration of 30-45 minutes three to four times a week for a period not less than 12 weeks. The walking should be intermittent in the form of walk-rest-walk. This means that the patient should walk until the lower extremity pain tolerance limit is reached. This should be followed by a brief period of rest until the pain relief is obtained, following which the patient should return to walk to repeat the cycle. Studies show that exercise protocol, though easy to follow, is not applicable in more than one third patient with claudication due to comorbid conditions. In another one third, there is considerable compliance issue.

Pharmacological Agents:

Despite extensive research over the last 30 years, progress in terms of pharmacologic treatment of intermittent claudication has been far from satisfactory. To date only two drugs have obtained approval from US FDA for symptomatic relief of lower extremity ischemia. They are Pentoxyphylline and Cilostazol.

Pentoxyphylline was the first drug to be FDA approved (1984) for use in claudicants. A methylxanthine derivative, it is thought to improve oxygen delivery to ischemic limb due to its effect on RBC wall flexibility and deformability. These effects result in reduced blood viscosity. Pentoxyphylline also decrease platelet aggregation and increase fibrinogen levels. Multiple well-designed clinical trials have documented increase in pain free walking distance with the use of Pentoxyphylline compared with placebo. The drug is available in Bangladesh market as 400 mg tablet to be taken three times daily.

Cilostazol gained FDA approval for the treatment of claudication in 1999. It's a phosphodiesterase III inhibitor which inhibits smooth muscle cell contraction and proliferation and platelet aggregation by increasing cyclic Adenosine Monophosphate. It also works on serum lipid metabolism to decrease triglyceride level and increase HDL level. Results of several clinical trials including a meta-analysis confirmed the efficacy of cilostazol. Increase of maximum PFWD by 50% along with significant improvement in the quality of life has been reported with use of cilostazol. Clinical trials have also documented superiority of cilostazol over pentoxyphylline in the treatment of claudication. Unfortunately, this drug has quite a few side effects that include headache, diarrhea and gastrointestinal discomfort. A progressively incremental dosing starting at low dose is an effective strategy to minimize side effects. Its use is contraindicated in advanced heart failure. Cilostazol is widely available in Bangladesh market being manufactured by a number of manufacturers.

Lipid lowering agents particularly statins decrease MI related death in high-risk patients. The beneficial effect of statin therapy on blood vessels is pleomorphic and not just reduction of serum cholesterol level. They stabilize atheromatous plaque, reduce vascular inflammation and oxidative stress. Though less well documented compared with CAD, aggressive statin therapy in PAD patients has been shown to improve survival over a mean follow-up period of 6 years. Modulation of HDL fraction has also been found beneficial in PAD patients. Studies have documented that addition of niacin to lower HDL resulted in atheromatous plaque regression in Femoral stenosis and carotid Intima-Media Thickness [14]. Statins have also been shown to increase pain free walking time in claudicants. Though the exact mechanism for this benefit is unclear, it is thought to be resulting from an increase in vasomotor blood flow and increased angiogenesis. Thus, drug treatment of patients with PAD should always include statins irrespective of their serum lipid levels. According to current ACC/AHA guidelines LDL cholesterol level should be less than 100 mg/dl in patients with PAD and less than 70 mg/dl in high risk patients.

Antiplatelet therapy is an important part of the drug treatment of PAD. Though it has no effect on claudication, there are compelling evidences that it reduces overall cardiovascular events. Antiplatelet therapy is also beneficial in maintaining graft patency after peripheral revascularization as evident from a significantly lower graft occlusion rate with its use compared with placebo. Therefore, antiplatelet therapy should be recommended for all patients with PAD[14].

Other pharmacologic agents used sparingly for PAD include levocarnitine, Naftodrofuryl, Ketansarin, calcium channel blockers etc. Vitamin B and Folates are used in young patients with hyperhomocystienemia. The use of prostaglandin analogues in the treatment of critical limb ischemia patients who are not candidates for revascularization is also increasing. Evidence suggest that they are effective in reducing ischemic rest pain and healing small ulcers. Therapeutic angiogenesis by gene therapy or bone marrow stem cell therapy is also an evolving strategy for this group of patients.

Role of Revascularization in the Treatment of PAD:

The decision of revascularization largely depends on the presentation of PAD. As long as PAD symptoms do not interfere with quality of life (QoL), patients can be managed conservatively with lifestyle modification and medical therapy. Even many of the patients having PAD symptoms

that affect QoL may benefit from conservative management including supervised exercise therapy and remain stable. Only those symptomatic PAD patients who do not improve with conservative management or those who deteriorate along with patients with CLTI will need angiographic evaluation and some form of revascularization- surgical or endovascular [9,10]. The Trans-Atlantic Intersociety Consensus (TASC) working group has published recommendations on the treatment strategy for APD in 2000 and 2007 based on which these decisions are generally made. About the type of revascularization to be employed, TASC II recommendations published in 2007 have categorized PAD according to severity of lesions for aorto-iliac, Femoro-Popliteal segments. Lesion severity is described from category A through D with simpler lesions belonging to A and most complex ones to D. TASC II recommendations support revascularization of TASC A lesion by endovascular means while surgical intervention is reserved for TASC D lesions. There is insufficient data regarding TASC B and C lesions to support the superiority of one modality over the other. However, Type B lesions are probably better treated by endovascular means and Type C lesion by surgical means.[10,14].

Endovascular Intervention:

In the current era of rapid advances in technology, the scope and application of endovascular interventions are increasing. Though TASC recommendations are generally followed, sometimes, complex lesions are also treated defying TASC recommendations. This trend is particularly evident at high volume centers with adequate expertise, experience and logistic support. The commonest procedures employed to treat peripheral arterial stenotic/occlusive lesions are Plain Old Balloon Angioplasty (POBA) and stenting with bare metal stents (Figure 4). More recent procedures include the use of drug coated balloons, covered stent, debulking by atherectomy etc.

Surgical Intervention:

According to TASC II recommendations complex long segment occlusive lesions are better treated by surgical intervention. However, with growing expertise and experience, wire-based techniques have been successfully applied to many of the long lesions in the aorto-iliac and infra-inguinal segment thus changing the indications for surgery in this group of patients. According to a US in-patient data of 1996-2000, there was 850% increase in the use of percutaneous techniques to treat
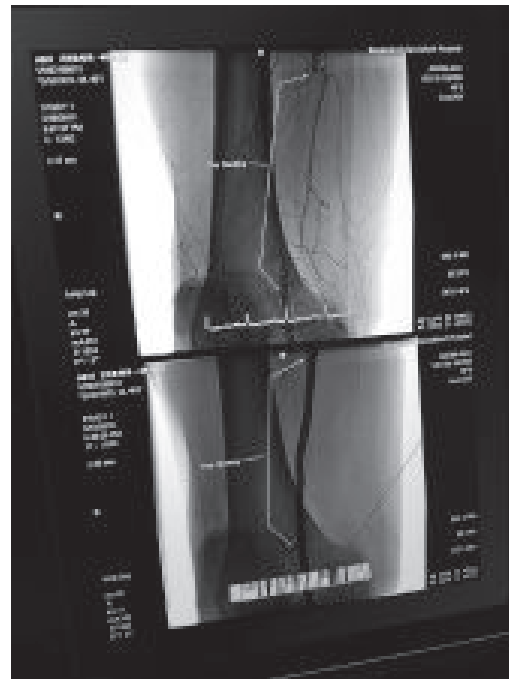

Fig.-4: *Catheter Angiogram showing occlusion of distal Superficial Femoral Artery and Popliteal at the top and its treatment by Percutaneous Transluminal Angioplasty (PTA)*

aorto-iliac disease and a 16% decrease in aorto-bi-femoral bypass procedure. Despite such paradigm shift in application, surgery still holds an important place in the treatment of PAD. Different types of surgical procedures are available. They are basically divided into two broad categories; anatomic and extra-anatomic. Aorto-femoral bypass, Femoro-Popliteal bypass, Femoro-distal bypass are examples of anatomic bypass (Figure 5) whereas Femoro-Femoral cross-over bypass, Axillo-Femoral bypass, obturator bypass are examples of extra-anatomic bypass. For aorto-iliac bypass procedures, a prosthetic graft is generally used as conduit whereas for infra-inguinal bypasses, the conduit of choice is autologous vein. In Bangladesh, surgical revascularization procedures for complex aorto-iliac, infrainguinal and infrapopliteal diseases are now performed with results that are comparable to standard outcome for these procedures. In one study, Bashar et al. reported an 89% 2-year patency for aorto-bi-femoral bypass performed for complex aorto-iliac occlusive disease [28]. Besides bypass procedures, another mode of revascularization is endarterectomy which is reserved only for short segment lesions across joints or at the point of important bifurcations.
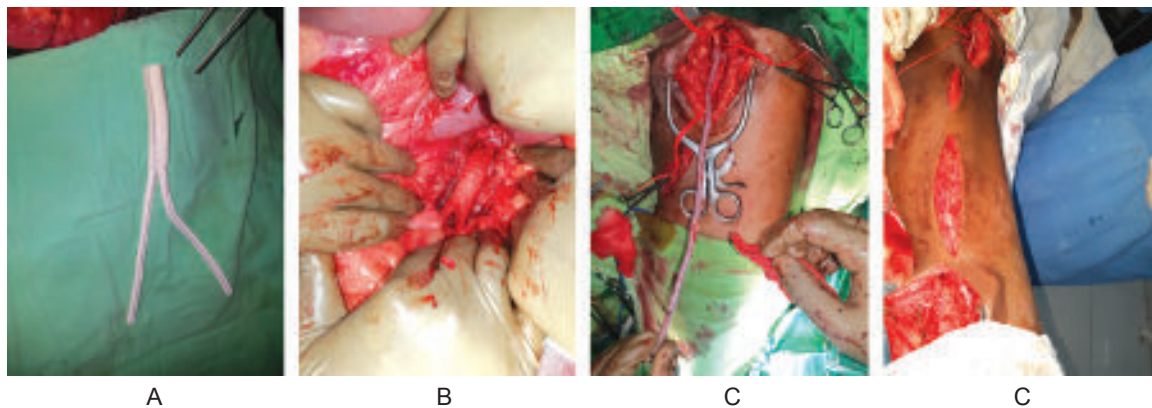
Fig.-5: *A. Prosthetic graft used in aorto-bi-femoral bypass for aorto-iliac occlusive disease. B. Prosthetic aorto-bi-femoral bypass graft anastomosed with abdominal aorta. C. Femoro-Popliteal bypass being fashioned using autologus long saphenous vein. D. Completed Femoro-Popliteal bypass.*

Conclusion:

In Bangladesh, presentation of patients with PAD to vascular surgeons is generally late. Most patients come in the stage of CLTI with some form of tissue loss. Though no published data exists, in-patient and out-patient experience at NICVD, Dhaka suggests that as high as 90% of patients of PAD present with CLTI. Systematic campaign to generate awareness among the common people as well as primary care physicians, neurologists, diabetologists, podiatrists and orthopedic surgeons can change this dismal scenario.

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Thoracic Endovascular Aortic Repair (TEVAR): A Case Report

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Abstract:

Thoracic aortic aneurysm (TAA) is generally a disease of the elderly which remains mostly asymptomatic. It is often detected incidentally with imaging studies of the chest done for other reasons. We present a 55year-old smoker, normotensive and non-diabetic male patient who was diagnosed as a case of TAA and treated by endovascular means with thoracic endovascular aortic repair (TEVAR) technique. Due to small caliber femoral artery, thoracic endograft was deployed through a Dacron graft conduit of 10 mm diameter which was anastomosed to the common iliac artery. It was a hybrid procedure done in cardiac catheterization laboratory under general anesthesia. Completion angiogram revealed good technical success with no endoleak or neurological deficit. Patient improved symptomatically after TEVAR.

Keywords: Aortic; Endovascular; Dacron graft

Introduction:

Aortic diseases, including aortic aneurysms, are the 12th leading cause of death in the United States.[1] Although aneurysm of the abdominal aorta (AAA) and ascending aorta are more common, those of the descending thoracic aorta (TAA) and thoracoabdominal aorta (TAAA) are not rare. TAA and TAAA have an estimated incidence of 5.9 cases per 100,000 person-years.[2] A study by Clouse and others suggests that the incidence is increasing. [3] During the last 5 years, the mortality for non-ruptured and ruptured TAAs in the US population aged 55 years and above ranges from only 0.1 to 2.8 and 0.2 to 3.2 per 100,000, respectively. Surgical repair of TAA is associated with a high morbidity and mortality.

Aortic aneurysm is an emerging vascular problem in our country. In the recent years, there has been an increasing trend in the detection of aortic aneurysm cases because of sophisticated investigation tools like CT Scan, MRI etc. Most aortic aneurysms are asymptomatic. These are often incidentally detected during plain X-ray chest, abdominal ultrasonogram, CT scan or MRI.

Case:

Mr. X aged about 55 years who was a smoker, normotensive and non-diabetic presented with low thoracic back pain. CT scan of the chest identified a large saccular aneurysm in the descending thoracic aorta at the level of 10th – 11th thoracic vertebra. Diameter of the sac was about 6.6 mm. Endovascular treatment was planned and thin-slice contrast CT scan with reconstruction was performed for precise measurements and customization of the endograft.

Procedure:

A hybrid approach was planned for this case with arrangements for surgical procedure in the cathlab. This was necessary because the right common femoral artery was of narrow caliber with a diameter of only 6mm which would not accommodate a large vascular access sheath for the deployment of the 22F compatible Thoracic endograft.

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Steps:

1. Under general anesthesia, retroperitoneal laparotomy was done in right lower abdomen and control of right common iliac artery (CIA) was taken.

2. Percutaneous vascular access through left common femoral and left brachial artery.

3. Dacron tube graft of 10 mm diameter was anastomosed to CIA.

4. Descending thoracic aortogram was done through left femoral artery using marker pigtail catheter.

5. Marker pigtail catheter confirmed location with length of lesion as well as the proximal and distal landing zone.

6. After removing the marker pigtail catheter, an angled tip diagnostic wire was introduced in the coeliac trunk through left femoral approach.

7. A 22F access sheath was introduced through the Dacron graft in the right CIA.

8. Thoracic endograft (Valiant Captiva, Medtronic, USA) was introduced through the 22F access sheath and positioned across the TAA against the proximal and distal landing zones.

9. Once the position of the prosthesis was confirmed, it was deployed slowly excluding the sac.

10. Post dilatation was done using compliant balloon (Reliant, Medtronic, USA).

11. Completion angiogram revealed good visualization of the endograft and obliteration of sac and absence of any endoleakage.

12. Dacron tube graft was ligated and divided just distal to anastomosis with right CIA.

13. Laparotomy was closed in layers.

14. Patient was extubated.

Hardware used:

-Thoracic endograft (26 mm×100mm, Valiant Captiva, Medtronic, USA)

-Lunderquist stiff wire (.035"×260cm, Cook, USA)

-Marker pigtail catheter

-Vascular access sheath (22F)
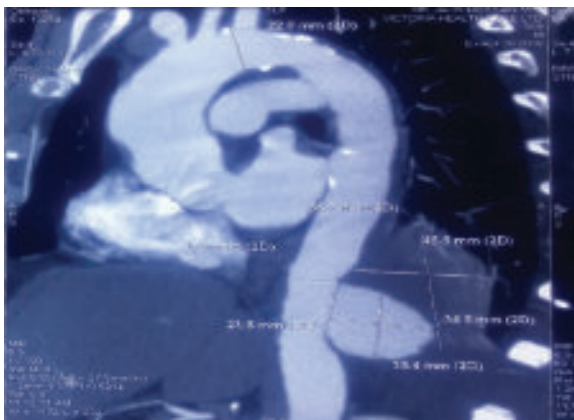
-Compliant balloon

-Straight Dacron graft (10mm)
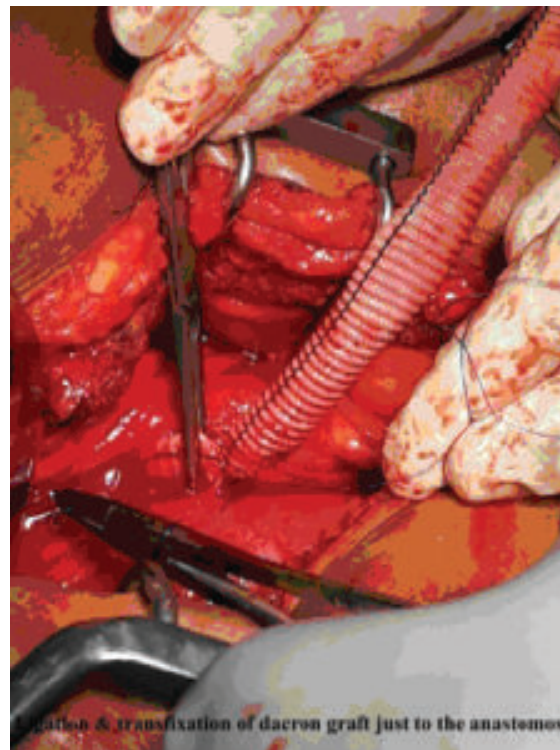

Fig.-1: *CT Angiogram*

Fig.-2: *Retroperitoneal Laparotomy*

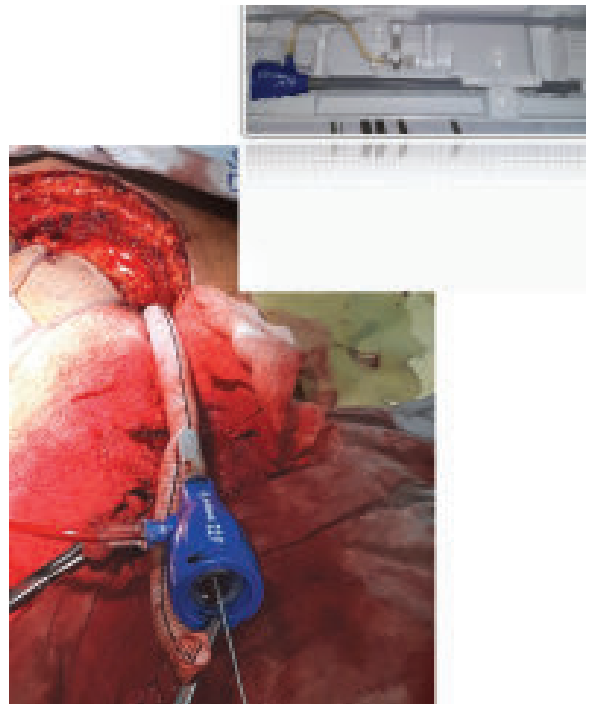**Fig.-3:** *10 mm dacron graft anastomosed with right CIA*

Fig.-4: *Retroperitoneal Laparotomy*

Fig.-5: *Ligation and transfixatgion of dacron graft just distal to the anastomosis*

Fig.-6: *Closure of abdomen*

Fig.-7: *Before Procedure*

Fig.-8: *After Procedure*

Discussion:

Endovascular procedure is a less invasive and cosmetic alternative to open surgical treatment. It requires little or no incision and hospital stay is short. On the other hand, open repair requires large thoracolaparotomy which subjects the patient to significant surgical trauma. Therefore, in elderly patients, TEVAR has virtually replaced open surgery in the treatment of TAA. Open surgery is considered in younger patients with longer life expectancy and low surgical risk. TEVAR is indicated when aneurysm diameter exceeds 5 cm, has a saccular morphology, when the patient is symptomatic irrespective of size of the aneurysm and when the aneurysm expands rapidly.

Endovascular aneurysm repair is different from angioplasty for stenosis or occlusion of artery. Precise measurement of the lesion using CT angiogram with 1mm axial cut is mandatory to customize the endograft and thereby prevent complications like endoleakage and migration which may result from undersizing of the device. At least 2 cm proximal & 2cm distal landing zone is needed for proper fixation of endograft. Post dialatation is always with compliant balloon. Aortic angulation more than 60° is a contraindication for TEVAR.

US Food and Drug administration pivotal trial revealed 98% technical success for TEVAR which means delivery of the endograft to the intended location with satisfactory exclusion of the aneurysm and no type I or II endoleaks. Recent trials report a 30-day mortality of 1% to 2% in case of TEVAR which is significantly less than 7%

mortality for open surgical repair. [4, 5] Complications of TEVAR, like those of all endovascular procedures, can be divided into a general category common to all operative interventions and a procedure-specific category. General complications are not well detailed, and the FDA trials focused on combined trial-specific safety endpoints, which made individual complication rates difficult to determine. At any rate the incidence of major or serious adverse events strongly favors TEVAR over open repair in the three regulatory trials that compared similar metrics. As expected in a population with advanced age and atherosclerotic disease, cardiopulmonary complications dominated the early morbidity, although frequency and severity were less than open repair.[6,7] For example, the STARZ trial reported a cardiovascular complication rate of 15.6% (TEVAR) and 44.3% (open repair) with an identical incidence of pulmonary complications (15.6% vs. 44.3%).[6] The incidence of major or serious adverse events and other secondary measures, such as blood loss and hospital stay, were strongly in favor of TEVAR.

A procedure-specific complication of TEVAR is spinal cord ischemia (SCI) resulting in paraplegia, the incidence of which ranges between 2-10% [8]. Unfortunately, SCI detection protocol like somato-sensory and motor evoked potential monitoring and cord protection measures such as spinal fluid drainage, hypothermia, blood pressure management etc. have not been able to significantly reduce the incidence of this complication. Studies are on-going to better understand and prevent TEVAR associated SCI and paraplegia.

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Obituary

Prof. Md. Sadequzzaman
(18/02/1942 – 16/03/2019)

We deeply express our sorrows and grief at the death of our respected teacher **Prof. Md. Sadequzzaman**. MBBS, FCPS (medicine), Professor of Cardiology. As a teacher he served Dhaka Medical College; Institute of Post-Graduate Medicine & Research; National Institute of Cardiovascular Diseases. He was dear to the students for his sympathetic attitude and fatherly affection. But he was punctual and followed the systemic routine properly. His relationship with his colleagues was exemplary . We never saw him making any arguments with his fellow colleagues. I had experiences to work with him. Though I was too junior to him, he never ignored me neither he avoided me. Though I was not his direct student (Late Prof. M A Zaman, his yearmate from Rajshahi Madical College was my direct teacher at Dhaka Medical College), he bestowed his love and affection on me like his own student.

After retirement, he used to live in Uttara and continued practice there. In more than one occasions I was invited as the key note speaker at his recommendations in Uttara and he eagerly listened to my presentation. Indeed it was an example of blessings from a senior to his junior in our profession.

Dr. Abdullah Al Shafi Majumder