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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.

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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:

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

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Original Article

Radiofrequency Catheter Ablation for Supraventricular Tachycardias: A Six-Year Single Centre Experience at NICVD

Md. Mustafizur Rahman[1], Md. Mohsin Hossain[2], Asif Zaman Tushar[3], Al-Mamun[4], Md. Nazmul Haq[3], Kanak Jyoti Mondol[5]

Abstract:

Pharmacological therapy is mostly employed in the management of supraventricular tachyarrhythmias in different part of the world including Bangladesh. However, Radiofrequency catheter ablation has been found to be highly effective and safe in the treatment of such tachyarrhythmias. Objective: The current study is aimed at sharing our experiences of 842 patients who presented with Supraventricular tachycardias and were diagnosed by EPS and treated with Radiofrequency catheter ablation. Methods: This descriptive study has been carried out in the cardiac electro physiology Department of NICVD, Dhaka, Bangladesh from 2nd January 2015 to 31st December, 2020. Electrophysiology study(EPS) was carried out to identity and diagnose the mechanism of different SVTs in 842 consecutive patients. RF catheter ablation was used to interrupt the tachycardia circuit. Results: Out of a total 842 patients who underwent Electrophysiology study, 435 were found to have atrioventricular nodal re-entry tachycardia (AVNRT) as underlying mechanism and 391 were having accessory pathway responsible for the reentry mechanism; of these accessory mediated tachycardia, 250 patients were manifested accessory pathway (WPWS); 141 were concealed accessory pathway (out of them 365 were presented with orthodromic and 26 as antidromic reciprocating tachycardia); moreover among the accessory pathway 231 patients were found having left sided accessory pathway whereas 155 having right sided pathway; 12 patients were having focal atrial tachycardia and 4 were found atrial flutter as the underlying cause for SVT. Radiofrequency catheter ablation was used with an overall success rate of 95%, recurrence rate of 2% without any significant complication. Complication: One patient developed pulmonary thrombo-embolism, 6 patients developed DVT of right lower limb, 4 patients developed complete heart block. Conclusion: RF catheter ablation is safe and highly effective mode of treatment of different types of supraventricular tachyarrhythmias which is emerging and becoming popular in our country.

Keywords: Radiofrequency Catheter ablation (RFA), Supraventricular tachycardia (SVT), Atrioventricular nodal re-entry tachycardia (AVNRT), Wolf Parkinson White (WPW) Syndrome

(Bangladesh Heart Journal 2021; 36(2): 68-73)

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Introduction:

Over the last 4 decades, cardiac electrophysiological studies have gained widespread acceptance for the diagnosis and treatment of cardiac arrhythmias. The spectrum of tachyarrhythmias that can be cured by catheter ablation has increased dramatically and includes most types of supraventricular and ventricular arrhythmias. In cardiology, our ability to cure is rare. When cardiac disease is diagnosed, most of our treatments are palliative. Complaints may be diminished and life prolonged, but the disease process will not be stopped. Cure, however, is possible in the patient suffering from a tachycardia in an otherwise normal heart. [1–4]

Supraventricular type of tachyarrhythmias (SVT) are a frequent cause of admissions to emergency room and mostly drug therapy is offered due to limited availability of electrophysiological (EP) services. In the past, occasionally surgery and even catheter-based DC shocks have been used for drug refractory SVT.[1–4] By carrying out an EP study, we can locate the site of abnormal impulse formation or a critical part of the tachycardia pathway by cardiac activation mapping during the arrhythmia. By means of a catheter, radiofrequency (RF) energy can be applied to that area, resulting in destruction of a few mm of critical tissue and cure of the patient. This technique of EP/RFA has been found to be the first line of therapy for poorly tolerated SVT with hemodynamic intolerance or recurrent symptomatic SVT.[3,5–7] The charm of this treatment modality is that most of the patients, once treated with EP/RFA, can have complete cure of their arrhythmia, and do not require any further drug therapy or follow-up.

The estimated prevalence of SVT is 3.5%.[8] There are different forms of SVT; atrioventricular nodal re-entry (AVNRT) is the most common form accounting for approximately 60% of the cases, while 30% are atrioventricular tachycardia (AVRT), atrial tachycardia and atrial flutter constitute 10% of SVT. [9]

The first interventional catheter fulguration of an accessory pathway was performed by Weber and Schmiz in 1983.[10] Since then, there has been lot of development to make ablation safer and now cryo-ablation has been proposed to be the safest for ablation targets close to sensitive structures like compact AV node.[11] The success rate of RFA depends upon the type of arrhythmia, however, it is more than 96% in atrioventricular nodal re-entry.[12] Although several energy sources have been used for ablation, this article will deal only with ablation of different types of supraventricular tachyarrhythmias using RF energy.

The current study is aimed at sharing our experiences of 842 patients who presented with SVTs and were diagnosed by EPS and treated with RF catheter ablation.

Material and Methods:

After obtaining informed consent, 842 consecutive patients with symptomatic drug resistant SVT were admitted in the Cardiac Electrophysiology Department of NICVD, Dhaka, Bangladesh from 2nd January 2015 to 31st December,2020. All antiarrhythmic drugs were discontinued at least three half-lives of the respective drugs before the study except amiodarone, which was withdrawn two months before study. Those with atrial fibrillation, age below 12 years of age, SVT with structurally abnormal heart, were excluded from the study. The study protocol was approved by the hospital ethical committee and patients were transferred to the lab in a fasting state having been sedated with tab. diazepam or midazolam, while pethidine was given as analgesic. An intravenous bolus dose of Regular Heparin 2500 IU for left sided procedures was routinely administered.

Four diagnostic EP catheters were introduced, through the right femoral veins and placed at the following sites; right atrial appendage (quadripolar 6-Fr catheter), right ventricular apex (quadripolar 6-Fr), His bundle region (Octopolar 6-Fr catheter) and Coronary sinus (CS) (decapolar 6-Fr catheter). A 7-Fr 4 mm ablation catheter was introduced through the right femoral vein. Left sided pathways were approached transeptally (via interatrial septal puncture) by using multipurpose 7-Fr sheath. An indifferent patch was applied on back at left scapular area. EP recording system Lab System Pro (Boston Scientific), stimulator Micropace III and Maestro 4000 (Boston scientific) EP ablator were used to deliver radiofrequency current. Before inducing tachycardia, baseline intervals (PR, QRS, QT, AH, HV) were measured. The following parameters were looked for in all the tachycardias:

- Onset of tachycardia - with or without jump
- VA activation – concentric/eccentric
- VA interval – < or > 70 ms
- Parahisian Pacing response–Nodal or extra nodal
- Ventricular entrainment – post pacing interval < or > 115 ms
- VAV or VAAV response. The SVTs were grouped into four on the basis of initiating mechanism:
  1. Atrioventricular nodal re-entry
  2. Atrioventricular reciprocating tachycardia (Right or Left sided)
  3. Atrial tachycardia (Right or Left sided)
  4. Atrial flutter (Right or Left sided)

The right and left accessory pathways were further grouped into lateral, septal, anterior and posterior, parahisian and middle cardiac vein on the basis of their location. For ablation in atrioventricular nodal reentry, the RF energy was applied at anterior lip of CS os to modify the slow pathway. Mostly a power of 30 watts and a temperature of 60 ºC energy was delivered for 60 Sec. The accessory pathways were modified by RF energy delivery at AV ring during sinus rhythm in manifest pathways or during tachycardia or ventricular pacing in orthodromic tachycardias. The focal atrial tachycardias were targeted when atrial intracardiac electrogram on ablation catheter was 20–30 ms earlier than surface P wave. Isthmus dependent atrial flutters were managed by ablation line across isthmus from tricuspid valve to inferior vena cava. Ablation was declared successful if no tachycardia could be induced after RFA even with isoproterenol.

Results:

The mean age of our patients was 38±19 years, with male to female ratio of 1:2.37. Table-I summarizes the frequency of various types of SVTs among the patients who underwent RF ablation at our Centre and their outcomes. Majority of the patients had the clinical history of AVNRT. Among the Accessory pathways, more patients were presented with manifested ECG and the most of the patients had left sided pathways. Failure rate was more among the patients of focal atrial tachycardia.

Figure-2 shows the frequency and location of different accessory pathways. Left lateral pathways were more among our study sample.

Figure-3 shows how the pre-excitation pattern is lost on the surface ECG as soon as the accessory pathway is ablated. It is simultaneously visible in the intracardiac signals detected by the various catheters placed inside the heart at selective sites; there is fusion of AV signals which is lost after the pathway is ablated, and the AV signals become clearly separated from each other.

Table-I

Catheter ablation of different SVTs in our experience of 842 patients and outcome

Supraventricular tachycardias	Number	Percentage %	Outcome	
			Success	Failure
AVNRT	435	51.66%	428(98%)	07
AVRT	391	46.43%	366(93%)	25
Concealed	141	16.74%	127	14
Menifested	250	29.69%	239	11
Right sided pathways	153	18.17%	140	13
Left sided pathways	231	27.43%	221	10
Middle cardiac vein	4	0.47%	03	01
Mahaim pathway	3	0.35%	02	01
Orthdromic	365	43.34%	346	19
Antidromic	26	3.08%	20	06
Focal atrial tachycardia	12	1.42%	02	10
Atrial flutter	4	0.47%	03	01
Total	842		799(95%)	43(5%)

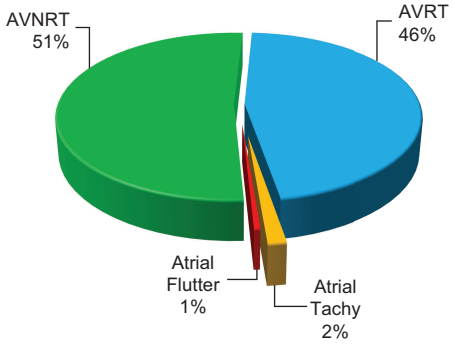

Fig.-1: *Frequency of the various SVTs that have undergone EPS & RFA at our Centre.*

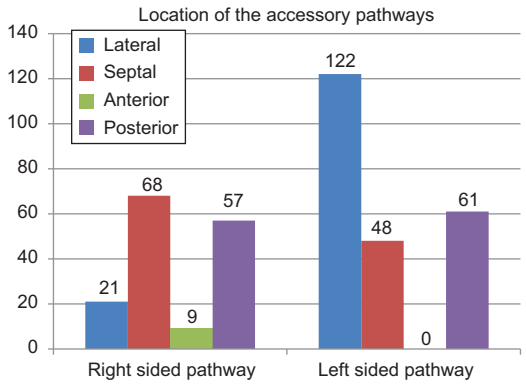

Fig.-2: *Frequency & location of different Accessory pathways that have undergone EPS/RFA at our Centre.*

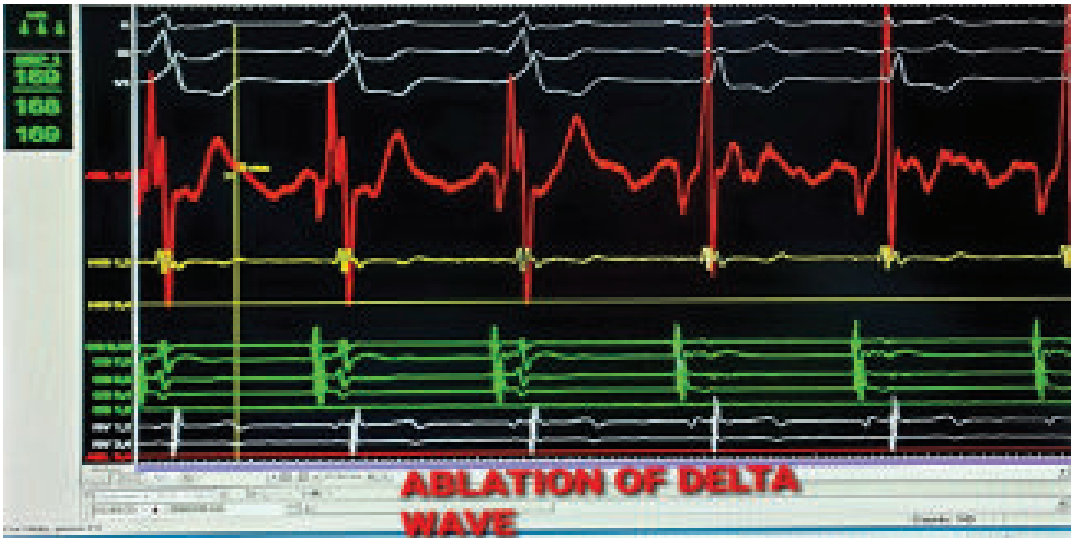

Fig.-3: *Top 3 tracings of surface ECG (leads II,III,V1) show pre-excitation in the first three beats which is lost in the 4th beat after RF ablation. Tracings CS of intracardiac signals show fusion of AV signals in first three beats, while separation of AV signals in the last two beats after ablation.*

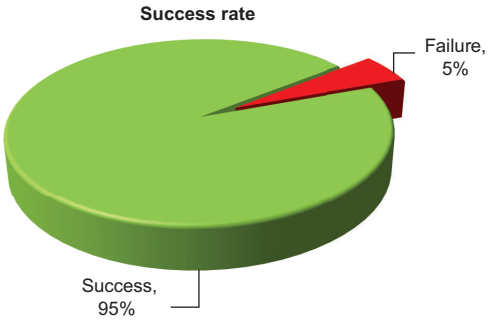

Fig.-4: *Success rate of EPS & RFA of different SVTs at our Centre*

Table-II

Common complications & its frequency during our procedure

Complications	Frequency
1. Pulmonary thrombo-embolism	1(0.1%)
2. DVT of right lower limb	6 (0.6%)
3. Complete heart block	4(0.4%)
Total	11(1.15%)

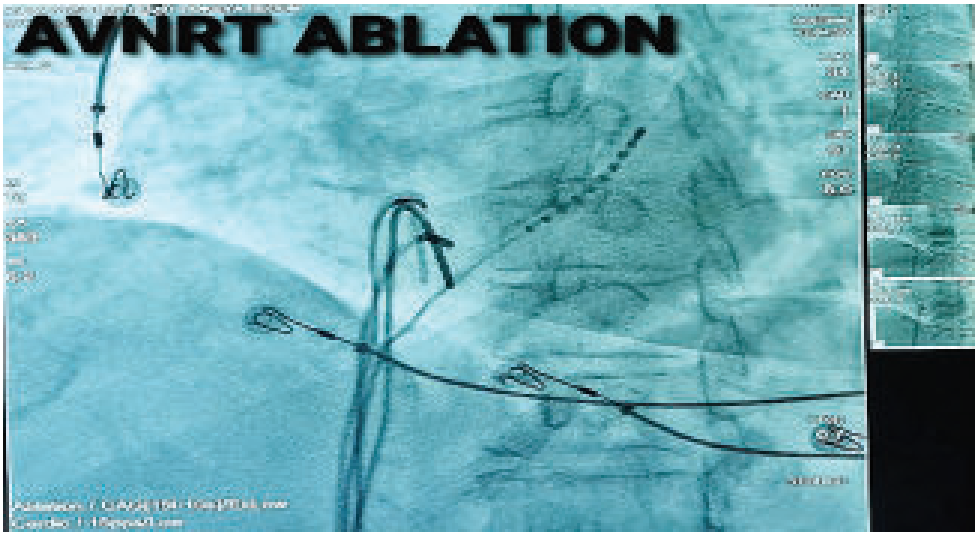

Fig.-5: *shows fluoroscopic view of AVNRT ablation in LAO 30^0.*

Discussion:

Atrioventricular nodal re-entry is the most common cause of regular narrow complex SVT. In our study, 52% of the tachycardias are due to atrioventricular nodal re-entry. If AVNRT are less frequent and responsive to therapy with beta blocker or Calcium channel blocker, then RFA can be deferred. However, in patients with frequent episodes or hemodynamic intolerance or those who refuse prolonged medication, RFA is a safe and cost-effective treatment modality. The success rate is more than 96% and the risk of damaging the compact AV node is less than 1% especially with cryo-ablation and the recurrence rate is also less than 3%.[13,14] All of the patients we ablated for SVT were symptomatic despite drug therapy. Our success rate in case of AVNRT is 98% and recurrence rate has been very low because it had been part of our protocol to look for slow junctional rhythm during RFA and to reassure with Isoproterenol that tachycardia could no longer be reinduced once RFA had been done. The presence of a junctional rhythm during slow-pathway ablation has been indisputably considered to be the most sensitive but non-specific marker of successful ablation.[15] Children under age of 10 years were not considered for the reason that radiofrequency ablation is not very safe in this age and cryo-ablation is a preferable option for AVNRT.[16–18] The SVTs due to AVNRT, ORT and ART on the right and left side were mapped usually by ablation catheter in LAO 30º view (Fig. 5). Those with evidence of ventricular pre-excitation on resting ECG were ablated in sinus rhythm targeting the closest AV site or the site having shortest delta-V wave and/or pathway potentials. [19–24] The RF energy was stopped if a pathway was not visualized in a 20 sec break. Also, after successful ablation, a confirmatory burn for 60 sec at 50 watts was given in all cases to reduce the risk of recurrence. Amongst our 51 patients with left sided accessory pathways, 48 were approached transeptally in LAO 60º view while in only 3 patients, ablation was done retrogradely via left ventricle; transeptal route was preferred because of the shorter procedure (average 20 min) and lesser radiation exposure. The all patients were given Aspirin 75mg and clopidogrel 75mg for 30 days after procedure to avoid any thromboembolic event. The higher failure rate in atrial tachycardia was due to limitations of conventional EP catheters to provide adequate information about the electrical activity at the roof of right atrium. [25,26] 3-dimensional or non-contact mapping system is now the preferred approach for atrial tachycardia to have better results. In our study, overall success rate was 95%(Fig:4), recurrence rate of 2% without any significant complication (only 1.15%) (Table II). One patient developed pulmonary thrombo-embolism, 6 patients developed DVT of right lower limb, 4 patients developed complete heart block.

Conclusion:

SVTs are mostly due to atrioventricular nodal re-entry or accessory pathways. RFA is a very safe and highly effective mode of treatment for SVT and should be considered as first line of therapy if EP services are available. Trans-septal approach for left side accessory pathways is also very safe and less time consuming and avoids prolonged exposure to radiation associated with retrograde approach. For atrial tachycardia, the preferred approach is non-contact mapping. However, conventional approach of RF catheter ablation is safe and highly effective mode of treatment of different types of supraventricular tachyarrhythmias which is emerging and becoming popular in our country.

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Original Article

Requirement of Postoperative Ventilation and analgesics during Off-Pump Coronary Artery Bypass (OPCAB) surgery – A Comparison between Combined High Thoracic Epidural Anaesthesia (HTEA) with GA and GA Alone

SI Azad, AK Beg

Abstract :

Beckground: This is often difficult to achieve optimal pain relief after coronary artery bypass surgery and also great challenge to choice appropriate analgesics with minimize the duration of mechanical ventilation. In the postoperative period inadequate analgesia may increase morbidity by causing adverse haemodynamic, metabolic, immunologic and haemostatic attentions and prolong mechanical ventilation with more ICU stay. High Thoracic Epidural Anaesthesia (HTEA) as an adjunct to general anaesthesia has been shown to be potentially beneficial in postoperative pain relief and the requirement of mechanical ventilationin patients with off-pump coronary artery bypass surgery (OPCAB). HTEA provides good protection from stress response, ensures hemodynamic stability, improves distribution of coronary blood flow with reducing demand of oxygen, less requirement of postoperative analgesia , mechanical ventilation and ICU stay.

Objective: This study has been undertaken with a view to compare requirement of postoperative mechanical ventilation and analgesics in OPCAB surgery between HTEA with GA and GA alone.

Methods: This prospective, randomized case control comparative study was carried out in sixty patients without having left main coronary artery disease, left ventricular ejection fraction <30% or contraindication of regional anaesthesia scheduled for OPCAB. They were divided into two groups, thirty in each group. Group A received GA alone and group B received high thoracic epidural anaesthesia with GA. Requirement of postoperative analgesics, pain score, consciousness score, sedation score, satisfection level and duration of ventilation with length of stay in intensive care unit were recorded in the post-operative period.

Results: Rescue analgesics received and found 16(53.3%) and 6(20.0%) needed analgesia in group A and group B respectively and the difference was statistically significant (p<0.05). Regarding the pain score (VAS) during maintenance with ventilator with awareness at first fourth hour significant (p<0.05) change between two groups. After extubation at rest in different time interval and found significant (p<0.05) change between two groups in all follow-up times. Post-operative pain score (VAS) after extubation at movement in different time interval and found significant (p<0.05) change between two groups. Post-operative pain score (VAS) after extubation at during coughing in different time interval and found significant (p<0.05) change between two groups. Post-operative sedation score at first six hour (hourly) and found significant (p<0.05) change between two groups except 1st hour, which was not significant (p>0.05). The mean extubation hours were 7.4±1.09 hours in group A and 5.3±0.81 hours in group B. The mean ICU stay was 72.9±9.2 hours in group A and 57.1±12.0 hours in group B and the difference was statistically significant (p<0.05) in unpaired t-test. No post-operative complication was observed in both groups.

Conclusion: HTEA with GA appeared to be most reliable postoperative pain relief, shorter mechanical ventilation, ICU stay in OPCAB surgery

Key word: *pain, ventilation, analgesics, OPCAB, post-operative, epidural, HTEA, General anaesthesia.*

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Introduction:

Pain control with thoracic epidural is probably the most easily documented benefit. All studies examining the use of thoracic epidurals for cardiac surgery have documented superior pain relief when compared to all other modalities, including intrathecal opiate analgesia.

It is important to use TEA to its maximum capacity to benefit from its full potential: outstanding analgesia, excellent protection against stress hormone surge after surgery, reduction of postoperative ventilation period, fast recovery and better pulmonary recovery outcome. It seems imperative to begin its use before surgery starts, continue its infusion at a constant rate during surgery, and carry on for at least 2 days if possible. One study has shown that the maximum pain after surgery occurs within the first 48 hours, after which pain subsides significantly. In addition, use of TEA for longer than 3 days carries the risk of losing the control over its use and increase the likelihood of human error due to miscommunication. The safest duration of TEA in cardiac surgery is a maximum of 3 days; exceptionally longer use should be justified on a patient-by-patient basis .In the postoperative period inadequate analgesia may increase morbidity by causing adverse haemodynamic, metabolic, immunologic and haemostatic attentions (Chancy, 2006; Weissman, 1990; Kehlet, 1989; Roizen, 1988). This is often difficult to achieve optimal pain relief.

Aim:

- To assess postoperative pain score, consciousness score and sedation score between HTEA with GA and GA alone.
- To observe duration of ventilation and length of stay in intensive care unit between HTEA with GA and GA alone.
- To observe the requirement of post-operative rescue analgesia.

Methodology:

After selection of patients according to the inclusion and exclusion criteria, and after obtaining informed consent, a total of 60 adult patients with coronary artery diseases were prospectively enrolled in this study. All patients were undergone elective CABG on the beating heart with complete median sternotomy either using General Anaesthesia alone (group A) or combined High Thoracic Epidural Anaesthesia with General Anaesthesia (group B). All patients were premedicated Tab. Midazolam 7.5 mg received at bed time day before operation. On the arrival in the operation theater, patients were pre oxygenated and after stablist ECG monitor with all aseptic precaution intravenous cannulation, radial arterial cannulation and central venous catheterization was established in both groups. In the group B (study group), with all aseptic precaution a side holed multiport epidural catheter was inserted through 18G Touhy needle at the level of T1-2 or T2-3 interspaces in the morning on the day of surgery under local anaesthesia using midline approach at lateral decubitus position with the loss of resistance or hanging drop technique. The catheter was directed cephalic and advance 3-4 cm into the epidural space. Continuous epidural infusion with 0.25% bupivacaine was maintained after operation @ 4-5 ml/ hr up to 48 hours. Sensory block was determined bilaterally using loss of warm- cold sensation as well pinprick discrimination.

In both groups general anaesthesia was induced with fentanyl 10 µg/kg IV and with propofol 1 mg/kg IV. Tracheal intubation was facilitated by pancuronium bromide 0.1 mg/kg. Anaesthesia was maintained with propofol infusion @ 3-6 mg/kg/hr (50-100µg/kg/min) and fentanyl infusion @ 1-2 µg/kg/hr, neuromuscular booking agent pancuronium bromide 1/3rd dose of induction dose was given at one hour interval through iv route. The lungs were ventilated mechanically at normocapnia in an air and Oxygen mixture.

The parameters including heart rate (HR), arterial blood pressure (ABP), ECG, SPO_2, CVP, ABG analysis, Urine output were monitored during operation. Ephedrine 5-10 mg iv bolus or repeated was given if hypotension associated with epidural anaesthesia, dopamine 1-20 µg/kg/min was the first choice to maintain MAP above 70 mmHg if not corrected then adrenaline 0.05-0.2 µg/kg/ min, dobutamine 2-20 µg/kg/min was added accordingly.

On the arrival at ICU from Operation Theater the patient, ventilation was maintained by mechanical ventilator. Mechanical ventilation was started in assist control mode with a respiratory rate 10-12 breath / min, Tidal volume 10ml/kg, FiO_2: 0.7 and was adjusted to maintain O_2 saturation by pulse oxymetry >95% and PEEP was set at

5 cm H_2O .Tidal volume was adjusted to maintain partial pressure of arterial CO_2 between 35 and 40 mm Hg. When patient is haemodynamically stable and arousal, ventilation mode was changed to SIMV then Spontaneous ventilation mode. When there were accepted criteria for tracheal extubation then the patient was extubated and postoperative mechanical ventilation hour was recorded. Postoperative analgesia was performed by the epidural infusion 0.25% bupivacaine 3-4 ml/hour in patients group B and both groups of the patients were received injection ketorolac 30 mg iv 8 hourly.

Pain exceeding a visual analog score (VAS 0-100) of 50 or whenever were requested by the patients or deemed necessary by the nurse in case the patients are not fully awake and able to respond sufficiently, the hourly epidural rate was increased by 1 ml and intravenous Ketorolac 30 mg was administered simultaneously for instant pain relief. Morphine 1-2 mg IV as needed was used if ketorolac were insufficient. These rescue analgesics need were recorded. The epidural catheter was removed after 48 hours of post-operative period with normal coagulation profile.After extubation the level of consciousness (LOC) was hourly assessed for 6 hours using 5-point LOC scale. A higher score on the LOC were indicated a poorer LOC. After awareness postoperative pain scores were assessed and recorded of all patients at rest, exercise (e.g. Movement, coughing and so on) using a 100-mm visual analog scale, with ends marked as 0 (no pain) and 100 mm (worst imaginable pain) every four hour interval for 48 hours postoperatively. Sedation score was assessed and recorded by using a 3- point scale (1, completely awake and open eyes; 2, asleep but responds to verbal commands and/or touch; 3, does not respond) every hourly for first six hour of postoperative period. On the 3rdpost-operative day all patients were questioned as to satisfaction and whether they would choose the anaesthetic technique again and ask to other patients to receive this anaesthetic technique. After accepted criteria for discharge from the intensive care unite (ICU) patient was shifted to the post-operative care unit and the duration of ICU stay was recorded. Following post-operative complications were recorded in this study.

Pneumothorax: Evidenced on chest x-ray for consecutive post-operative 3 days.Prolong mechanical ventilation: Tracheal intubation for more than 24 hours, tracheal reintubation after initial extubation.Neurologic complication: Assessed with sensory, motor or reflex abnormalities any time after surgery; global abnormalities within two days operation.Acute infection: Patients were defined as confused when, after extubation they were unable either to cooperate or communicate with the nurses and were disoriented in time and place for 8 hours or more.Epidural haematoma: Suspected if patients had radicular pain on the back, sensory, motor deficits, and urinary retention diagnosed was confirm with immediate MRI.

Results:

The mean (±SD) age of the study patients were 49.9±7.1 years in group A and 49.3±7.2 years in group B. The mean (±SD) body surface area (BSA) of the study patients were 1.6±0.11 m^2 in group A and 1.7±0.15 m^2 in group B. No significant ($p>0.05$) mean age and body surface area (BSA) differences were found between two groups in unpaired t-test .

During postoperative ventilation with awareness at first fourth hour and after extubation from ventilator at rest and during movement in different time interval significant ($p<0.05$) change found regarding pain score (VAS) between two groups.

Table-I

Post-operative pain score (VAS) during maintenance with ventilator with awareness at different times of the study patients (n=60)

	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
1st fourth hour	53.4±9.4	26.0±8.7	0.001

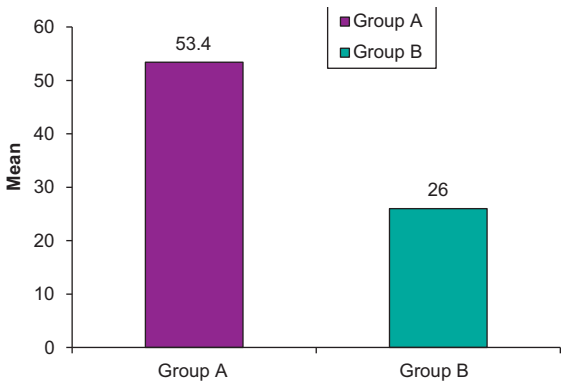

Fig.-1: *Bar diagram showing post-operative pain score (VAS) during maintenance with ventilator with awareness at different times of the study patients*.

Table-II

Post-operative pain score (VAS) after extubation at rest in different time interval of the study patients (n=60)

Four hours time interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8th hour	47.5±9.6	23.3±5.0	0.001
12th hour	47.5±8.8	23.3±5.8	0.001
16th hour	45.3±5.1	22.3±5.3	0.001
20th hour	42.1±6.1	21.9±5.3	0.001
24th hour	42.5±6.2	21.5±4.3	0.001
28th hour	41.7±5.9	21.5±4.3	0.001
32nd hour	40.5±4.6	21.5±4.3	0.001
36th hour	40.7±4.7	21.5±4.3	0.001
40th hour	40.2±5.7	21.2±4.2	0.001
44th hour	39.5±5.1	21.5±5.2	0.001
48th hour	37.8±4.6	21.3±4.3	0.001

Table-III

Post-operative pain score (VAS) after extubation at movement in different time interval of the study patients (n=60)

Four hours time interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8th hour	51.2±7.5	25.0±6.1	0.001
12th hour	52.5±8.6	24.8±6.9	0.001
16th hour	48.5±4.8	23.8±5.8	0.001
20th hour	47.1±5.1	22.9±5.5	0.001
24th hour	47.0±9.5	22.9±5.7	0.001
28th hour	44.2±5.7	22.3±6.2	0.001
32nd hour	41.7±4.9	22.5±5.3	0.001
36th hour	43.0±4.7	22.3±4.4	0.001
40th hour	43.5±5.4	22.5±6.4	0.001
44th hour	41.7±6.5	21.7±4.3	0.001
48th hour	40.6±4.8	21.7±5.3	0.001

Table-IV

Post-operative pain score (VAS) after extubation at during coughing in different time interval of the study patients (n=60)

Four hours time interval	Group Ax (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
8th hour	53.7±7.5	28.3±8.3	0.001
12th hour	56.7±8.2	28.7±9.5	0.001
16th hour	50.8±6.1	25.8±7.5	0.001
20th hour	50.2±7.2	24.6±6.6	0.001
24th hour	48.5±9.3	23.7±6.6	0.001
28th hour	45.7±5.4	22.9±6.4	0.001
32nd hour	45.0±4.3	23.1±5.5	0.001
36th hour	45.2±6.8	22.9±4.6	0.001
40th hour	45.0±5.4	23.1±7.6	0.001
44th hour	43.2±6.5	21.7±4.3	0.001
48th hour	42.8±3.5	22.4±5.6	0.001

The following table showed mean distribution of post-operative sedation score at first six hour (hourly) and found significant ($p<0.05$) change between two groups except 1st hour, which was not significant ($p>0.05$) (Table V).

Table-V

Mean distribution of post-operative sedation score at first six hour (hourly) of the study patients (n=60)

One hour interval	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	pvalue
1st hour	2.9±0.3	2.8±0.5	0.352 NS
2nd hour	2.8±0.5	2.1±0.6	0.001
3rd hour	2.4±0.7	1.4±0.5	0.001
4th hour	2.1±0.5	1.1±0.3	0.001
5th hour	1.4±0.5	1.0±0.0	-
6th hour	1.15±0.4	1.0±0.0	-

The following table showed Status of rescue analgesics received and found 16(53.3%) and 6(20.0%) needed analgesia in group A and group B respectively and the difference was statistically significant ($p<0.05$) in chi square test (Table VI).

Table-VI

Status of rescue analgesics received by the study patients (n=60)

Rescue analgesics	Group A (n=30)		Group B (n=30)		p value
	N	%	n	%	
Received	16	53.3	6	20.0	0.015
Not received	14	46.7	24	80.0	

The following table showed the requirement of postoperative mechanical ventilation i.e. The mean extubation hours were 7.4±1.09 hours in group A and 5.3±0.81 hours in group B. The mean ICU stay was 72.9±9.2 hours in group A and 57.1±12.0 hours in group B and the difference was statistically significant (p<0.05) in unpaired t-test (Table VII).

Table-VII

Mean distribution of extubation hour and duration of ICU stay of the study patients (n=60)

	Group A (n=30) Mean±SD	Group B (n=30) Mean±SD	p value
Extubation hours	7.4±1.09	5.3±0.81	0.001
ICU stay	72.9±9.2	57.1±12.0	0.001

No post-operative complication was observed in both groups.

Discussion:

This prospective, randomized observational comparative study was carried out with an aim to compare, which one more efficient for short duration of postoperative ventilation with the length of stay in intensive care unit and optimal pain relief after off pump coronary artery bypass surgery (OPCAB) between combined High Thoracic Epidural anaesthesia (HTEA) with General anaesthesia (GA) and general anaesthesia (GA) alone.

A total of 60 patients undergo elective CABG on off pump having ASA grade I, II, III and IV and NYHA class I, II, III and IV were included in the study at the National Institute of Cardiovascular Diseases and Hospital, Sher-E-Bangla Nagar, Dhaka and they were randomly allocated by lottery methods in two groups; group A: using GA alone and group B: using HTEA+ GA.

Regarding the mean pain score during maintenance with ventilator with awareness in this study at first fourth hour was significantly (p<0.05) higher in group A, which was 53.4±9.4 and 26.0±8.7 in group A and group B respectively.

Kessler et al. (2005) have assessed the VAS (0-100mm) at rest were subsequently higher in group A than group B at all times after surgery, always reaching significance level except at 48 hours. Similarly Salvi et al. (2004) assessed the VAS (0-10 mm) for the first 24 hour period were 0.9 at rest and 1.7 during coughing in each patients the VAS score always less than <2, which indicating that the post-operative pain relief was excellent in their study patients (group B). In the present study it was found that post-operative pain score VAS (0-100mm) was >40 in group A and <30 in group B after extubation at rest, movement and during coughing which were significantly (p<0.05) higher in group A in all the different follow-up times. The results obtained in the present study are comparable with the above studies.

In the current series it was observed that the status of rescues analgesics need 53.3% in group A and 20.0% group B and the difference was statistically significant (p<0.05).

In the present study post-operative sedation score at first hour was almost similar between two group, however the remaining times sedation score were significantly (p<0.05) higher in group A. Kessler et al. (2005) reported that sedation score were significantly higher at 6 hour post-operatively in group A.

Most of the patients in group B awareness were occurred at 2 hour after arrival at Intensive care unit but 4 hour later in group A. After 4 to 5 hour later after arrival at Intensive care unit it was observed that group B patients awake from sedation as like a normal healthy person with sound sleep, but in patients group A most of them looked anxious.

It was observed in the current study that post-operative level of consciousness score at different times almost similar between two groups. No significant (p>0.05) change was found between two groups.

A conscious and oriented patient will communicate their needs and cooperate with the medical staff providing post-operative care. The ability to concentric and learn instructions may facilitate tactual extubation, chest tube removal and cooperation with physiotherapist and moving staff.

In this study it was observed that the level of satisfaction with the anaesthetic technique was 36.7% and 83.3% mentioned good in group A and group B respectively, which was statistically significant (p<0.05). Kessler et al. (2005) found identical level of satisfaction with the anaesthetic technique.

Patients satisfaction is as much related to the comparison between anticipated and experienced pain

as it is to the actual level of pain experience. Satisfaction is achieved when a situation is better than expected and dissatisfaction when one is worse than expected. Patients undergoing cardiac surgery are very concerted regarding post-operative pain and tend to preoperatively expect more intense post-operative pain than that actually experienced. So in the present study patients who were received HTEA (group B) express very high satisfaction level than the groups A only. In the present study the patients in both groups were asked during 3rd postoperative day about their anesthetic technique and their feeling in comparison with the other patients who underwent OPCAB in the same day or next day at the same cardiac post anaesthesia care unit, a specialized unit caring a exclusively for open heart surgery patients. The patient group B, most of the patient expressed their feeling good and few of them expressed fair and none of them not fair. But in group A, 23.0% patients expressed their feeling not fair.

In this study no post-operative complication was found between two groups. In a study Scott (2001) done a study on 202 patients in group A and 206 in group B and found the incidence of postoperative confusion was 5.5% and 1.5% in group A and group B respectively. The incidence of CVA was 3.0% in group A and 1.0% in group B. Similar technique was used by Tuman et al. (1991) on outcome of major vascular surgery and found that prolong mechanical ventilation 12.5% in group A and 2.5% in group B, reintubation 2.5% in group A and none was found in group B, neurologic complications 7.5% in group A and none was found in group B.

In this study it was found that the mean ventilation hours was significantly ($p<0.05$) higher in group A, which were 7.4±1.09 in group A and 5.3±0.81 hours in group B. Similarly, the mean ICU stay was also significantly ($p<0.05$) higher in group A, which were 72.9±9.2 hours in group A and 57.1±12.0 hours in group B. Kessler et al. (2005) observed the higher mean ventilation hours in group A, which was 5.0±2.6 hour in group A and 3.7±2.4 hours in group B. The mean ICU stay was also higher in group A, which was 11.2±7.9 hours and 9.2±8.1 hours in group B. Salvi et al. (2004) observed the mean ventilation hour was 4.6±2.9 in group B and the mean ICU stay was 36.0±19.2 hours.

Conclusion:

Based on the present study shows that anaesthetic technique High Thoracic Epidural Anaethesia with General Anaesthesia (HTEA with GA) during off pump coronary artery bypass surgery (OPCAB) shortens the post-operative requirement of mechanical ventilation with the duration of ICU stay and optimize the pain relief with satisfaction than GA only.

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Original Article

Triglyceride to High Density Lipoprotein Cholesterol Ratio in Acute Myocardial Infarction And Its Relationship with Angiographic Severity

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Abstract:

Background: In acute myocardial infarction (AMI) the extent of the coronary artery lesion is evaluated by coronary angiogram (CAG). Recent evidences suggest that, ratio of triglyceride and high-density lipoprotein cholesterol (TG/HDL-C) could be a non-invasive marker for the prediction of the extent of coronary artery lesion. The aim of this study was to evaluate the association between TG/HDL-C ratio and the extent of coronary artery lesion assessed by coronary CAG among AMI patients.

Objective: The aim of this study was to assess relationship between TG to HDL-C ratio and extent of coronary artery lesion in AMI patients.

Materials & Method: This cross-sectional study was carried out in the Department of Cardiology, Chittagong Medical College Hospital in 224 admitted AMI patients. Blood samples were taken within 24 hours of admission following AMI for fasting lipid profile assessment, (total cholesterol (TC), HDL-C, low-density lipoprotein cholesterol (LDL-C) and TG). Each patient was underwent CAG within 2 to 6 weeks of the events and angiographic findings were classified according to presence of significant stenosis, number of vessel involved and Gensini score.

Results: The subjects consisted of 197 males and 27 females with a mean age of 51.24 (±11.22) years. Mean value of TC was 185.74 (±41.96) mg/ dL, TG was 222.17 (±99.05) mg/dL, HDL-C was 38.92 (±5.46) mg/dL, LDL-C was 127.99 (±36.94) mg/dL, TG/HDL-C was 5.91 (±2.99), median Gensini score was 28 (Range:1-146). Analysis of receiver operating characteristic curves showed that only TG/HDL-C and TG were useful for detecting high Gensini score (score >42), with the former more area under the curve (AUC: 0.611; 95% CI: 0.531-0.691; p=0.008). The TG/HDL-C was an independent predictive factor (Odds ratio: 2.706; 95% CI: 1.397-5.242; p = 0.003) for the presence of significant coronary artery lesion on CAG. Linear regression analysis revealed that, age and TG/HDL-C ratio significantly predicted Gensini score.

Conclusion: TG and HDL-C ratio was independently associated with extent of coronary artery lesion.

Key words: *TG/HDL-C ratio, AMI, Angiographic Severity,*

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Introduction:

Around the world, cardiovascular disease (CVD) is recognized as the leading cause of death (accounting for approximately 31% of all deaths) and is predicted to remain as such in 2030.[1] Myocardial infarction (MI) is one of the most common form of CVD.[2] World Health Organization forecasts an increase of 11% in the burden

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of CVD by 2030, bringing the worldwide number of MI and stroke to approximately 36.2 million.[3]

Although the incidence of MI is decreased in the industrialized nations partly because of improved health systems and implementation of effective public health strategies, nevertheless the rates are surging in the developing countries such as South Asia, parts of Latin America, and Eastern Europe.4 Due to lack of national population-based surveys or central administrative health data it is hard to find accurate information on the prevalence of MI in Bangladesh. However, a recent review observed a high CVD prevalence along with an upward trend in Bangladeshi adults.[5]

"Dyslipidemia" refers to an abnormality within the lipid profile, encompassing a variety of disorders relating to elevations in total cholesterol (TC), low density lipoprotein cholesterol (LDL-C), or triglyceride (TG), or conversely, lower levels of high-density lipoprotein cholesterol (HDL-C). The dyslipidemia may present as a single disorder affecting only one lipoprotein parameter, or may represent a combination of lipoprotein abnormalities, such as elevated TG and low HDL-C.[6]

The third Adult Treatment Panel (ATP) Guidelines of the US National Cholesterol Education Program (NCEP 2001) recommend a full fasting lipoprotein profile, including TG, TC, HDL-C, and LDL-C. According to ATP III guideline dyslipidemia is considered with Serum TC > 200 mg/dl, TG >150 mg/dl, LDL-C >100 mg/dl, HDL-C <40mg/dl (male) and <50mg/dl (female). Although the guidelines only provide for evaluation of individual lipid fractions, the application of ratios such as TC/HDL-C and TG/HDL-C may offer a refined risk assessment by simultaneously considering both anti-atherogenic and atherogenic lipid parameters.

Selective coronary angiography remains the gold standard to determine the extent of CAD, because it is the only technique that can simultaneously provide both functional and anatomic information for the estimation of ischemic burden of CAD.[7]

Significant CAD was defined as ≥70% stenosis in any of the three major epicardial coronary arteries or a left main coronary artery stenosis ≥50%. Patients were grouped as having single vessel disease (SVD), double vessel disease (DVD) and triple vessel disease (TVD) according to the number of vessel involvement.[8]

To determine the severity of CAD Gensini score was also estimated in the study. Gensini score is a widely used angiographic scoring system for quantifying the severity of CAD.[9]

Several studies have reported the condition of dyslipidemia among CAD patients of Bangladesh but the study assessing association between TG to HDL-C ratio and severity of CAG findings among MI patients.[10-11]

There are few studies on TG/HDL-C ratio in AMI and their Angiographic correlation in Bangladesh. The relevance of this study is to correlate relationship of TG/HDL-C in AMI and to see their angiographic severity. In developing countries like Bangladesh, coronary angiogram facility is limited to the tertiary care hospitals and specialized hospital. If we can find any relation between TG/HDL-C ratio and severe coronary artery lesion, then that will helpful to influence the decision of a strategy non invasive investigation in patients with AMI. So we can predict invasive investigation by non-invasive way, which will in long run reduce morbidity and mortality due to coronary artery disease in our country.

Materials and Methods:

Study design and patients:

This is a hospital based Cross-sectional study was conducted on 224 patients of AMI admitted in Department of cardiology, Chittagong Medical College & Hospital, Chattogram, Bangladesh and underwent CAG within 2-6 weeks of events during May 2019 to April 2020.

Purposive sampling was done. Patients were excluded on the background of refusal to give consent, severe comorbid condition like renal failure, liver failure, stroke.

Study procedure:

In this study, patients with acute myocardial infarction were assessed during their admission for the eligibility in the study. After inclusion an informed written consent was taken from the patient. Demographic profile of the patient including age, sex and occupation and major risk factors like diabetes, hypertension, dyslipidemia, smoking, family history of CAD, were recorded. The body height was measured in the standing position without shoes. Weight was measured similarly without shoes and heavy dresses.

With all aseptic precautions 5 ml of fasting blood sample was drawn and sent to biochemistry laboratory for analysis. Fasting lipid profile was determined on the day of blood collection in enzymatic kinetic method by Siemens Dimension EXL 200 auto analyzer made in Germany. Then TG/HDL-C ratio was calculated as more than 4 and less than 4.

Subsequently patients were undergoing coronary angiography after the AMI events as per the hospital protocol. Coronary Angiography was performed in Cath

lab of cardiology ward by SHIMADZU BRANSIST alexa C12 (ceiling mounted angiographic machine) made in Japan. Coronary angiogram was obtained for each coronary vessel in e"2 projections in cardiology ward. Analysis of the coronary angiograms was performed visually by an experienced operator. The severity of the CAD was assessed by vessel score and Gensini score.

Data 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 median (range). Means were compared using independent sample t-test between two groups. Qualitative or categorical variables were described as frequencies and proportions. Proportions were compared by using chi-square test.

Correlation between two variables was determined by Pearson correlation coefficient. A ROC curve was used to determine the diagnostic performance of TG/ HDL-C ratio in the prediction of the extension of coronary artery lesion. Binary logistic regression and linear regression analysis were conducted to determine the independent predictive factors for severe CAG findings. Theses analysis included the variables which were found to have significant association with CAG findings in bivariate analysis. Statistical significance and confidence interval were set at $p<0.05$ and 95% level respectively.

Results:

The present cross sectional study intended to investigate the relation of TG to HDL- C ratio with angiographic severity of CAD in patient's admitted with AMI. Finally, 224 patients admitted with AMI and had CAG were included in the analysis. The findings obtained from data analysis are presented below:

The mean age of 224 patients with AMI was 51.24±11.22 (Range: 26-70) years and 87.9% of participants were men. Regarding occupation majority of the men were either doing institutional service or un-institutional job and in women majority were housewife.

In the 224 AMI patients most prevalent risk factor was dyslipidemia present in 211 (94.2%) of patients followed by smoking in 174 (77.8%), overweight and obesity in 131 (59%), DM in 82 (37%), hypertension in 73 (33%) and family history of CAD in 59 (26%) of patients (Figure 1).

Out of 224 patients with AMI 148 of them were diagnosed as NSTEMI (66.1%) and other 76 (33.9%) were diagnosed as STEMI (Figure 2).

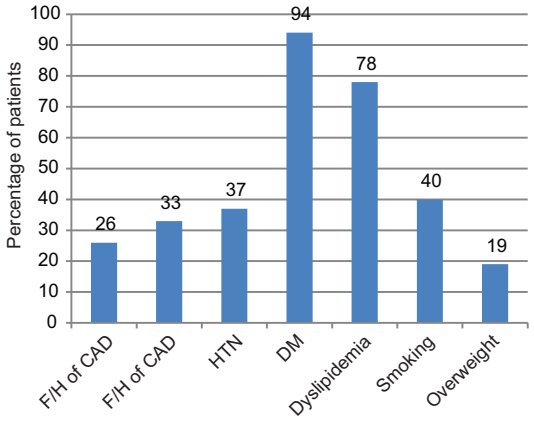

Fig.-1: *Distribution of risk factors of CAD among AMI patients (n=224)*

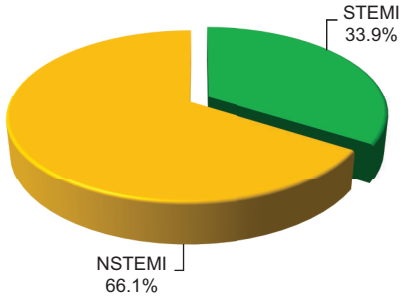

Fig.-2: *Distribution of the patients by AMI type (n= 224)*

Table-I

Lipid profile of the patients (n=224)

Parameters	Mean (±SD)
Total cholesterol (mg/dl)	185.74±41.96
LDL cholesterol (mg/dl)	127.99±36.94
HDL cholesterol (mg/dl)	38.92±5.46
Triglyceride (mg/dl)	222.17±99.05
Triglyceride/HDL-C	5.91±2.99

Table I shows that, mean LDL-C, and mean TG values were higher than the expected normal values (<100mg/dl and <150mg/dl respectively) among the studied patients. Similarly mean HDL-C level was lower than the expected normal values (≥40 mg/dl for male and ≥50mg/dl for female). However, mean TC value was within the expected normal range (<200mg/dl) in the studied AMI patients. Mean TG/HDL-C ratio was also higher than the normal expected value <4.

Among the lipid sub fractions most prevalent lipid abnormality was high LDL-C present in 183 (81.7%) of patients followed by high TG present in 163 (72.8%), low

HDL-C in 163 (56.7%) and high TC in 80 (35.7%) patients (Figure 3). About 63% (141/224) patients had TG/HDL-C ratio ≥4. Only 13 (5.8%) patients had normal lipid profile in all sub fractions and had TG/HDL-C ratio <4.

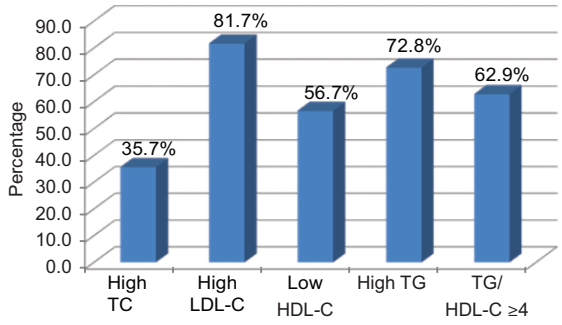

Fig.-3: *Prevalence of abnormal lipid sub-fractions and ratio among AMI patients (n=224)*

Table-II

Angiographic profile of the patients (n=224)

Characteristics		Frequency (%)
Significant CAD	Present	153 (68.3)
	Absent	71 (31.7)
No of involved vessel	Single vessel	110 (49.1)
	Double vessel	55 (24.6)
	Triple vessel	59 (26.3)
	Median (Range)	28 (1-146)
Gensini score	Low (score ≤20)	45 (33.5)
	Intermediate (score 21-42)	78 (34.8)
	High (score >42)	71 (31.7)

Data are expressed as frequency (percentage) if not otherwise mentioned.

Out of 224 AMI patients underwent CAG, majority (68.3%) have significant obstruction in angiogram. About half of the patient's had SVD. About one fourth of the patients had double vessel and triple vessel diseases each. Patients' were divided into tertile according to their Gensini score, and 45 (33.5%) patients were in lowest tertile of Gensini score had score equal to or below 20 and 71 (31.7%) patients were in highest tertile had score >42 (Table II).

Table-III

Bivariate association between CAG findings and TG/HDL-C category in AMI patients (n=224)

Variables	TG/HDL-C of the patients		p value
	<4 (n=83)	≥4 (n=141)	
Significant CAD			
Present	40(48.2)	113(61.7)	**0.001***
Absent	43(51.8)	28(38.3)	
Number of vessel involved			
Single	50(60.2)	60(42.6)	
Double	18(21.7)	37(26.2)	**0.027***
Triple	15(18.1)	44(31.2)	
Gensini tertile			
Low	32(38.6)	41 (29.1)	
Medium	35(42.2)	48(34.0)	**0.021***
High	16(19.3)	52(36.9)	

[a]<40 mg/dl for male and <50mg/dl for female. Data are expressed as frequency (percentage); *p value derived from Chi-square test. Significant values are in bold face.

Table III shows that association between angiographic findings of the AMI patients and their TG/HDL-C pattern. It shows that, patients with TG/HDL-C ≥4 have severe CAG findings in terms of all the three characteristics like, significant stenosis, vessel number and Gensini tertile compared to the patients with TG/HDL-C <4.

The scattered plot in Figure 4 shows that, among the 224 AMI patient's TG/HDL-C had a positive correlation with Gensini score. It indicates that, as the TG/HDL-C ratio increases the Gensini score of the AMI patients also increase. This positive correlation was statistically significant (p=0.011).

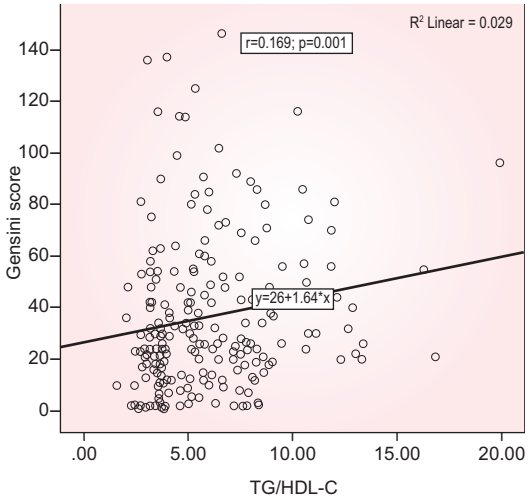

Fig.-4: *The relationship between TG/HDL-C and Gensini scores (n=224)*

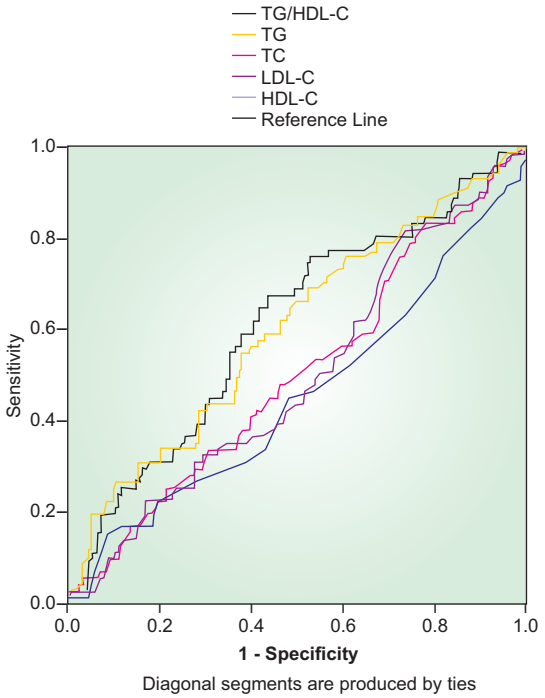

Fig.-5: *ROC curves for TG/HDL-C ratio and individual lipid sub-fractions in predicting for high Gensini score (>42) in AMI patients (n=224).*

Table-IV

Area under the curve (AUC) with 95% CI for different lipid parameters for predicting high Gensini score (n=224)

Variables	AUC	95% CI of AUC		p value
		Lower limit	Upper limit	
TG/HDL-c	0.611	0.531	0.691	0.008
TG	0.600	0.519	0.680	0.016
TC	0.503	0.421	0.585	0.946
LDL-C	0.496	0.415	0.577	0.919
HDL-C	0.455	0.370	0.539	0.274

CI: confidence interval

ROC analysis demonstrated a significant diagnostic value of TG/HDL-C ratio and TG level of the AMI patients to detect AMI patients having high Gensini score (Figure 5 and Table IV).

Discussion:

The present study observed the mean age of the AMI patients was 51.24±11.22 years ranging from 26 to 70 years. Previous studies from Bangladesh reported similar age distribution of patients with AMI with mean age around 51 years with maximum number of the patients in the age range of 51-60 years.[10-12] In contrast to these findings from Bangladesh, studies from India reported comparatively higher mean age like 62.74 ± 13.6 years, 13 56.06 ± 11.29 years,14 and 56.75 ± 10.47 years. 15 Moreover, western study has reported higher mean age as compared to these studies conducted in Asia such as study (68 years).[16]

With regard to sex distribution, 87.9% of our study population was male and only 12.1% was female (male: female ratio of 7.2:1), showing a clear male preponderance. Similar sex ratio with male predominance were also observed by other studies.[10-12]

Regarding the traditional risk factors, it was found in the current study that, most of the patients of AMI (211/224; 94.2%) had unrecognized dyslipidemia. Similar to this finding reported such high prevalence (85.1% and 82.1% respectively) of unrecognized dyslipidemia among the admitted patients for first time AMI.[12,17] Followed by dyslipidemia the other risk factors in descending order were smoking (77.8%), overweight and obesity (59%), DM (37%), hypertension (33%) and family history of CAD (26%). Amin et al., (2014) reported that smoking was found in the highest (65.3%) number followed by hypertension (51.7%), overweight (50.8%), DM (42.4%) and family history of CAD (10.2%). Major CAD risk factors were noted to be very prevalent in the present study, which is similar to previous published data evaluating the prevalence of these risk factors in Bangladesh.[18-19]

The present study demonstrated that, among the lipid sub fractions most prevalent lipid abnormality was high LDL-C present (81.7%), followed by high TG (72.8%), low HDL-C (56.7%) and high TC (35.7%). Several studies have reported varying prevalence and type of dyslipidemia. The prevalence of high TG (28-72.2%), high LDL cholesterol (23.3-44.5%), low HDL (27-72.2%) and high TC (19-38.7%) were observed from different region of India and Bangladesh.[10,11,21] These variations can be explained by differences in the study population with respect to age and sex distribution, inclusion of patients with CVD and population or hospital-based study.

In the current study coronary angiographic severity was assessed by presence or absence of significant obstruction, number of vessel involvement and Gensini score calculation. It was observed that 68.3% patients had significant obstruction.

Regarding vessel involvement 49.1% had SVD, 24.6% DVD and 26.3% TVD. Almost similar result has been observed by other study.[14,16]

This study showed that patients with TG/HDL-C ≥4 have severe CAG findings in terms of all the three parameters

like, significant stenosis, vessel number and Gensini tertile compared to the patients with TG/HDL-C <4. About 38.3% patients without significant obstruction had high TG/HDL-C ratio (≥4) whereas 61.7% patients with significant obstruction had high TG/HDL-C ratio (≥4).

The multivariate analysis by binary logistic regression showed that a subject with TG/HDL-C value ≥4 had higher odds of having significant coronary lesion than AMI patients with TG/HDL-C vale <4 (adjusted OR=2.706; 95% CI=1.397-5.242).

Previous reports have shown that high TG/HDL-C ratios correlate independently with presence of angiographic coronary artery disease (defined as stenosis >70%) among men and women even after adjustment for traditional risk factors, including diabetes. 22-24 The present study was also able to reproduce this finding in AMI patients and extend the observation to demonstrate that the TG/HDL-C ratio was also associated with coronary artery disease severity as expressed by a Gensini score.

Conclusion:

In this study high TG/HDL-C ratio (≥4) correlated with severity of CAD in terms of Gensini score and significant obstruction. High TG/HDL-C ratio was found as the most important predictor of severe coronary heart disease among all the lipid variables examined.

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Original Article

Coronavirus Disease 2019: One Year Experience at Tertiary Care Cardiac Hospital

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Abstract:

Background: The Coronavirus Disease 2019 (COVID-19) pandemic is a significant challenge particularly for low and middle-income countries like Bangladesh. Interventions such as home isolation, frequent hand washing, wearing face mask, maintaining social distancing are difficult to implement in densely populated areas. The aim of the study was to delineate demographics, clinical manifestations, treatment modalities and outcomes of COVID-19 affected patients of our hospital.

Methods: This prospective observational study was carried out at National Heart Foundation Hospital & Research Institute of Bangladesh between 08 March 2020 to 07 March 2021. During this period all admitted patients who subsequently were diagnosed as COVID positive and health care personnel of this hospital, who experienced fever or respiratory symptoms or came in close contact with COVID-19 patients at home or their workplace & become COVID positive were included.

Results: During this one-year period a total of 769 COVID positive patients were detected in our hospital. Mean age of the patients was 48.16 ±15.63 years (range 1-92 years). Two third were male (64.9% vs 35.1%) and had multiple co-morbidities. One fifth of the patients were (19%) asymptomatic. The mean duration of onset of symptoms to test was 3.72±3.7 days. Most common symptoms were fever (65.3%), cough (37.1%), shortness of breath (33.6%) and fatigue (27.8%). Other symptoms were bodyache (18.6%), headache (16.6%), anosmia 16%), sore throat (12.1%), diarrhoea (6.8%), dizziness (5.3%), generalized itching (3.8%). Nearly two third of the COVID positive patients (63.2%) had a diagnosed cardiovascular disease at onset and remaining 36.8% patients presented with only COVID-19 disease. About 75% patients received ivermectin, 5.1% patients received favipiravir and 4.4% patients received remdesivir. Three fourth (74.38%) of patients were hospitalized and remaining one fourth (25.62%) patients were treated either in home isolation or in institutional isolation. Most of the patients recovered, with a case fatality rate of 3.5%. Diabetes, hypertension and age ≥50 years were the independent predictors of mortality.

Conclusion: Although most of the patients had good outcome the study revealed 3.5% case fatality. Male with multiple co-morbidities were predominantly affected by COVID 19. Fever, cough, shortness of breath and fatigue were common presenting symptoms.

Key words: *COVID-19, clinical features, treatment, in-hospital outcome, predictors of mortality*

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Introduction:

Like many other countries, Bangladesh has also been experiencing a public health crisis due to Coronavirus Disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2). As of March 07, 2021, about 117 million confirmed cases and 2.6 million deaths were reported worldwide[1]. The first COVID -19 positive patient was detected in Bangladesh on 8th March 2020. The first case of non-health care personnel (non-HCP) COVID-19 was confirmed in our hospital on 14th April and the first case of HCP on 29th April. By 7th March, SARSCoV-2 had caused 5,50,330 infections and 8,462 deaths in Bangladesh[2]. The common symptoms of the disease include fever, headache, bodyache, shortness of breath, dry cough, sore throat, and fatigue; some patients develop severe pneumonia, acute respiratory distress syndrome, thrombo-embolism, and multiple organ failure progressing to death. However, most affected individuals are healthy asymptomatic carriers or have minor symptoms[3]. SARS-CoV-2 not only involves lung, but may also affect the cardiovascular system[4-6], gastrointestinal system[7,8], central nervous system[9-11], renal system[12] and skin[13]. The SARS-CoV-2 protein characteristic spike binds to its cellular receptor, the angiotensin-converting enzyme 2 (ACE2), which is widely expressed in many cell types and organs like lung alveolar cells, nasal epithelium, cerebral cortex, digestive tract, kidney, gallbladder, testis, and adrenal gland[11]. The majority of patients with COVID-19 infection are thought to be paucisymptomatic and do not require hospitalization[14]. Hypertension, diabetes, cardiovascular disease, and pulmonary disease are the most common morbidities among COVID-19 patients[15]. There are many challenges in treatment strategies as there is currently no specific treatment for COVID-19. However, pharmacologic and non-pharmacologic symptom management and supportive care measures should be given to all patients with symptomatic COVID-19[15]. In spite of its high contagiousness the mortality rate is low. We previously analyzed COVID-19 infection among healthcare personnel[16]. The goal of the present study is to narrate the clinical characteristics, severity of disease at the time of their initial evaluation, treatment and outcome of a large cohort of patients diagnosed with COVID-19 over the initial one year since the first case was declared in Bangladesh.

Methods and Materials:

Study design, setting, and population

This prospective observational study was carried out in the non-COVID tertiary cardiac care hospital (National Heart Foundation Hospital & Research Institute, Dhaka, Bangladesh) from March 08, 2020 to March 07, 2021. All admitted patients, who were subsequently diagnosed as COVID positive and health care personnel of this hospital, who experienced fever or respiratory symptoms or came in close contact with COVID-19 patients at home or their workplace & later became COVID positive were included in this study. Epidemiological, clinical characteristics, treatment and outcomes data were obtained from data collection forms. The study was approved by the Ethics Review Committee of National Heart Foundation Hospital & RI (N.H.F.H. & R.I. 4-14/7/AD-1105) and written informed consent was obtained from all patients or patient's attendance.

Definition and variables

A confirmed case of COVID-19 was defined as having a positive result through real-time reverse-transcriptase-polymerase-chain-reaction (RT-PCR) assay of naso-pharyngeal swab specimens[17]. We studied confirmed COVID-19 cases only. Demographic information included gender, age, risk factors and co-morbidities (diabetes mellitus, hypertension, smoking, dyslipidemia, obesity, cardiovascular disease, cerebro-vascular disease, chronic obstructive pulmonary disease /bronchial asthma (COPD/BA), chronic kidney disease, pregnancy). The degrees of severity of COVID-19 were classified as mild, moderate, severe, and critical ill[18,19]. Mild type was defined as have mild clinical symptoms without any imaging findings of pneumonia. Moderate type was defined as clinical symptoms (fever or other respiratory symptoms) with imaging findings of pneumonia. Patients with severe type had any of the following parameters: (I) respiratory distress, respiratory rate ≥30 times/min; (II) oxygen saturation ≤93% at rest. Also patients showing a rapid progression (>50%) of chest imaging within 24–48 hours was regarded as severe type. Patients with critical ill type had to meet any of the following standards: (I) respiratory failure requiring mechanical ventilation; (II) shock; (III) complicated extrapulmonary organ failure requiring care in the intensive care unit. The case fatality rate (CFR) was defined as the percentage of the cumulative number of deaths divided by the total number of laboratory-confirmed COVID-19 infections[20].

Nasopharyngeal swabs collection process

Using a standardized technique, trained doctors or laboratory technicians obtained the nasopharyngeal swabs from patients. After collection, swabs were placed in a transport medium and delivered to the laboratory. Diagnosis of COVID-19 was confirmed by real-time reverse transcription-polymerase chain reaction assay.

Statistical analysis

Categorical variables were presented as numbers and percentages and continuous data as mean and standard deviation. Binary logistic regression was used to identify the predictors of mortality. Variables significantly related to in-hospital outcome such as mortality in univariate analysis were included in a binary logistic regression model with the forward method to identify independent predictors of the mortality. A two-sided p value <0.05 was considered statistically significant. All analyses were performed using SPSS statistical software version 16.0 (SPSS Inc., Chicago, IL, USA).

Results:

During one year period a total of 769 patients were infected by SARS-CoV-2. Mean age of the patients was 48.16 ±15.63 years (range 1-92 years), of whom 539 (70.1%) were non-HCP and 230 (29.9%) were HCP. Most of the patients were male (64.9% vs 35.1%). Baseline characteristics of COVID-19 patients are shown in Table I.

Table-I

Baseline characteristics of COVID-19 patients (n=769)

Variables	Mean±SD/ Frequency	Percentage
Age (Mean±SD) in years	48.16 ±15.63	
Gender		
Male	499	64.9
Female	270	35.1
Patients category		
Non-HCP	539	70.1
HCP	230	29.9
Risk factors & co-morbidities		
HTN	399	51.9
DM	320	41.6
Smoking	242	31.5
Dyslipidemia	296	38.5
Cardiovascular disease	452	58.8
COPD/BA	54	07.0
Obesity	263	34.2
CKD	247	32.1
Pregnancy	08	01.0
Number of co-morbidities		
0	143	18.6
1	128	16.6
>1	498	64.8

COVID-19: coronavirus disease 2019; HCP: healthcare personnel; non-HCP: non-healthcare personnel; SD: standard deviation; HTN: hypertension; DM: diabetes mellitus; COPD: chronic obstructive pulmonary disease; BA: Bronchial asthma; CKD: chronic kidney disease.

Among the infected, 143 (18.6%) patients did not have any pre-existing comorbidities. Cardiovascular disease (58.8%), hypertension (51.9%) and diabetes mellitus (41.6%) were the most prevalent comorbidities. Other comorbidities are dyslipidemia (38.5%), obesity (34.2%), smoking (31.5%), chronic kidney disease (32.1%) and chronic obstructive pulmonary disease/bronchial asthma (7%). Most of the patients had multiple co-morbidities (Figure 1).

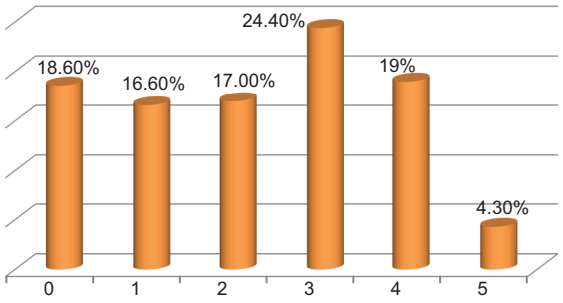

Fig.-1: *Bar diagram showing number of co-morbidities of COVID-19 patients (n=769).*

COVID-19: coronavirus disease 2019

It was noted that the infection rate was highest in the month of July during the early stage of the pandemic in Bangladesh. Subsequently, the infection rate plateaued in our hospital (Figure 2).

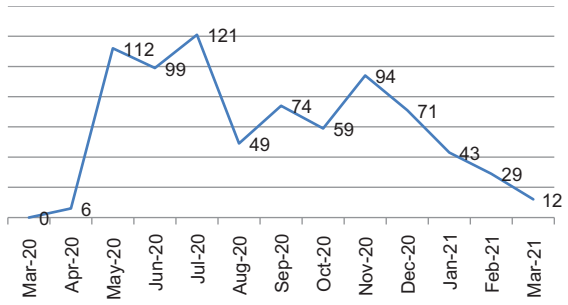

Fig.-2: *Bar diagram showing month wise distribution of COVID-19 patients (n=769)*

COVID-19: coronavirus disease 2019

About 81% of the patients were symptomatic and 19% patients were asymptomatic. The mean duration of onset of symptoms to test was 3.72±3.7 days. Patients had clinical manifestations of fever (502 [65.3%] patients), cough (285 [37.1%] patients), shortness of breath (258 [33.6%] patients), fatigue (214 [27.8%] patients), bodyache (143 [18.6%] patients), headache (128 [16.6%] patients), anosmia (123 [16%] patients),

sore throat (93 [12.1%] patients), diarrhoea (52 [6.8%] patients), dizziness (41 [5.3%] patients), generalized itching (29 [3.8%] patients), vomiting (27 [3.5%] patients) nausea (20 [2.6%] patients), anorexia (15 [2.0%] patients), abdominal pain (10 [1.3%] patients) and numbness (10 [1.3%] patients). Clinical characteristics of 769 confirmed COVID-19 patients are outlined in Table II. Most of the patients had good left ventricular function (64%).

Table-II

Clinical characteristics of COVID-19 positive patients (n=769)

Variables	Frequency	Percentage
Clinical presentation		
Symptomatic	630	81.1
Asymptomatic	139	18.9
Presenting symptoms		
Fever	502	65.3
Fatigue	214	27.8
Cough	285	37.1
Bodyache	143	18.6
Headache	128	16.6
Anosmia	123	16.0
Sore throat	93	12.1
Shortness of breath	258	33.6
Diarrhea	52	6.8
Dizziness	41	5.3
Generalized itching	29	3.8
Vomiting	27	3.5
Nausea	20	2.6
Anorexia	15	2.0
Abdominal pain	10	1.3
Numbness	10	1.3
Left ventricular ejection fraction		
Good	492	64.0
Mild	165	21.4
Moderate	92	12.0
Severe	20	2.6

COVID-19: coronavirus disease 2019.

Most of the patients (63.2%) had a cardiac diagnosis: Acute coronary syndrome [ST-segment elevation myocardial infarction (13.4%); non-ST segment elevation myocardial infarction (10.6) & unstable angina (7.9%)]; chronic coronary syndrome (22.8%); ischemic cardiomyopathy (2.1%); valvular heart disease (3.6%); sinus & atrio-ventricular node disease (1.1%), congenital heart disease (1.3%) and dilated cardiomyopathy (0.4%). Remaining 36.8% patients had only COVID-19 disease.

All patients were treated in isolation. Oxygen therapy (low flow, high flow) was given when required. Prone positioning was advised for all patients. Treatment outline is given in Table III. Most of the patients received ivermectin (576 [74.9%]). Only four (0.5%) patients received hydroxy-chloroquine at the early period of COVID-era. Total 39(5.1%) patients received favipiravir (1600 mg on day 1 followed by 600 mg 12 hourly from day 2 to day 10) and 34(4.4%) patients received remdesivir (200 mg IV infusion [within 30 min-2 hours] on day 1 followed by 100 mg infusion within [30 min to 2 hours] from day 2 to day 5). One (0.1%) patient was also treated by 2 doses of tocilizumab (8 mg/kg [max: 800 mg/dose]) and 1 dose of convalescent plasma therapy due to cytokine storm.

Table-III

Distribution of treatment of COVID-19 patients (n=769)

Variables	Frequency	Percentage
Antibiotics		
IV	123	16.0
Oral + IV	65	8.4
Oral	498	64.8
Not received	83	10.8
Antibiotics		
Single	516	67.1
Double	170	22.1
Not received	83	10.8
Steroids (oral & IV)	56	7.3
Favipiravir	39	5.1
Remdesivir	34	4.4
Ivermectin	576	74.9
Hydroxy-chloroquine	4	0.5
Enoxaparine	483	62.8
Rivaroxaban	485	63.1
Tocilizumab	1	0.1

COVID-19: coronavirus disease 2019; IV: intravenous.

Regarding antibiotic therapy, 516 (67.1%) patients were treated with a single antibiotic and 170 (22.1%) patients were given combination therapy. Rest of the patients (10.8%) did not require antibiotic therapy. The antibiotics used generally covered common pathogens. The antibiotics used were doxycycline, macrolide, cephalosporins, fluoroquinolones, carbapenems and β-lactamase inhibitors. Regarding oral antibiotic treatment, 275 (35.8%) patients were treated by azithromycin and 341 (44.3%) patients by doxycycline. Most of the patients received either ivermectin plus azithromycin or ivermectin plus doxycycline combination. The duration of antibiotic treatment was 5–10 days. Around 56 (7.3%) patients were also treated with methylprednisolone and

dexamethasone for 3–7 days. Low molecular weight heparin was used in 483 (62.8%) patients and newer oral anticoagulant (rivaroxaban 10 mg once daily for 1 month) was used in 485 (63.1%) patients. We administered vitamin C, vitamin D_3 and zinc to most of the patients.

Total 572 (74.38%) patients were hospitalized and remaining 197 (25.62%) patients were treated either in home isolation or in institutional isolation. Regarding disease severity, 18.1% patients had asymptomatic disease, 67.3% had mild disease; 6.6% had moderate disease; 6.2% had severe disease and 1.8% were critically ill. Case fatality rate (CFR) was 3.5% (Table IV).

Table-IV
In-Hospital outcome of COVID-19 patients (769)

Variables	Frequency	Percentage
Hospitalization	572	74.38
Home isolation	197	25.62
Disease severity		
Asymptomatic	139	18.1
Mild	517	67.3
Moderate	51	6.6
Severe	48	6.2
Critical ill	14	1.8
Mortality	27 1	3.5

COVID-19: coronavirus disease 2019.

Table V shows the univariate analysis of in-hospital outcome of study population. Age more than 50 years, non-health care personnel, presence of cardiovascular disease, Left ventricular ejection fraction (LVEF) category, disease severity and diabetes mellitus significantly related with in-hospital mortality.

Among 769 patients, 27 (3.5%) patients died. Univariate analysis showed several factors were significantly related with in-hospital mortality. Based on these variables, binary logistic regression using the forward method was performed, and we found that diabetes mellitus, hypertension and age more than 50 years were the independent predictor of mortality (Table VI).

Table-V
Distribution of factors associated with in hospital outcome of study population (n=769)

Variables	Outcome		P value*
	In hospital deathf(%)#	Recovered f(%)#	
Age group			
<50 Y	04 (14.8)	364 (49.1)	0.000
>50 Y	23 (85.2)	378 (50.9)	
Gender			
Male	20 (74.1)	479 (64.6)	0.210
Female	07 (25.9)	263 (35.4)	
Non-HCP/HCP			
Non-HCP	26 (96.3)	513 (69.1)	0.001
HCP	01 (03.7)	229 (30.1)	
CVD			
Present	21 (10.2)	311 (41.9)	0.030
Absent	06 (0.6)	431 (58.1)	
Obesity			
Non obese	19 (70.4)	487 (65.6)	0.388
Obese	08 (29.6)	255 (34.4)	
LVEF Category			
Severe LV Dysfunction	03 (11.1)	17 (02.3)	0.007
Moderate LV Dysfunction	05 (18.5)	87 (11.7)	
Mild LV Dysfunction	08 (29.6)	157 (21.2)	
Good Function	11 (40.7)	481 (64.8)	
Disease Severity			
Asymptomatic	01 (03.7)	138 (18.6)	0.000
Mild	03 (11.1)	514 (69.3)	
Moderate	01 (03.7)	50 (06.7)	
Severe	13 (48.1)	35 (04.7)	
Critically ill	09 (33.3)	05 (0.70)	
Diabetes Mellitus			
Diabetic	20 (74.1)	300 (40.4)	0.001
Non diabetic	07 (25.9)	442 (59.6)	
Blood Pressure			
Hypertensive	13 (48.1)	386 (52.0)	0.420
Normotensive	14 (51.9)	356 (48.0)	

HCP: healthcare personnel; non-HCP: non-healthcare personnel; CVD: cardiovascular disease; LVEF: left ventricular ejection fraction. # Value in the parenthesis shows the corresponding row percentage; *Chi square test to find out significance.

Table-VI

Multivariate analysis of in hospital outcome of study population (n=769)

	Wald	Sig.	Exp(B)	95.0% C.I. for Exp(B)	
				Lower	Upper
Age ≥50 years	4.457	0.035	0.281	0.086	0.913
Gender Male	0.104	0.747	1.167	0.456	2.986
Non-HCP/HCP	3.705	0.054	9.411	0.960	92.260
CVD	1.964	0.161	2.206	0.730	6.668
Obese	0.365	0.546	1.311	0.545	3.155
LV Dysfunction	0.634	0.426	0.702	0.294	1.676
Disease Severity	3.670	0.055	0.136	0.018	1.047
DM	5.861	0.015	0.314	0.123	0.802
HTN	7.147	0.008	3.112	1.354	7.153
Constant	0.777	0.378	8.074		

a. Variable(s) entered on step 1: Age ≥50 years, Gender (Male), NOHCP/HCP, CVD, Obese, LV Dysfunction, Disease severity, DM, HTN.
HCP: healthcare personnel; non-HCP: non-healthcare personnel; CVD: cardiovascular disease; LV: left ventricular; DM: diabetes mellitus; HTN: hypertension; Sig.: significant; C.I.: confidence interval; Exp: exponential.

Discussion:

Important findings of this study are: 1) Most of the patients were male; 2) Most of the patients had multiple co-morbidities; 3) Around 19% patients had asymptomatic presentation; 4) Most common symptoms of COVID-19 were fever, cough & shortness of breath; and 5) Most of the patients had mild disease with a low mortality rate (3.5%).

Our study was based in a large tertiary cardiac care hospital in Dhaka, Bangladesh. Many COVID-19 affected patients present with cardiovascular symptoms. Also, many cardiac patients have underlying COVID-19 infection. Our hospital is a non-COVID hospital. However, during the pandemic many patients were admitted who were subsequently diagnosed with COVID-19. Undoubtedly taking care of these non-HCP put the HCP of our hospital at risk of becoming infected with COVID-19.

Analysis of 207,079 RT-PCR positive patients in Argentina showed mean age of the patient 42.9±18.8 years and 50.0% were males[17]. Most common symptoms were fever, cough, headache and sore throat. Death or intensive care unit admission were independently associated with older age, male, coma, dyspnea or tachypnea, and seizures, with underlying co-morbidities such as immunodeficiency, chronic renal failure, and liver disease showing the strongest effects. The burden of SARS-CoV-2 infection among healthcare personnel was 10.6%, The total case fatality rate was 5.3%.

Meta-analysis of sixty studies included a total of 59,254 patients from 11 countries[21] and detected the most common symptoms in patients with SARS-CoV-19 infection were fever, cough, muscle aches and/or fatigue and dyspnea. Overall, the male/female ratio was 1.08. All-cause mortality was 0.3%. Epidemiological studies showed that mortality was higher in males and elderly patients.

Summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention[22] showed among a total of 72 314 case records, 44 672 were classified as confirmed cases of COVID-19 (62%) and asymptomatic cases (1%). Most case patients were 30 to 79 years of age (87%). Most cases were classified as mild (81%). However, 14% were severe and 5% were critical. The overall case-fatality rate (CFR) was 2.3%. Infection rate among health care personnel were 3.8%.

Result from five retrospective clinical studies[3], which included a total of 1556 hospitalized patients with COVID-19 and showed 57.5% were male and mean age of the patients 49.1 years. Common symptoms were fever, cough and fatigue. Critical cases with complications were 9%, intensive care unit admission was required in 7.3%, invasive ventilation in 3.4%, and mortality was 2.4%.

Clinical and epidemiological characteristics of 1420 European patients with mild-to-moderate coronavirus disease 2019[14] showed 67.7% were females and 30.7% patients were HCP. The mean age of patients was 39.17±12.09 years. The most common symptoms were headache, loss of smell, nasal obstruction, cough, asthenia, myalgia, rhinorrhea, gustatory dysfunction and sore throat. Fever was reported by 45.4%. The prevalence of symptoms significantly varied according to age and sex. Young patients more frequently had ear, nose and throat complaints, whereas elderly individuals often presented fever, fatigue and loss of appetite. Loss of smell, headache, nasal obstruction and fatigue were more prevalent in female patients.

Analysis of eighty articles[15] included a total of 417 patients with a mean age of 48 years. The most common clinical manifestations were fever, cough, dyspnea, and myalgia or fatigue. Less common clinical manifestations included nausea or vomiting, dizziness, rhinorrhea, and chills. Hypertension, diabetes, cardiovascular disease, and pulmonary disease were the most common morbidities among COVID-19 patients.

Analysis of 140 hospitalized COVID-19 patients in Wuhan[23] revealed 50.7% of patients were male with an overall median age of 57.0 years. Fever, cough and fatigue were the most common symptoms in COVID-19 patients. More than 1/3 of the patients had chest tightness or dyspnea and gastrointestinal symptoms such as nausea, diarrhea, and anorexia. Hypertension and diabetes mellitus were the most common comorbidities.

Retrospective, single-center case series of the 138 hospitalized patients with confirmed novel coronavirus–infected pneumonia in Wuhan, China showed[24] the median age of the patients was 56 years. Common symptoms were fever, fatigue and dry cough. The overall mortality rate was 4.3%.

A cohort study[25] on 201 Bangladeshi patients was done in Combined Military Hospital, a tertiary level hospital in Dhaka, Bangladesh from April 2020 to May 2020. Mean age of the patients was 32.2±2 years and 90% were male. Common symptoms are fever, cough, headache, myalgia, sore throat, malaise, respiratory distress. Asymptomatic cases were 4.5%. Death rate was 1% which was associated with comorbidity of CKD.

Mean age of our study population was 48 years, which is consistent with other studies[3,15]. However, in some studies[14,17,25] mean age of the patients was less than our study and some other studies, median age was greater than our studies (56-57 years)[23,24]. Male were predominant in our study as also in other studies [3,21,23,25].

The COVID-19 pandemic has shown a striking gender bias with more cases and a higher mortality rate in men than in women[26]. Increased male susceptibility might be explained by biological and behavioral factors. Biological factors include men's high level of testosterone that inhibits antibody production, and the presence of angiotensin-converting enzyme 2 (ACE2) receptors (cell receptors which play an essential role in SARS-CoV-2 entry) that facilitate viral replication[27]. Similarly, behavioral and lifestyle factors include men's higher rates of smoking and low level of hand-washing practices [28], although there is no clear evidence these behavioral factors have any impact on COVID-19 transmission.

Most common symptoms in our study were fever, cough, shortness of breath and fatigue which are almost consistent with other studies[3,15,17,21-24]. In contrast to our study, one European study[14] showed female predominance and the most common symptoms were headache, loss of smell, nasal obstruction, cough, asthenia, myalgia, rhinorrhea, gustatory dysfunction and sore throat.

As COVID-19 involves multisystem, it also affects olfactory and gastrointestinal tract (GIT). In our study, 16% patients developed anosmia. In one of the first studies from China[10], anosmia was mentioned to affect only about 5.1% of COVID-19 patients. Another study from France reported 47% patients with confirmed COVID-19 had anosmia[11]. The pathophysiological mechanism underlying the occurrence of anosmia is still not well-understood, but two explanations have been proposed[12]. The first hypothesis suggests peripheral viral involvement. Another hypothesis, currently the most widely accepted, suggests the direct changes to the central nervous system by the virus[12]. SARS-CoV-2 infection is strongly associated with the development of anosmia , especially in females and those with fever[12].

In our study, diarrhea (6.8%) was the most common GIT symptom. Other symptoms were nausea, vomiting, altered taste and abdominal pain. SARS-CoV-2 infects the GI tract *via* its viral receptor angiotensin converting enzyme II, which is expressed on enterocytes of the ileum and colon[7]. Viral ribonucleic acid (RNA) has also been isolated from stool specimens of COVID-19 patients, which raised the concern for fecal-oral transmission in addition to droplet transmission[7].

The largest cases of patients (74 patients) with COVID-19 with GI symptoms outside Wuhan showed its novel characteristics of increased family clustering and liver

injury, severe/critical tendency and higher rate of body temperature >38.5°C [8]. Among enrolled 651 patients, 74 (11.4%) presented with at least one gastro-intestinal symptom (nausea, vomiting or diarrhoea)[8].

In our study, most cases were classified as mild which is consistent with other studies[3,14,21,22,25]. A total of 8096 severe acute respiratory syndrome (SARS) cases and 774 deaths across 29 countries were reported for an overall CFR of 9.6%[22]. Middle East respiratory syndrome (MERS) is responsible for 2494 confirmed cases and 858 deaths across 27 countries for a CFR of 34.4%[22]. Despite much higher CFRs for SARS and MERS, COVID-19 has led to more total deaths due to the large number of cases. In our study, case fatality rate was 3.5% which is comparable with other studies[3,22,25].

Asymptomatic infection is often understood as detection of SARS-CoV-2 by RT-PCR, in the absence of a clinical illness compatible with COVID-19[29]. Asymptomatic transfer leads to lower prevalence estimates and higher transmission rates in the community. Various reports worldwide showed various COVID-19 asymptomatic case rates diverse from 1.2% to 51.4%[30]. In our study, 18.9% patients had asymptomatic infection. Public health measures, including quarantining in the community, frequent hand washing, maintaining social distancing, wearing mask, to trace close contacts of those testing positive for COVID-19 as well as timely diagnosis and strict adherence to universal precautions in health care settings, are critical in controlling COVID-19.

Our study has some limitations: First, it is a single centre study. So, it may not reflect the true scenario of the entire country. Second, it is non-COVID dedicated hospital. Only patients with cardiac symptoms were admitted. Third, cardiac manifestations of COVID-19 could not be evaluated as almost all non-HCP were cardiac patients.

Conclusion:

Regarding prevalence of COVID 19

Male were predominant with multiple co-morbidities. Most common symptoms were fever, cough, shortness of breath and fatigue. Most patients had good outcome. Asymptomatic cases of SARS-CoV-2 can be unknown carriers magnifying the transmission of COVID-19. Thus, mask wearing, maintaining social distance, extensive testing for identification and the quarantine of infected asymptomatic individuals are essential to curb this pandemic. Diabetes, hypertension and age ≥50 years were the independent predictors of mortality.

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Original Article

High Density 3D Mapping and Ablation of Complex Cardiac Arrhythmias: Our Experience in NICVD.

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Abstract:

Background: Catheter ablation can be curative in patients with drug-refractory tachyarrhythmias. 3D electro anatomical mapping (EAM) is an established tool facilitating catheter ablation. This system is particularly valuable for mapping complex arrhythmias, which provide excellent assistance to catheter navigation, reduces fluoroscopy exposure, and also allow for the accurate placement of catheters. The Rhythmia Mapping System (RMS, Boston Scientific) is a novel system that allows for ultra-fast, high-density 3D mapping.

Aim of this Study: The aim of this study was to find out the result of a high-density 3D mapping for the ablation of complex Cardiac Arrhythmias and to share our experiences.

Methods: A total number of 44 patients of different tachyarrhythmias were scheduled for catheter ablation by Rhythmia Mapping System in National Institute of Cardiovascular Diseases, Bangladesh from 3rd February'2018 to 18th July'2019. During and after, the procedure all the cases were evaluated for different procedure parameters, acute success and in-hospital success.

Results: Among the patients (28/44 male) 13 (25.55%) cases were atrial fibrillation, 6 (16.64%) cases were atrial flutter, 6 (16.64%) cases were atrial tachycardia, 2 (4.55%) cases were ventricular tachycardia, 11 (25%) cases were PVC and 6 (16.64%) cases were accessory pathway. The mean age was 38±4.5 years. In 25 (56.82%) of tachyarrhythmia patients, the mechanism was macro reentry/micro reentry, while in 19 (43.18%) cases the mechanism was increased automaticity. In all cases, the tachycardias were adequately mapped & proper identification of focus was done during the index procedure with the ultra-high density 3-D Rhythmia Mapping System (RMS). These all were successfully terminated by radiofrequency ablation, except one, which was one of the two cases of Ventricular tachycardia. With this system our study samples had a success rate of 98% with arrhythmia elimination. In patients of atrial fibrillation, all 4 pulmonary veins isolation were done. The mean mapping time was 28.6 ± 17 minutes, and the mean radiofrequency ablation time to arrhythmia termination was *3.2*± 2.6 minutes. During our study only two out of 44 patients developed complications. One of the patients with atrial fibrillation developed cardiac tamponade and the other patient with PVC originating from Aortic cusp developed ischemic stroke. Fortunately, they were both managed accordingly. During hospital discharge, all the patients were free of tachyarrhythmia and were in sinus rhythm.

Conclusions: This new automated ultrahigh-resolution mapping system allows accurate diagnosis of tachyarrhythmia circuits. Ablation of the focus resulted in high acute success.

Keywords: *Ultra-High density, 3D mapping, Cardiac Arrhythmias, Rhythmia Mapping System.*

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Introduction:

Catheter ablation can be curative in the patients of drug refractory tachyarrhythmia. 3D electro anatomical mapping (EAM) is an established tool facilitating catheter ablation. This system is particularly valuable for mapping complex arrhythmias, which provide excellent assistance to catheter navigation, reduces fluoroscopy exposure and also allow for the accurate placement of catheters. The Rhythmia Mapping System (RMS, Boston Scientific) is a novel system that allows for ultra-fast, high- density 3D mapping.

Contemporary High-Resolution Mapping Systems are fit for obtaining and annotating multiple Electrograms (EGMs), which are handled via mechanized calculations to produce actuation and substrate guides to help and guide removal methodology. All the more as of late, a novel Ultra-High Density (UHD) Electroanatomic Mapping System empowers fast programmed procurement of High-Resolution Maps through a 64 Pole Basket Array Catheter with little and firmly dispersed ELECTRODES in mix with a committed Mapping Platform (Boston Scientific, Marlborough, MA, USA). The remarkable qualities of fast and programmed procurement of Maps with High Spatiotemporal Resolution, without the requirement for broad manual comment, has been assessed in Pre-Clinical and beginning experience studies.[1–3] Furthermore, various human examinations announced information in a wide scope of genuine Clinical Settings including the utilization of Mapping for both Atrial and Ventricular Arrhythmias.[4–9] Although a large portion of these investigations have shown that the System is protected, effectual and Clinically helpful in explicit settings, to date there has been no planned investigation to evaluate the intense wellbeing, intense viability and Clinical utilization of the System on a wide range of various Arrhythmias to direct Ablation in certifiable Clinical Practice. Contemporary High-Resolution Mapping Systems are capable of acquiring and Annotating Multiple Electrograms (EGMs), which are processed by automated algorithms to generate activation and substrate maps to support and guide ablation procedures. In this study, our main objective is to share our experiences regarding find out the result of a high-density 3D mapping for the ablation of complex Cardiac Arrhythmias. Also, the research will provide a comprehensive insight into the overall significance of topic of our study.

Method:

The study was a prospective, observational and single centered study conducted using purposive sampling technique. The objective was to assess the acute safety, procedural success, and the utility of a novel RMS (Boston Scientific) and to share our experience. The RMS system was paired with a catheter with small and closely spaced electrodes in patients who underwent an ablation procedure in a clinical setting. A total number of 44 patients of different tachyarrhythmias were scheduled for catheter ablation by Rhythmia Mapping System in National Institute of Cardiovascular Diseases and hospital, Dhaka, Bangladesh from 3rd February'2018 to 18th July'2019. During and after, the procedure all the cases were evaluated for different procedure parameters, acute success and in hospital success.

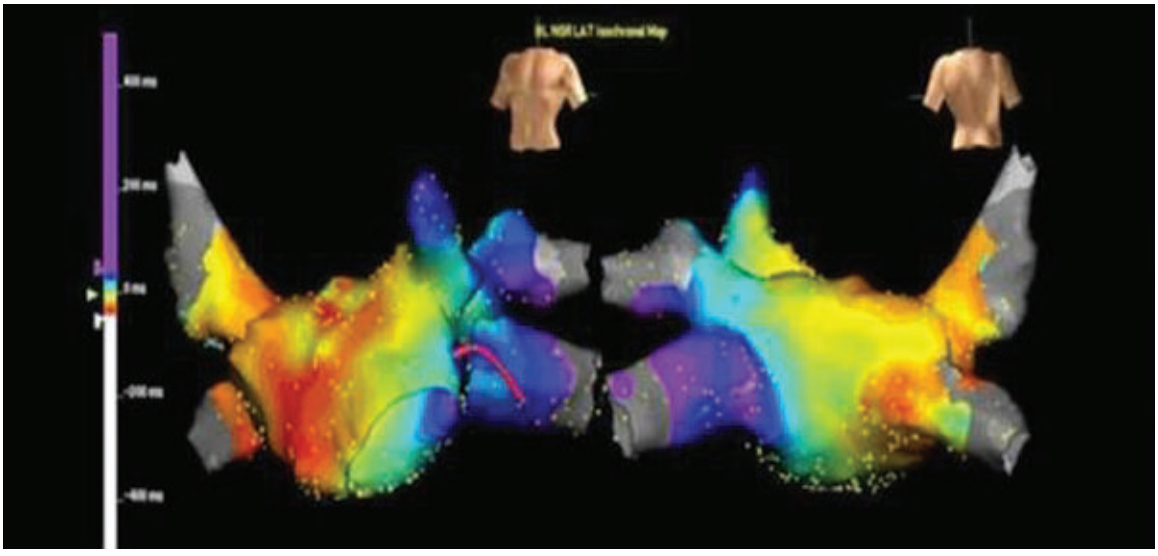

Fig.-1: *3D Mapping with RMS.*

All 44 patients enrolled in the study with conscious consent. The undergoing index ablation procedure were required to use the catheter in conjunction of the Rhythmia Mapping System (RMS). Any commercially available ablation catheter was used in the study with the discretion of the attending physicians. The primary effectiveness endpoint was the acute procedural success for mapping and ablation of the primary clinical cardiac arrhythmia. A procedure was considered acutely successful if all the following criteria were met;

I. Ability to map the primary arrhythmia (ongoing) or its electro-anatomical substrate with the RMS,
II. Completion of the indispensable ablation lesions,
III. Arrhythmia cessation, (in applicable cases), and
IV. Ablation substantiation through a documented validated technique.

Procedures where the mapping catheter system entered the cardiac chamber, but no electroanatomic maps were created for either diagnosis or validation purposes. These were categorized as an attempt, regardless of whether ablation was achieved or not. Procedures with at least one utilized map for diagnosis or validation defined the treatment cases. Success with validation in treatment cases was required to count a success for the primary effectiveness endpoint.

Fig.-2: *3D mapping of the RA &LA was done which revealed Atrial tachycardia originated from RA appendage. Termination of tachycardia by successful ablation.*

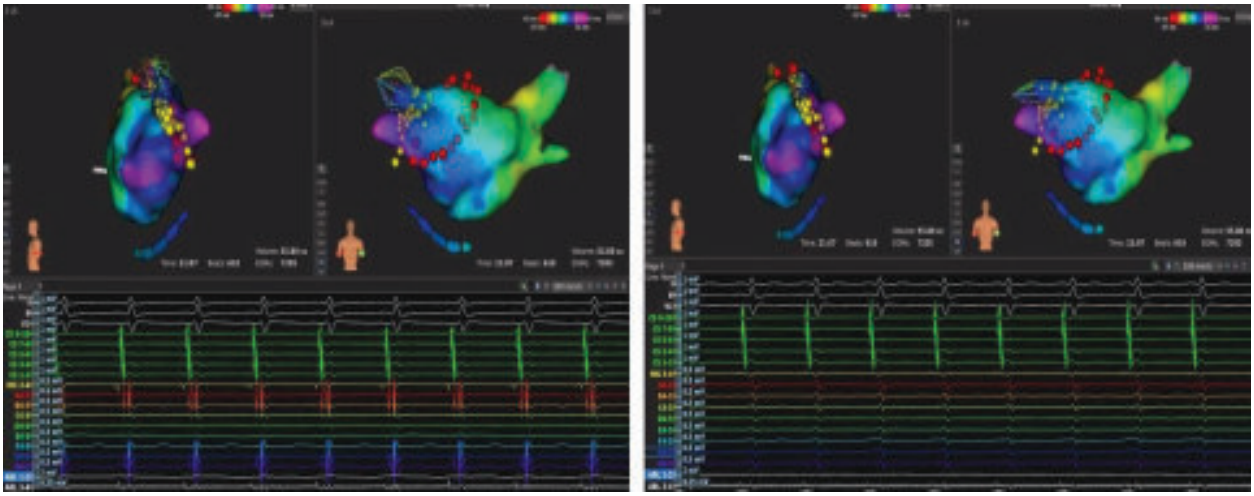

Fig.-3: *3D mappping of the left & right, superioir & inferior pulmonary veins and isolation was done in case of atrial fibrillation. The pictures showing left superior pulmonary vein (LSPV) isolation before & after ablation by the absence of PV potential.*

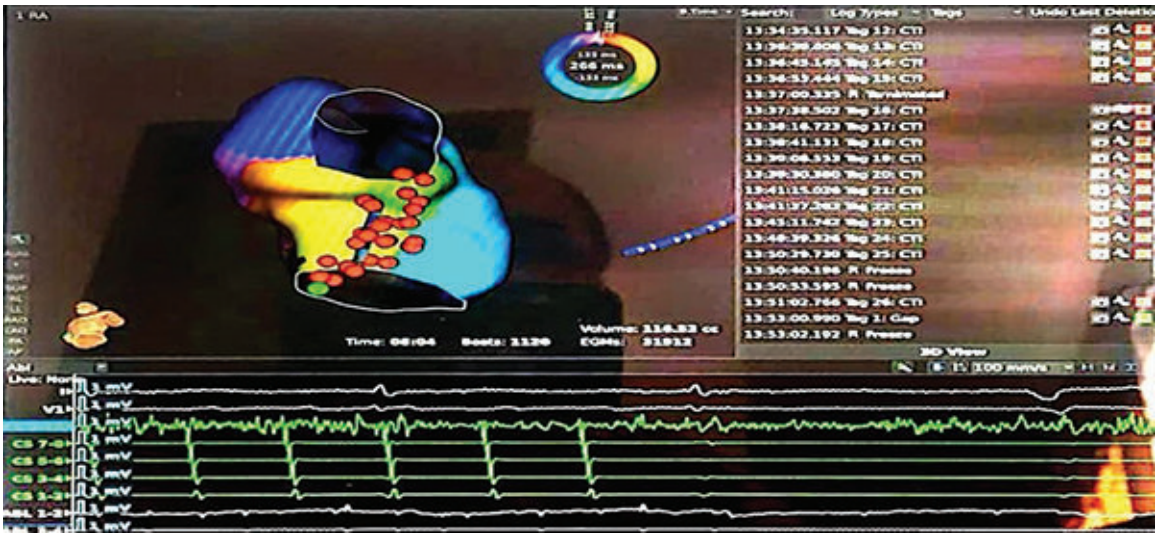

Fig.-4: *3D mapping of the Right atrium which revealed counterclockwise activation of the atrial flutter. Successful termination of atrial flutter by CTI ablation.*

Fig.-5: *3D mapping of the right ventricle & RVOT by RMS which revealed PVC originated from anterior RVOT. Right side of the picture showing termination of PVC by successful ablation.*

The primary safety endpoint included all serious adverse events and study devices related adverse events within 30 days after the procedure. Seriousness and relationship with the procedure/device were determined by the investigator at each study site. In all cases of the study, the tachycardias were adequately mapped & proper identification of focus was done during the index procedure and successfully terminated by radiofrequency ablation. In patients of atrial fibrillation all 4 pulmonary veins isolation were done (Figure-3). However, on statistical analysis of the study, we primarily took on a ration-logical approach and used frequency distribution, mean, and standard deviation techniques to analyze the findings of our study. All 44 samples were informedly participated in the study with the means of a consent form as well as with a verbal agreement.

Result:

The study was participated by 28 (63.64%) male which were the majority samples of the study. The remaining 36.36% were of female gender (Figure-6).

Majority of the sample had a clinical history of atrial fibrillation. Few of the samples had the clinical history of multiple cardiac arrhythmia symptoms which in reflected in the Table-1 below. The mean age of the samples was 38 with the standard deviation of 4.5 as shown in Table-I.

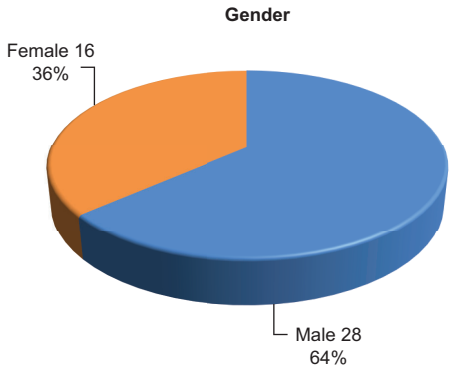

Fig.-6: *Gender Distribution. (n=44)*

Table-I

Demographic Distribution and baseline characteristics Among the Samples (n=44)

Demographic Description	
Age (years)	38 ± 4.5
Male, N (%)	28(63.64%)
Female, N (%)	16(36.16%)
Hypertension	5(11.36%)
Diabetes Mellitus	02(4.54%)
LV Function (LVEF%)	64±05%

Table-II

Clinical History of Arrhythmia Among the Samples. (n=44) And Results

Clinical Arrhythmia History	Number	Percentage%	Outcome		Complications
			Success	Failure	
Ventricular tachycardia	2	4.55%	01	01	0
Atrial fibrillation	13	25.55%	13	0	01
Atrial tachycardia	6	16.64%	06	0	0
Atrial flutter	6	16.64%	06	0	0
PVC	11	25.00%	11	0	01
Accessory Pathways	6	16.64%	06	0	0
Total	44		43(98%)	01(2%)	02(4.5%)

Table-III

Complications & its frequency during our procedure.

Complications	Frequency
1. Cardiac Tamponade	1(2.27%)
2. Ischemic stroke	1 (2.27%)
Total	2(4.54%)

In 25 (56.82%) of tachyarrhythmia patients the mechanism was macroreentry/microreentry, while in 19 (43.18%) cases the mechanism was increased automaticity as shown in Figure-7.

The mean mapping time was 28.6 ± 17 minutes, and the mean radiofrequency ablation time to arrhythmia termination was 3.2 ± 2.6 minutes.

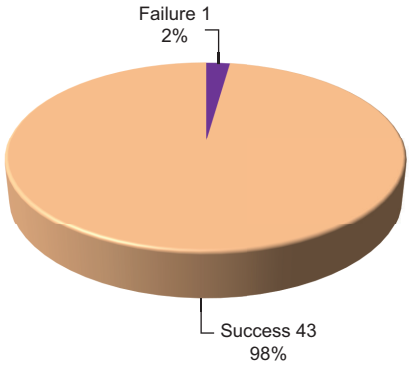

Fig.-7: *Success rate of 3-D mapping & ablation at our Centre*

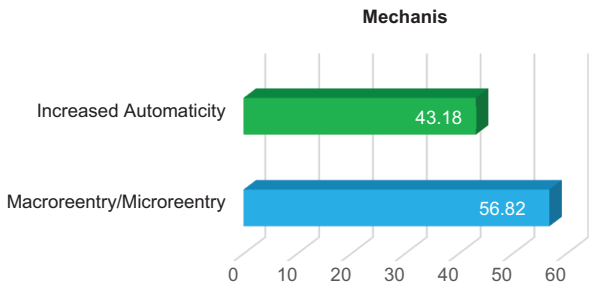

Fig.-8: *Tachyarrhythmia Mechanism. (n=44)*

Table-IV
Mapping Description.

Mapping Description	Mean ± SD
Mapping time (in minutes)	28.6 ± 17
Radiofrequency ablation time to arrhythmia termination (in minutes)	3.2 ± 2.6

Discussion:

This is the first prospective, single-centred study in Bangladesh to perform systematic data collection in order to describe clinical use of a UHD mapping technology as used in different arrhythmias. Previous studies published on this topic included patients,[3,5-7] focused on specific mapping capabilities or concentrated on specific arrhythmia types.[8] Moreover, these studies demonstrated the clinical advantages in the management of particular cases such as complex atrial[9] or ventricular tachycardias (VTs). In our study, we used A total number of 44 patients of different tachyarrhythmia were scheduled for catheter ablation by Rhythmia Mapping System in National Institute of Cardiovascular Diseases, Bangladesh during 3rd February'2018 to 18th July'2019. During and after, the procedure all the cases were evaluated for different procedure parameters, acute success and in hospital success. the patients (28/44 male) 13 (25.55%) cases were atrial fibrillation, 6 (16.64%) cases were atrial flutter, 6 (16.64%) cases were atrial tachycardia, 2 (4.55%) cases were ventricular tachycardia, 11 (25%) cases were PVC and 6 (16.64%) cases were accessory pathway. Mean age was 38±4.5 years. In all cases, the tachycardias were adequately mapped & proper identification of focus was done during the index procedure. These were successfully terminated by radiofrequency ablation, except one, which was one of the two cases of Ventricular tachycardia. In our study, 25 (56.82%) of tachyarrhythmia patients the mechanism was macroreentry/microreentry, while in 19 (43.18%) cases the mechanism was increased automaticity.

In patients of atrial fibrillation all 4 pulmonary veins isolation were done. The mean mapping time was 28.6 ± 17 minutes, and the mean radiofrequency ablation time to arrhythmia termination was 3.2 ± 2.6 minutes. The mapping time coincides with the approximate timings of few other studies, [5, 8-10] and proves the high efficiency of the RMS. With this system our study samples had a success rate of 98% with arrhythmia elimination. During our study only two out of 44 patients developed complications. The patient with atrial fibrillation developed cardiac tamponade and the patient with PVC originating from Aortic cusp developed ischemic stroke. Fortunately, they were both managed accordingly. The success rate is not so overwhelming in studies that had more samples to work with, so it varies marginally from the facts and literature mentioned few other studies. [4,9,11] During hospital discharge all the patients were free of tachyarrhythmia and were in sinus rhythm.

Conclusion:

Different study evaluated the safety and acute effectiveness of using this novel UHD mapping system in a variety of clinical arrhythmias as standard of treatment throughout the world. Our study is the first real-world data acquired in Bangladesh that confirm that the new novel system performs well with a very low rate of complications. As we have studied on a limited sample within a short time-period, further studies are necessary to validate the facts mentioned in this research. However, with the given findings, we can conclude that the new automated ultrahigh resolution 3-D mapping system allows accurate diagnosis of tachyarrhythmia circuits and ablation of the focus, resulting in a high acute success.

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Original Article

Prognostic Value of Electrocardiographic Abnormalities and Troponin-I Elevation in Hospitalized COVID-19 Patients

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Abstract:

Background: Corona Virus Disease (COVID -19) patients present mainly with respiratory manifestations and viral pneumonia. The cardiovascular presentation includes early signs of acute myocardial injury. Troponin elevation is a frequent laboratory finding in hospitalized patients with the disease, and may reflect direct vascular injury or nonspecific supply-demand imbalance. In this work, we assessed the correlation between different ranges of Troponin elevation, Electrocardiographic (ECG) abnormalities and mortality.

Methods and materials: It was a prospective observational study, conducted in four tertiary care Private Hospitals of Chattogram City of Bangladesh. The study enrolled 181 consecutive patients admitted to hospital from June 01, 2020 to December 31, 2020 due to Covid-19 disease on the basis of presentation of signs and symptoms severity. Upon admission, routine investigations cTnI and ECG were carried out.

Results: Mean age of the patients was 54.3±7.3 years with 63.5% male. Hypertension was the most common comorbidity followed by diabetes and obesity. 57.1% of the patients had abnormal ECG. Abnormal axis deviation [26 % (left axis deviation 23.9% vs right axis deviation 2.0%)], Poor R wave progression (22.9%), T inversion (14.5%), left ventricular hypertrophy (LVH) (11.4%) followed by ST segment depression (8.3%) were major findings observed in the study population. Presence of LVH (p=0.008), ST segment elevation (p≤0.001), ST segment depression (p≤0.001) and T inversion (p=0.003) showed statistically significant association with Severe COVID-19 disease. 48.2% had raised cTnI level. Thirteen (7.2%) patients expired in hospital. The mortality rate increased with incrementally higher troponin group: 12/18 than mildly elevated troponin 1/63 (p < 0.01). The presence of an abnormal ECG finding resulted in significant in the intermediate Troponin elevation group (0.05-1 ng/ml) but not in the low (<0.05 ng/ml) or high (> 1 ng/ml) Troponin elevation groups. There were statistically significant association between between cTnI level and death; and between ECG findings and death.

Conclusion: Study conclude that Troponin-I level and ECG are a prognostic factor for mortality in hospitalized COVID-19 patients.

Key words: *COVID-19, Cardiac troponin I, Electrocardiography; Mortality.*

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Introduction:

In December 2019, a cluster of unusual cases of pneumonia were reported from Wuhan, China. Later on, the causative agent was identified as severe acute respiratory syndrome coronavirus 2 (SARS CoV2) which

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is a highly infectious single stranded RNA virus. This novel viral infection was subsequently termed as coronavirus disease 2019 (COVID 19).[1] Soon COVID19 had spread rapidly to most of the countries in the world. Consequently, on 11th March 2020, the world health organization (WHO) declared COVID-19 as "pandemic", an emergency of international concern, requiring urgent public health interventions to control the disease.

SARS CoV2 binds to Angiotensin converting enzyme (ACE2) receptors with help of its spike protein and thus gains access into the human cell.[2] ACE 2 receptors are expressed on pneumocytes (both type-1 and type-2) and endothelial cells. Though the virus mainly targets the respiratory system, other organ involvement is also common.1-3 Research demonstrates that various tissues, including the myocardium of the heart, express ACE2 protein on their cellular surface.[3]

The clinical presentation of COVID-19 is remarkably heterogeneous; although it was initially considered a respiratory illness, multiple organ systems are often affected.[3] The heart is one of the most critical organs and it is particularly probable that COVID-19 also contributes to viral myocardial damage, which could also be considered one of the leading causes of COVID-19 patients' death.[4] Myocardial injury, as heralded by elevated troponin levels, was previously observed in various medical conditions, including pneumonia, and was found to be correlated with adverse outcomes such as cardiac complications and death.[5,6] To date, several studies have described myocardial injury in patients diagnosed with COVID-19.[7-11]

Electrocardiographic (ECG) and Troponin I are two highly available commonly used parameters to detect myocardial injury and these can be used to predict the prognosis of COVID 19.[12] This study was thus conducted to further evaluate the incidence of myocardial injury in COVID-19 hospitalized patients, to characterize risk factors for myocardial injury among these patients, to determine its prognostic significance by reviewing admission troponin and ECG findings in a group of patients from Bangladesh.

Methods:

Study subjects and design

It was a prospective observational study was conducted in four tertiary care Private Hospitals of Chattogram City of Bangladesh includes- CSCR Hospital, Delta Health Care, Ctg. Ltd., Park View Hospital Ltd. & Ma-O- Shishu Hospital. The study enrolled 181 consecutive patients admitted to hospital from June 01, 2020 to December 31, 2020 due to Covid-19 disease on the basis of presentation of signs and symptoms severity. All patients were diagnosed and graded as per the National guideline.[14] The diagnosis of COVID-19 was confirmed with real-time reverse transcriptase-polymerase chain reaction (RT-PCR). Clinical data was collected by the attending physician during hospitalization of patients within 48 hours. This study complies with the edicts of the 1975 Declaration of Helsinki, and approval was taken by the institutional ethics board of each hospitals.[13] Informed consent was taken from the attendants and stable patients.

We considered major adverse event (MAE) the composite of all-cause death and respiratory failure requiring oro-tracheal intubation during the hospitalization. Written informed consent was waived by the designated hospital's ethics committee for patients with emerging infectious diseases.

The clinical data of patients were collected including demographics, clinical symptoms, and signs, co-existing conditions, imaging findings, laboratory results as per case record form. To detect myocardial injury 12-lead ECG and cardiac troponin I was done at admission.

Electrocardiogram analysis

All 12-lead electrocardiograms recorded on admission and review it later (paper speed of 25 mm/s and 1 millivolt equivalent to 10 mm) were analyzed off-line. According to pre-defined criteria, two expert cardiologists blinded to clinical information and non-invasive diagnostic results, independently evaluated the ECG.

The considered parameters were as follows: rhythm (sinus, supraventricular or ventricular arrhythmias); heart rate; PR and QRS durations; QT and QTcorrected (using Bazett or Fridericia formula when the heart rate was >90 beats per minute was used) intervals; conduction disturbances (atrioventricular block, bundle branch block, or fascicular block) and ST-T segment alterations. The ST-segment deviation was measured as the height difference (in millimeters) between the J point and the isoelectric line (TP segment).

T wave was analyzed in all 12 leads and classified as normal (positive in all leads apart from III, aVR, V1, with voltage $\geq$0.1 mV), inverted (negative in any lead except III, aVR, V1, with voltage $\geq$0.1 mV) or flat (voltage <0.1 mV). Pathological Q waves were identified as any Q wave >40 ms wide, >2 mm deep or >25% of QRS complex depth.

According to the ESC guidelines (Ibanez et al., 2018; Roffi et al., 2016), ST-T segment alterations were

classified as primary if suggesting acute ischemia. Left ventricular hypertrophy (LVH) was defined using Sokolow–Lyon criteria (S in V1 + R in V5 or V6 ≥35 mm or R in aVL ≥11 mm) with or without secondary ST-T segment changes.

Electrocardiogram was defined as abnormal for any patient if ischemia alterations, left ventricular hypertrophy, tachy or bradyarrhythmias, and any new atrioventricular (AV), bundle branch blocks, or significant morphology alterations (e.g., new Q pathological waves) were present. Otherwise, patients presenting sinus rhythm without previously described alterations were reported as normal.

Troponin I:

Cardiac troponin, along with inflammatory and thrombotic markers, may aid clinicians in determining stage classification and stratifying risk for myocardial injury among patients with coronavirus disease 2019 (COVID-19), according to a review article published in the *Journal of the American College of Cardiology*.

Increases in cardiac troponin that are suggestive of myocardial injury are common in patients with COVID-19 and are associated with arrhythmias and death. These increases more frequently occur in patients who have chronic cardiovascular conditions and in those who present with severe COVID-19.

Elevated troponin levels above the 99th percentile can be classified as chronic myocardial injury, acute nonischemic myocardial injury, or acute myocardial infarction. Chronic myocardial injury "is likely the etiology for many [patients with] COVID-19 because of the high prevalence of chronic cardiovascular conditions," noted the researchers. "These elevations are true positives for myocardial injury and associated with an adverse prognosis even without intercurrent disease."

We collected cardiac biomarkers, troponin I (Tn I), creatinine kinase (CK), and pro- brain natriuretic peptide (Pro-BNP). Troponin I levels were defined as elevated if they were above the "high-sensitive" assay specific upper reference limit (cut-off of 0.05 ng/ml).

Clinical data

Demographic characteristics (age and sex), clinical data (symptoms, co-morbidities, laboratory findings & imaging) and therapy were collected from electronic medical records. Severe COVID-19 was defined as meeting arterial oxygen saturation ≤93% at rest or PaO2/FiO2 ≤300 mm Hg. We did not include respiratory rate ≥30 breaths/min according to the Diagnosis and Treatment Plan of COVID-19 suggested by National Health Commission of China due to the considerable inter-observer variability (Yang et al., 2020).

Statistical analysis

Categorical variables are presented as percentages, and continuous variables as mean and standard deviation (SD). Categorical variables are gender, symptoms such as chest pain, SOB, co-morbidities (Cardiovascular disease, Chronic Lung disease, smoking, obesity, Hypertension, diabetes) ECG pattern, during hospitalization. The Chi-Squared exact test for categorical variable and independent t-test for continuous variables were used. The differences in the means for TnI, d-dimer, C-reactive protein CRP, creatinine phosphokinase CPK, creatinine kinase-MB CKMB, Serum Urea, age temperature, respiratory rate, body mass index BMI, number of co-morbidities were analyzed using independent t-test. Multivariate logistic regression analysis was used to assess the association between severity status (critical and non-critical). All statistical analyses will be performed with SPSS, version 24.0 with p> 0.05 as a level of significance.

Results:

The study included 181 patients with a mean age of 54.3±7.3 years. Majority of them were male (63.5%) and belonged to the age group of 31-50years [n=73 (40.3%)]. Patients who were referred to ICU in view of severe disease constituted about 10.4% (n=19) of the total cases. About 38.6% (n=70) of the cases had co-morbidities. The predominant co-morbidity among patients who were discharged (non-severe COVID-19 disease) and those who got referred to ICU (Severe COVID-19 disease) was hypertension (58.0% vs 89.4%), followed by diabetes mellitus (56.1% vs 57.8%). Cough (67.9%) was the most common symptom at presentation, followed by fever (64.6%) and Fatigue (57.4%), among cases which were discharged from the hospital. However, patients with severe disease had breathlessness (19.3%) as their principal presenting complaint. The demographic and clinical characteristics of the patients in the present study, by the outcome status are depicted in Table I.

Analysis of the characteristics of the patients' Electrocardiogram, done at/near the time of admission revealed abnormal ECG in 57.1% (n=96) of the patients focused on table-II.

Table II depicts that, significantly higher proportion of patients with abnormal ECG at admission expired in-hospital compared to patients having normal ECG.

Table-I

Demographic and clinical characteristics of patients (n=181) admitted with COVID-19 by outcome.

Variables	Total (%) N-181	Discharged/ Non severe (n=162) Frequency (%)	ICU support/Severe (n=19) Frequency (%)	P-value
Gender				
Male	115 (63.5)	102 (62.9)	13 (68.4)	0.001
Female	66 (36.4)	60 (37.0)	06 (31.5)	
Age group (in years)				
18 – 30	38 (20.9)	37 (22.8)	01 (5.2)	0.000**
31 –50	73(40.3)	70 (43.2)	03 (15.7)	
51 – 70	64 (35.3)	53 (32.7)	11 (57.8)	
>70	6 (3.3)	2 (1.2)	4 (21.0)	
Age (Mean ± SD)	54.3±7.3	53.4±8.9	55.2±5.7	0.001
Co-morbidities				
Hypertension	111 (61.3)	94 (58.0)	17 (89.4)	0.02
Diabetes Mellitus	102 (56.3)	91 (56.1)	11 (57.8)	0.05
Smoking	69 (38.1)	65 (40.1)	04 (21.0)	0.04
Hyperlipidaemia	78 (43.0)	73 (45.0)	05 (26.3)	0.01
Chronic Kidney Disease	13 (7.1)	09 (5.5)	04 (21.0)	0.05
Coronary Artery Disease	15 (8.2)	12 (7.4)	03 (15.7)	0.06
Symptomatology				
Fever	117 (64.6)	109 (67.2)	08 (42.1)	0.793
Cough	123 (67.9)	112 (69.1)	11 (57.8)	0.534
Breathlessness	35 (19.3)	30 (18.5)	05 (26.3)	0.067
Fatigue	104 (57.4)	98 (60.4)	06 (31.5)	0.051
Chest pain	54 (29.8)	47 (29.0)	07 (36.8)	0.063

*p<0.05, **p<0.01 (statistically significant)

Table-II

Association between ECG change and outcome

ECG change	Survived (n=168) %	Expire in hospital (n= 13) %	P value
Normal	72 (42.8)	1 (7.7)	0.003
Abnormal	96 (57.1)	12 (92.3)	

Among abnormal ECG, abnormal axis deviation [26 % (left axis deviation 23.9% vs right axis deviation 2.0%)], Poor R wave progression (22.9%), T inversion (14.5%), left ventricular hypertrophy (LVH) (11.4%) followed by ST segment depression (8.3%) were major findings observed in the study population. Presence of LVH (p=0.008), ST segment elevation (p≤0.001), ST segment depression (p≤0.001) and T inversion (p=0.003) showed statistically significant association with Severe COVID-19 disease (Table III). Sinus Tachycardia was noted 55.2% (53) in abnormal ECG cases. (Table-III)

Patients are categorized according to guidelines- mild, moderate and severe cases. Maximum patients were mild illness 60.2 % and 92.3% were death from severe cases 10.4% which were statistically significant (p=0.001). Table-IV

The mortality rate increased with incrementally higher troponin group: 12 out of 18 and only 1out of 63 in mildly elevated troponin (p < 0.01). The presence of an abnormal ECG finding resulted in significant in the intermediate Troponin elevation group (0.05-1 ng/ml) but not in the low (<0.05 ng/ml) or high (> 1 ng/ml) Troponin elevation groups.

Thirteen patients who were expired or death with raised troponin- I and this association was statistically significant (Table V).

Table-III

Abnormal Electrocardiographic characteristics of patients admitted with COVID 19, overall and by outcome status (n=181).

Variables	N= 96 (%)	Discharged/ Non severe (n=69) Frequency (%)	ICU support/ Severe (n=27) Frequency (%)	P-value
Atrial premature complex	03 (3.1)	02 (2.8)	01 (3.7)	0.625
Ventricular premature complex	04 (4.1)	03 (4.3)	01 (3.7)	0.342
AV block	01 (1.0)	0	01 (3.7)	0.004*
RBBB	02 (2.0)	02 (2.8)	0	0.625
LBBB / LAHB	02 (2.0)	01 (1.4)	01 (3.7)	0.068
Left ventricular hypertrophy	11 (11.4)	8 (11.5)	03 (11.1)	0.008*
ST elevation	04 (4.1)	0	04 (14.8)	0.001*
ST depression	08 (8.3)	02 (2.8)	06 (22.2)	0.001
T inversion	14 (14.5)	10 (14.4)	04 (14.8)	0.003
Poor R wave progression	22 (22.9)	20 (28.9)	02 (7.4)	0.756
Abnormal axis deviation	25 (26.0)	21 (30.4)	04 (14.8)	0.340
Left axis	23 (23.9)	19 (27.1)	04 (14.8)	
Right axis	02 (2.0)	2 (2.9)	0	

*p<0.05, **p<0.01 (statistically significant), AV block–atrioventricular block, RBBB-right bundle branch block, LBBB-left bundle branch block, LAHB–left anterior hemiblock

Table-IV

Clinical severity and outcome

Variables	Total (n=181)	Discharged (n=168) Frequency (%)	Death (n=13) Frequency (%)	P-value
Clinical category				
Mild	109 (60.2)	109 (64.8)	0	0.001
Moderate	53 (29.2)	52 (30.9%)	01 (7.6)	
Severe/critical	19 (10.4)	07 (4.1)	12 (92.3)	

*p<0.05, **p<0.01 (statistically significant)

Table-V

Association between Troponin I, ECG and mortality.

Variables	Overall (n = 181)	ECG changes (n = 96)	No ECG changes (n = 85)	P-value
Clinical category				
Initial troponin (ng/mL)	0.21 ± 1.73	0.8 ± 4.06	0.09 ± 0.37	0.17
Maximum troponin	2.16 ± 16.83	3.50 ± 12.63	1.87 ± 17.62	0.01
Troponin group				<0.01
≤0.05	100 (55.2%)	22 (22.9%)	78 (91.7%)	
0.05-1.00	63 (41.9%)	58 (60.4%)	05 (5.8%)	
>1.00	18 (11.0%)	16 (16.6%)	02 (2.3%)	
Mortality	13 (7.1%)	12 (12.5%)	01 (1.1%)	0.09

*p<0.05, **p<0.01 (statistically significant)

Discussion:

COVID-19 has been shown to cause cardiovascular morbidity by direct myocardial injury as a result of the inflammatory cascade or cytokine release, microvascular damage due to disseminated intravascular coagulation and thrombosis, direct entry of SARS-CoV-2 into myocardial cells via binding to ACE2 receptors, and hypoxemia combined with increased metabolic

demands of acute illness leading to myocardial injury [9-11]. In this prospective cohort study we further assess the interaction of ECG abnormalities and Troponin elevation. We demonstrate that (1) myocardial injury defined by elevated Troponin is common among patients hospitalized with COVID-19 but is more often mild, associated with low-level elevation in troponin concentration. (2) more significant myocardial injury, as evident by increased Troponin level may be associated with higher risk of mortality. (3) In the group of patients with mild Troponin elevation (0.05-1 ng/ml), ECG abnormalities are associated with significantly increased mortality.

A variety of electrocardiographic manifestations have been documented in COVID-19. In patients with pre-existing heart disease, the spectrum of ECG changes, from common atrial arrhythmias, precipitated by acute systemic illness to conduction system abnormalities and life-threatening arrhythmias in severe disease, besides other manifestations such as acute coronary syndrome, myocarditis and heart failure, are noted.[24] In addition to the disease process, biochemical abnormalities like electrolyte imbalance, especially in critically ill patients and potential treatment modalities employed in COVID-19 management, such as hydroxychloroquine and other antiviral drugs, may have varied impact on the electrocardiographic parameters such as the QT interval.

In our study, only 8.2% of the patients had prior Coronary artery disease, yet about 57.1% of the patients showed abnormal ECG at admission in the hospital indicating an acute COVID-19 disease process as the potential cause of the electrocardiographic changes. In a case report by Zhung et al ECG changes documented in a COVID-19 patient with fulminant myocarditis were sinus tachycardia and Right bundle branch block. RBBB pattern without Significant ST-T wave abnormalities.[25] Kim et al have reported nonspecific interventricular conduction delay (IVCD) and premature complexes in a 21-year female with COVID-19 related myocarditis while in few other patients, ST elevation seen were in inferior leads.[26,27] Diffuse ST segment elevation in inferolateral leads and ST depression with T inversion in V1 and aVR were the ECG findings in a study done by Inciardi et al.[6]

Arrhythmias were reported more in the COVID-19 patients with severe disease than those with mild disease (44.4% vs 6.9% p<0.001).[22] While atrial premature complexes and ventricular premature complexes accounted for 3.1% and 4.1% of abnormal ECG changes in our study, conduction abnormalities such as Atrioventricular block (AV block), left bundle branch block (LBBB) and Right bundle branch block (RBBB) constituted only about 5%. In our study, sinus tachycardia was seen in 55.2% (n=53) of the patients. Sinus tachycardia is noted to be the frequent manifestation in patients with COVID-19. Wang et al in their study comparing ECG changes in severe and critically ill COVID-19 patient found out sinus tachycardia to be the second most frequent ECG characteristic, more so in critically ill patients.

The relationship between ST-T changes on ECG and myocardial damage with poor prognosis has been demonstrated.[34] Abnormal ST segment deviation (elevation/depression) and T inversion together, were the most common (26.9%) abnormal ECG manifestation in our study. Also, these changes had statistically significant difference among severe and non-severe groups (p=0.001). Patients with ST segment depression on admission ECG were more likely to progress to severe disease needing referral to State COVID ICU. Similar results were found out by Wang et al in their study of severe and critically severe patient groups of COVID-19, in which ST-T abnormal changes were the most common ECG manifestation. They also noticed that such changes were more pronounced in critically severe patients compared to severe patients.[28] Similarly, in another study ST depression, T wave inversion were observed more in severe group than in non-severe group.[35] ST-T changes may have various pathological basis such as myocardial damage inflicted by SARS CoV2, hypocalcaemia, hypertension, or coronary heart disease. Thus, recognition of such abnormal ECG manifestations may guide the treating physicians in early identification of impending severe COVID-19 among infected patients.

Though troponin elevation above the 99th percentile of the upper reference limit is considered the central marker of “myocardial injury”, mild elevation between 0.05 to 1 is often nonspecific and associated with non-vascular etiologies such as strain, myocyte necrosis and increased cell membrane permeability [12]. Indeed, mild Troponin elevation was a frequent finding in our cohort, present in 31% of patients with COVID19. In this regard, our data suggests that assessment for the presence of ECG abnormalities can be used to enhance inpatient risk stratification in those patients with mild Troponin elevation.

This prospective study demonstrated that, more than half of the patients admitted with COVID-19 have elevated Troponin I level and abnormal ECG at admission. Both these parameters were significantly associated with poor in-hospital outcome in patients hospitalized with COVID

19. This was in agreement with the study of Ghaleb et al. who observed that, more than half of the patients were admitted to intensive care unit; cTnI level was elevated in 30 patients (58.8%), of whom 17 died (56.7%). The study observed statistically significant differences regarding the relation between cTnI level and death.[15] Deng et al. found the presence of myocardial injury in COVID-19 patients during hospitalization and one fourth of the patients, had presented abnormalities similar to myocarditis, with an increase in cardiac troponin I especially during hospitalization also in about (37.5%) of them, especially in those who were died. Cardiac troponin levels were significantly increased one week before death. With normal findings in Echocardiography and ECG, they suggested that the increase in troponin was related to systemic disorders and could be the warning sign for the death of patients with COVID-19 and should be taken seriously in clinical practice.[16] Recent data has shown that cTnI levels are mildly elevated in all patients with SARS-CoV-2 infection, but cTnI levels are markedly elevated in patients with severe SARS-CoV-2 infection compared to those with milder forms of the disease.[17] Another study suggested that mild cTnI elevation was frequent in COVID-19 patients and in such cases presence or absence of ECG abnormalities coul be used to enhance risk stratification of hospitalized COVID patients.[12]

Limitations: The study had some limitations inherent to its design. As patients were selected purposively from selected hospital their might be a chance of selection bias. Baseline ECGs were not available in all patients, and it is possible that some ECG abnormalities were present prior to the diagnosis of COVID-19.

Conclusion: From this study it was concluded that cardiac troponin I and abnormal ECG have predictive potential for mortality in hospitalized COVID-19 patients. Myocardial injury is more commonly seen in COVID patients who died in the hospital in the form of elevated troponin levels and ECG abnormalities, and there is a positive correlation between death and elevated troponin levels and ECG abnormalities.

Recommendations: The study findings could be used to enhance risk stratification in patients hospitalized with COVID19. Close examination of cardiac status should be taken into account during managing such patients.

Conflict of interest: Nothing to declare.

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Original Article

Comparison of Angiographic Severity of Coronary Artery Disease between Premenopausal and Postmenopausal Women with Acute Coronary Syndrome

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Abstract:

Background: The risk of coronary artery disease in women after menopause sharply rises in contrast to that of women before menopause because of hormonal protection against atherosclerosis. No research work has been done so far to see the angiographic pattern and severity of coronary artery disease in premenopausal women and their comparison with those of postmenopausal women. This study will help understand the pattern and severity of CAD both in premenopausal and postmenopausal women.

Methods: This cross sectional analytical study was conducted over 100 ACS female patients who were purposively selected and agreed to do coronary angiogram during index hospital admission. Among them 50 patients were premenopausal status with CAD constituted study group I and another 50 postmenopausal women with CAD constituted study group II. The main objective of the study was to compare the angiographic severity of coronary artery disease between premenopausal and postmenopausal women with acute coronary syndrome. Angiographic severity of CAD was assessed by vessel score, Gensini score and Friesinger score.

Results: LAD was the common artery involved (76% vs. 56%) followed by RCA (72% vs. 36%) and LCX (62% vs. 30%) in group-II compared to group-I and involvement of individual coronary artery was statistically significant (P values were 0.03, 0.003 and 0.001 respectively). Critical stenosis (70-99%) involving the all three major epicardial vessels (LAD, LCX and RCA) were found most frequently in group-II and the percentage of lesions were 56% vs. 30%; 56% vs. 22% and 54% vs. 22% respectively (p< 0.05). The vessel score of the study patients revealed that singe vessel involvement was significantly higher in group-I (52% vs. 24%) (p=0.003) and triple vessel involvement was found significantly higher in group-II (40% vs. 12%) (p=0.001).

Severity assessment by Friesinger score showed normal (0) and low (1-4) Friesinger score significantly higher in group-I patients (P=0.04 and P=0.007 respectively) and high Friesinger score (11-15) was found significantly higher in patients in group II (p=0.001). Severity assessment by Gensini score of the study patients revealed significantly higher mild Gensini score in group-I patients (P=0.002) and severe Gensini score in group II patients (p=0.002).

Conclusion: Coronary artery disease is one of the major important problems not only in postmenopausal women but in premenopausal women also. Postmenopausal women suffer from more triple vessels involvement, more diffuse and severe disease. This study results point out that premenopausal women suffer from less severe coronary artery disease and there is a trend to involve mid LAD more frequently in comparison to other two major coronary arteries and LM coronary artery in comparison to postmenopausal women.

Keywords: *Acute coronary syndrome (ACS), Angiographic severity, Premenopausal and postmenopausal women.*

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Introduction:

Cardiovascular disease (CVD) is the highest single cause of mortality and morbidity in women worldwide.[1] It is the largest single cause of death among women, accounting for one-third of all deaths.[2] In Bangladesh it is the fourth common cause of death and accounts for 10.68% of total death, of which male 12.47% and female 8.19%.[3] In fact, the incidence of Coronary artery disease (CAD) in women older than 65 years is similar to that in men and even surpasses than in men after 75.[4] The risk of coronary artery disease in women after menopause sharply rises in contrast to that of women before menopause because of hormonal protection against atherosclerosis.[5]

Menopause is a normal biological event that occurs in every woman during their late 40s or early 50s and marked by end of menstrual period. During menopause, women's oestrogen levels become approximately one-third of that during her premenopausal years.[6] With the changes in the production of female hormones after menopause, the risk of ischemic heart disease and cerebrovascular accident (CVA) are increased which are the main causes of morbidity and mortality in women of both developed and developing countries.[7] This era of globalization, female education, women empowerment, urbanization and industrialization, has changed the socioeconomic status and lifestyle of women. Modern women have professional and housewife responsibilities, consume excess fat and carbohydrates, smoke, do not exercise regularly and do not have enough time to rest. This situation leads to overweight, dyslipidemia, arterial hypertension, impaired glucose tolerance and diabetes mellitus. As a result increasing number of young women is now suffering from coronary artery disease, not only in western and industrialized countries but also in the Asian countries. Women do not often participate in preventive studies and undergo less intensive and invasive evaluation and treatment of chest pain when compared to men. However, the rate of coronary death is twice higher in women than in men after acute coronary syndromes and revascularization procedures. No research work has been done so far to see the angiographic pattern and severity of coronary artery disease in premenopausal women and their comparison with those of postmenopausal women. So, this study was designed to understand the pattern and severity of CAD both in premenopausal and postmenopausal women and also for risk stratification, and formulation of preventive strategies for these two groups of population.

Materials and methods:

This cross sectional analytical study with group comparison was conducted in the National Institute of Cardiovascular Diseases (NICVD), Dhaka from January 2013 to July 2014. Both premenopausal and postmenopausal women were purposively selected with ACS and agreed to do coronary angiography (CAG) during index hospital admission. Total 100 patients were included in the study and divided into two groups according to their menstrual history. Group I comprises 50 premenopausal women and Group II comprises 50 postmenopausal women. Both premenopausal and postmenopausal women with previous history of PCI, CABG, valvular heart disease, cardiomyopathy, hysterectomy and oophorectomy were excluded from the study. The study protocol was approved by Ethical Review Committee of NICVD. Informed consent was taken from each patient.

Assessment of angiographic pattern and severity of CAD:

Coronary angiography was done during same hospital stay. Interpretation of coronary angiogram was done by visual estimation by two cardiologists to assess the severity of CAD. Severity of coronary stenosis was graded according to the number of major epicardial vessel with significant stenosis (vessel score), Gensini score and Friesinger score.

A. Vessel score: [8]

This is the number of vessels with a significant stenosis (for left main coronary artery 50% or greater and for others 70% or greater reduction in luminal diameter). Score ranged from 0 to 3, depending on the number of vessel involved.

Score 0 = no vessel involvement.

Score 1 = single vessel involvement.

Score 2 = double vessel involvement.

Score 3 = triple vessel involvement.

B. Gensini score: [9]

The Gensini score was developed by Gensini taking into consideration the geometrical severity of lesion by angiography, the cumulative effects of multiple obstructions, and the significance of jeopardized myocardium.

Table-I

Shows CAD severity according to Gensini scores

Scores	CAD severity
≤36 points	Mild or absent
> 36 points	Moderate to severe

Quantitative analysis was performed by using the Gensini score.

Gensini score	
Segment	**Weighting factor**
Proximal RCA	1.0
Mid-RCA	1.0
Distal RCA	1.0
Posterior descending branch	1.0
Left posterior ventricular branch	1.0
LM coronary artery	5.0
Proximal left anterior descending	2.5
Mid-left anterior descending	1.5
Distal left anterior descending	1.0
First diagonal branch	1.0
Second diagonal branch	0.5
Proximal LCX	2.5
Distal LCX	1.0
Obtuse marginal	1.0

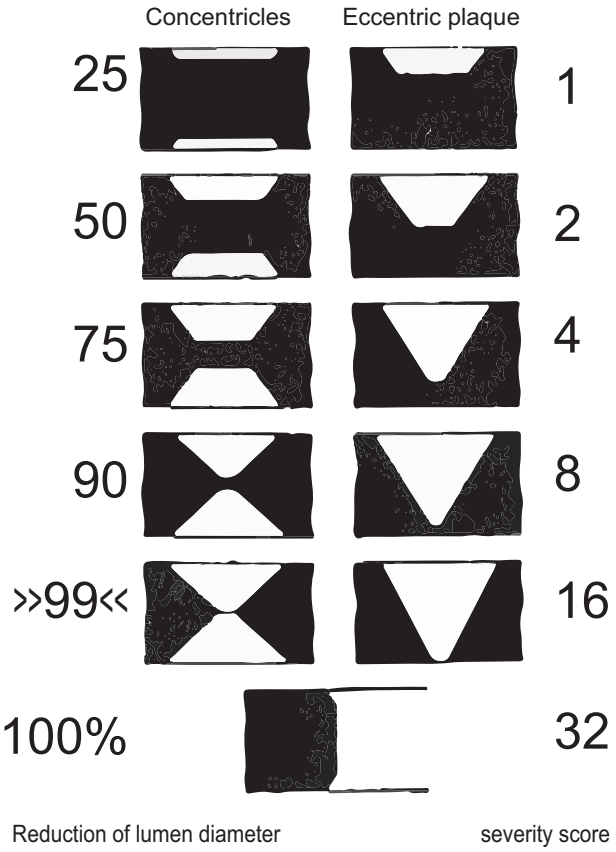

Fig.-1: *Gensini Score chart [Left panel- weighting factor according to the importance of vessel in the coronary tree.[10] Right panel-severity score according to reduction of lumen diameter.[11]*

C. Friesinger score: [8]

The Friesinger index is a score ranges from 0 to 15. Each of the three main coronary arteries was scored separately from 0 to 5.

Score 0 : No arteriographic abnormality
Score 1 : Trivial irregularities (lesion from 1-29%)
Score 2 : Localized 30-68% luminal narrowing
Score 3 : Multiple 30-68% luminal narrowing of same vessel
Score 4 : 69-100% luminal narrowing without 100% occlusion of proximal segments
Score 5 : Total obstruction of a proximal segment of a vessel.

Statistical Methods:

The numerical data obtained from the study were analyzed and significance of differences was estimated by using statistical methods. The SPSS Statistical Software (17.0 version, SPSS Inc., Chicago, Illinois, USA) was used for data analysis. Continuous variables were expressed as mean and standard deviation and categorical variables as frequency and percentage. Student's t-test was used to compare normally distributed continuous variables and for the categorical variables the chi-square test was done. To identify independent effects risk factors on CAD severity multiple logistic regression analysis was done. P value of less than 0.05 was considered as significant.

Results:

This study was done to compare the angiographic severity of coronary artery disease between premenopausal and postmenopausal women with acute coronary syndrome. A total of 100 ACS female patients undergoing coronary angiography were studied. Among them 50 patients were premenopausal status with CAD constituted study group I and another 50 postmenopausal women with CAD constituted study group II.

Among the studied patients, highest percentage had history of hypertension (76%) followed by diabetes

mellitus (68%), family history of premature CAD (58%), past OCP user(58%), chewing tobacco (50%) and dyslipidaemia (36%) in group II. Chewing tobacco, hypertension past OCP user and diabetes mellitus were observed significantly (p<0.05) higher among the group II patients than those of the group I patients. On the contrary, OCP user (76%), hypertension (54%), diabetes mellitus (46%), and family history of CAD (42%) were the most common risk factors in group I patients. OCP users were found significantly (p=0.001) higher in group I patients than those of group II patients.

Table-II

Distribution of the patients according to risk factors

Risk Factors		Group I (n= 50)		Group II (n=50)		Total (n=100)		p value
		Number	%	Number	%	Number	%	
Smoking								
	Yes	10	20.0	7	14.0	17	17.0	0.42^{NS}
	No	40	80.0	43	86.0	83	83.0	
Chewing tobacco								
	Yes	6	12.0	25	50.0	31	31.0	0.001^{S}
	No	44	88.0	25	50.5	69	69.0	
Hypertension								
	Yes	27	54.0	38	76.0	65	65.0	0.02^{S}
	No	23	46.0	12	24.0	35	35.0	
Dyslipidaemia								
	Yes	10	20.0	18	36.0	28	28.0	0.07^{NS}
	No	40	80.0	32	64.0	72	72.0	
Family H/O of CAD								
	Yes	21	42.0	29	58.0	50	50.0	0.11^{NS}
	No	29	58.0	21	42.0	50	50.0	
Diabetes mellitus								
	Yes	23	46.0	34	68.0	57	57.0	0.02^{S}
	No	27	54.0	16	32.0	43	43.0	
OCP use								
	Never	12	24.0	20	40.0	32	32.0	0.08^{NS}
	Current user	25	50.0	1	2.0	26	26.0	0.001^{S}
	Past user	13	26.0	29	58.0	42	42.0	0.001^{S}

Group I: Premenopausal women
Group II: Postmenopausal women
NS= Not significant (p>0.05)
S = Significant (p<0.05)
P value reached from Chi Square test.

Table-III

Distribution of study population by involvement of individual coronary artery (n=100)

Artery	Group I (n= 50)		Group II (n =50)		p value
	Number	1%	Number	%	
LM					
Present	8	16.0	3	6.0	0.11^{NS}
Absent	42	84.0	47	94.0	
LAD					
Present	28	56.0	38	76.0	0.03^{S}
Absent	22	44.0	12	24.0	
LCX					
Present	15	30.0	31	62.0	0.001^{S}
Absent	35	70.0	19	38.0	
RCA					
Present	18	36.0	36	72.0	0.003^{S}
Absent	32	64.0	14	28.0	

Group I: Premenopausal women
Group II: Postmenopausal women
NS= Not significant (p>0.05)
S = Significant (p<0.05)
p value reached from Chi Square test.

The table shows distribution of involvement of individual major coronary artery among the study population. Involvement of three coronary arteries including LAD, LCX and RCA was found significantly higher percentage in group-II patients compared to group-I patients (76% vs. 56%; 62% vs. 30% and 72% vs. 36% respectively). Interestingly LM involvement was found higher in number in group-I patients (16% vs. 6%) but it was statistically insignificant (P=0.11)

Normal LAD vessel was found 22 (44%) patients in group I and 12 (24%) patients in group II. Proximal LAD lesion was found 9 (18%) and 20 (40%) in group I and group II respectively. Mid LAD lesion was found 16 (32%) and 17 (34%) in group I and group II respectively. Distal lesion was found 3 (6%) in group I and 1 (2%) in group II. Analysis revealed that normal LAD vessel was significantly higher in group I (p=0.03) and proximal LAD lesion was significantly higher in group II (p=0.01).

Regarding the site of lesion of LCX, normal vessel was found 35 (70%) patients in group I and 19 (38%) patients in group II. Proximal lesion was found 3 (6%) and 14 (28%) in group I and group II respectively. Mid lesion was found 1 (2%) and 4 (8%) in group I and group II respectively. Distal lesion was found 11 (22%) in group I and 13 (26%) in group II. Analysis revealed that normal LCX vessel was significantly higher in group I (p=0.001) and proximal lesion in LCX was significantly higher in group II (p=0.003).

RCA normal vessel was found 32 (64%) patients in group I and 14 (28%) patients in group II. Proximal segment involvement was found 8 (16%) and 15 (30%) in group I and group II respectively. Mid lesion was found 7 (14%) and 14 (28%) in group I and group II respectively. Distal lesion was found 3 (6%) in group I and 7 (14%) in group II. Analysis revealed that normal RCA vessel was significantly higher in group I (p=0.001).

Regarding the site of coronary artery lesion normal LM was found in 42 (84%) and 47 (94%) patients in group I and group II respectively. Diseased LM was involved 8 (16%) in group I and 3 (6%) in group II respectively. Normal LM was not significantly higher in group II (p=0.11) and diseased LM was also not significantly higher in group I (p=0.11).

Table IV

Distribution of study patients by site of coronary artery lesion

Site of lesion	Group I (n= 50)		Group II (n =50)		p value
	Number	%	Number	%	
LAD					
Normal	22	44.0	12	24.0	0.03^{S}
Proximal lesion	9	18.0	20	40.0	0.01^{S}
Mid lesion	16	32.0	17	34.0	0.83^{NS}
Distal lesion	3	6.0	1	2.0	0.30^{NS}
LCX					
Normal	35	70.0	19	38.0	0.001^{S}
Proximal lesion	3	6.0	14	28.0	0.003^{S}
Mid lesion	1	2.0	4	8.0	0.18^{NS}
Distal lesion	11	22.0	13	26.0	0.63^{NS}
RCA					
Normal	32	64.0	14	28.0	0.001^{S}
Proximal lesion	8	16.0	15	30.0	0.09^{NS}
Mid lesion	7	14.0	14	28.0	0.08^{NS}
Distal lesion	3	6.0	7	14.0	0.18^{NS}
LM					
Normal	42	84.0	47	94.0	0.11^{NS}
Diseased	8	16.0	3	6.0	0.11^{NS}

Group I: Premenopausal women
Group II: Postmenopausal women
NS= Not significant (p>0.05)
S = Significant (p<0.05)
p value reached from Chi Square test and Fisher's exact test.

Table-V

Distribution of study patients by percentage of coronary artery lesion

Percentage of lesion	Group I (n= 50)		Group II (n =50)		p value
	Number	%	Number	%	
LAD					
<70%	6	12.0	4	8.0	0.50^{NS}
70-99%	15	30.0	28	56.0	0.008^{S}
100%	7	14.0	6	12.0	0.76^{NS}
LCX					
<70%	2	4.0	3	6.0	0.64^{NS}
70-99%	11	22.0	28	56.0	0.001^{S}
100%	2	4.0	0	0.0	0.25^{NS}
RCA					
<70%	2	4.0	3	6.0	0.64^{NS}
70-99%	11	22.0	27	54.0	0.001^{S}
100%	5	10.0	6	12.0	0.75^{NS}

Group I: Premenopausal women Group II: Postmenopausal women
NS= Not significant (p>0.05) S = Significant (p<0.05)
p value reached from Chi Square test and Fisher's exact test.

Regarding the percentage of lesion in LAD, <70% lesions were found 6 (12%) patients in group I and 4 (8%) patients in group II. 70-99% lesions were found 15 (30%) patients in group I and 28 (56%) in group II. 100% lesion was found 7 (14%) patients in group I and 6 (12%) patients in group II. Observation revealed that 70-90% lesions was significantly higher in group II than group I (p=0.008).

Regarding the percentage of lesion in LCX, <70% lesions were found 2 (4%) patients in group I and 3 (6%) patients in group II. 70-99% lesions were found 11 (22%) patients in group I and 28 (56%) in group II. 100% lesion was found 2 (4%) patients in group I but no patients in group II. Observation revealed that 70-90% lesions was significantly higher in group II than group I (p=0.001).

Regarding the percentage of lesion in RCA, <70% lesions were found 2 (4%) patients in group I and 3 (6%) patients in group II. 70-99% lesions were found 11 (22%) patients in group I and 27 (54%) in group II. 100% lesion was found 5 (10%) patients in group I and 6 (12%) patients in group II. Observation revealed that 70-90% lesions was significantly higher in group II than group I (p=0.001).

In LCX, type-A lesion was found 10 (20%) patients in group I and 7 (14%) patients in group II. Type B lesion was found in 3 (6%) patients in group I and 15 (30%) patients in group II. Type C lesion was found in 2 (4%) patients in group I and 9 (18%) patients in group II. It was observed that type B lesion was significantly higher in group II than group I (p=0.001). It was also observed that type C lesion was significantly higher in group II than group I (p=0.03).

In RCA, type A lesion was found in 12 (24%) patients in group I and 18 (36%) patients in group II. Type B lesion was found in 5 (10%) patients in group I and 14 (28%) patients in group II. Type C lesion was found in 1 (2%) patients in group I and 4 (8%) patients in group II. It was observed that type B lesion was significantly higher in group II than group I (p=0.02).

The below table shows the vessel score of the study patients. It was found that among group I patients, highest percentage had single vessel score 52% followed by double vessel score 24% and 12% patient had triple vessel score and no vessel score. On the contrary among group II patients, highest percentage had triple vessel score 40% followed by double, single and no vessel score 34% & 24% and 2% patients respectively. No vessel involvement was found insignificant in both groups (p=0.05). The table depicted that single vessel involvement was observed significantly higher in group I than group II (p=0.003). On the other hand, triple vessel involvement was found significantly higher in group II than group I (p=0.001)

The below table shows that normal Friesinger score (0) was found in 6 (12%) patients in group I and 1 (2%) patients in group II. Low Friesinger score (1-4) was found in 20 (40%) and 8 (16%) patients in group I and group II respectively. Hence, normal and low Friesinger score were higher and statistically significant in group I (p=0.04

and p=0.007 respectively). Intermediate Friesinger score (5-10) was found in 21 (42%) patients in group I and in 25 (50%) patients in group II. Intermediate Friesinger Score was found higher in group II but it was not statistically significant (p=0.42). High Friesinger score (11-15) was found in 3 (6%) patients in group I and 16 (32%) patients in group II. High Friesinger score was significantly higher in group II (p=0.001).

Below table shows Gensini score of the study patients. Mild Gensini score was 38 (76%) patients in group I and 23 (46%) patients in group II. Severe Gensini score was found 12 (24%) patients in group I and 27 (54%) patients in group II. The table observed that severe Gensini score was significantly higher in group II patients than group I (p=0.002) and mild Gensini score was significantly higher in group I patients than group II (p=0.002).

Table IX demonstrates the binary logistic regression analysis of Odds Ratios for characteristics of the patients likely to be associated with coronary artery disease severity among postmenopausal women. Results of binary logistic regression analysis for severe CAD showed that age, chewing tobacco, hypertension and diabetes mellitus were significantly related to the degree of severity of CAD (p<0.05). The above table also revealed that among postmenopausal women age ≥50, chewing tobacco, hypertension and diabetes mellitus of CAD with ORs being 2.836, 1.625, 1.235 and 1.837 in univariate analysis respectively. It was also observed that among postmenopausal patients age ≥50, chewing tobacco, hypertension and diabetes mellitus of CAD with ORs being 2.426, 1.490, 1.219 and 1.670 in multivariate analysis respectively.

The below table demonstrates the binary logistic regression analysis of Odds Ratios for characteristics of the patients likely to be associated with coronary artery disease severity among premenopausal women. Results of binary logistic regression analysis for severe CAD were shown for chewing tobacco, hypertension, diabetes mellitus, and family history of CAD and OCP users to the degree of severity of CAD. The above table revealed that among premenopausal women who used OCP have 1.932 times the risk of having significant (p=0.01) CAD as those who never used OCP in univariate analysis. The above table also revealed that among premenopausal women who used OCP have 1.792 times the risk of having significant (p=0.02) CAD as those who never used OCP in multivariate analysis. So, OCP use in premenopausal women has a significant association with the severity of CAD.

Table-VI

Distribution of the study patients according to vessel score

Vessel Score	Group I (n= 50)		Group II (n =50)		p value
	Number	%	Number	%	
Score – 0	6	12.0	1	2.0	0.05^{NS}
Score – 1	26	52.0	12	24.0	0.003^{S}
Score – 2	12	24.0	17	34.0	0.27^{NS}
Score – 3	6	12.0	20	40.0	0.001^{S}

Group I: Premenopausal women Group II: Postmenopausal women
NS= Not significant (p>0.05) S = Significant (p<0.05)
p value reached from Chi Square test and Fisher's exact test.

Table-VII

Distribution of the study patients according to Friesinger score

Friesinger Score	Group I (n= 50)		Group II (n =50)		p value
	Number	%	Number	%	
Normal (0)	6	12.0	1	2.0	0.04^{S}
Low (1 – 4)	20	40.0	8	16.0	0.007^{S}
Intermediate (5 – 10)	21	42.0	25	50.0	0.42^{NS}
High (11 – 15)	3	6.0	16	32.0	0.001^{S}

Group I: Premenopausal women Group II: Postmenopausal women
NS= Not significant (p>0.05) S = Significant (p<0.05)
p value reached from Chi Square test and Fisher's exact test.

Table-VIII

Distribution of the study patients according to Gensini score

Gensini Score	Group I (n= 50)		Group II (n =50)		p value
	Number	%	Number	%	
Severe CAD (>36)	12	24.0	27	54.0	0.002^{S}
Mild CAD (≤36)	38	76.0	23	46.0	0.002^{S}

Group I: Premenopausal women
Group II: Postmenopausal women
NS= Not significant (p>0.05)
S = Significant (p<0.05)
p value reached from Chi Square test.

Table-IX

Predictors of severe coronary artery disease (Gensini score >36) with risk factors among postmenopausal women (n=50)

Variables of interest	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Age ≥50	2.836 (1.237-6.506)	0.01^{S}	2.426 (1.127-5.206)	0.02^{S}
Chewing tobacco	1.625 (1.320-4.984)	0.02^{S}	1.490 (1.304-4.294)	0.03^{S}
Hypertension	1.235 (1.220-4.532)	0.03^{S}	1.219 (1.119-3.491)	0.04^{S}
Dyslipidemia	1.015 (0.372-2.077)	0.16^{NS}	0.992 (0.472-1.912)	0.20^{NS}
Diabetes mellitus	1.837 (1.234-6.103)	0.03^{S}	1.670 (1.291-5.32)	0.02^{S}
Family history of CAD	0.919 (0.411-2.054)	0.25^{NS}	0.822 (0.391-2.001)	0.29^{NS}

S=Significant
Ns=Not significant

Table-X

Predictors of severe coronary artery disease (Gensini score >36) with risk factors among premenopausal women (n=50)

Variables of interest	Univariate analysis		Multivariate analysis	
	OR (95% CI)	P value	OR (95% CI)	P value
Chewing tobacco	0.640 (0.099-5.789)	0.59^{NS}	0.500 (0.045-5.612)	0.54^{NS}
Hypertension	1.401 (0.345-6.290)	0.61^{NS}	1.392 (0.313-6.196)	0.66^{NS}
Diabetes mellitus	1.202 (0.289-4.823)	0.79^{NS}	1.162 (0.281-4.810)	0.83^{NS}
Family history of CAD	0.439 (0.096-1.910)	0.17^{NS}	0.386 (0.086-1.713)	0.21^{NS}
OCP user	1.932 (1.029-3.840)	0.01^{S}	1.792 (1.021-3.810)	0.02^{S}

S=Significant
NS=Not significant

Discussion:

This cross sectional observational study was conducted in National Institute of Cardiovascular Diseases (NICVD), Dhaka, from January 2013 to June 2014. The main objective of the study was to compare the severity of coronary artery disease between premenopausal and postmenopausal women with acute coronary syndromes. A total of 100 patients with acute coronary syndromes enrolled on the basis of predefined inclusion and exclusion criteria who underwent coronary angiography were included in the study. Based on menopausal status, the patients were divided into two groups. 50 patients were premenopausal status with ACS and constituted study group I and the other 50 patients were postmenopausal status with ACS who constituted group II.

The age distribution of most of the patients in group I belonged to 41-50 years of age, which were 30 (60%) and in group II belonged to 51 to 60 years of age and were 21 (42%). The mean age of the studied patients

was a 48.8±9.2 year ranging from 32 to 75 years. The mean age of the group I patients was 41.6±3.8 years ranging from 32 to 46 years and the mean age of the group II patients was 56.0±7.2 years ranging from 48 to 75 years. The mean age difference of the two groups were observed statistically significant (p=<0.05). This age distribution corresponds with the age distribution of population of related study done by Majumder, et al. where mean age of postmenopausal women was (56.8±6.5) years.[12]

Regarding the risk factors among the studied patients, it was observed that hypertension (76%) followed by diabetes mellitus (68%), family history of CAD (58%), past OCP user (58%), chewing tobacco (50%) and dyslipidaemia (36%) were the most common risk factors in postmenopausal women and on the other hand, OCP user (76%), hypertension (54%), diabetes mellitus (46%) and family history of coronary artery disease (42%) were the most common risk factors in premenopausal women. Chewing tobacco, hypertension and diabetes mellitus were observed significantly (p<0.05) higher among the postmenopausal women than those of the premenopausal women. In a study by Shehab, et al. in postmenopausal women found that hypertension, diabetes mellitus and dyslipidemia were the major risk factors for CAD (65.7%, 52.9% and 42.2% respectively).[13] In a similar study by Ke-fei, et al. hypertension, (55.0% vs.66.0%), Diabetes mellitus,(15.0% vs.31.5%) and Dyslipidemia, (23.9% vs.37.4%) were the most common major risk factors among premenopausal and postmenopausal women.[14] The prevalence of hypertension, diabetes mellitus and dyslipidemia in these studies exactly correlate with those of the present study.

Angiographic findings of both premenopausal and postmenopausal women showed normal CAG in 12% of premenopausal and 2% of postmenopausal women. Regarding the lesion characteristics, type-B and type-C lesion were found significantly high in postmenopausal women. Type-B lesions was found statistically significant different in LCX (P= 0.001) and RCA (P=0.02) and type-C lesion in LAD (P=0.04) and LCX (0.03) respectively in two groups.

Distribution of involved coronary arteries in group-I revealed involvement of LM artery was 16%, LAD artery was 56%, LCX artery was 30% and RCA was 36%, and in group-II involvement of LM artery was 6%, LAD was 78%, LCX was 62% and RCA was 72%. LAD was the common artery involved (76% vs.56%) followed by RCA (72% vs. 36%) and LCX (62% vs. 30%) in group-II compared to group-I. This frequency of involvement of individual coronary artery in group-II was statistically significant (P values were 0.03, 0.003 and o.001 respectively).

In a study, Akanda, et al. found that LAD was the most frequently involved artery (88.0%), followed by RCA (78.07%), LCX (52.61%) and LM (5.26%) in descending order of frequency.[15] This order of involvement of coronary arteries exactly correlated with that of our study. In group-I more frequently involved vessel was LAD (56%) followed by RCA (36%) and LCX (30%). In studies with premenopausal women by ke-fei, et al.[14] Nagamalesh, et al.[16] and Xie, et al.[17] LAD was found common culprit vessel which was 77.1%, 64.51% and 71.8% respectively. This frequency of LAD involvement in premenopausal women also correlates with findings of this study as LAD (56%) was the most common diseased vessel in premenopausal women.

Regarding the percentage of lesion, critical stenoses (70-99%) involving the all three major epicardial vessels (LAD, LCX and RCA) were found most frequently in group-II in respect to group-I and the percentage of lesions were 56% vs. 30%; 56% vs. 22% and 54% vs. 22% respectively. This observation was statistically significant (p< 0.05) between two groups.

Proximal segment involvement in all three coronary arteries was found higher frequency in group-II and percentage of involvement was in LAD, 40% vs. 18%; LCX, 28% vs. 6% and RCA, 30% vs. 16% respectively. There was statistically significant difference in the involvement of proximal LAD and LCX between two groups (P<0.05), Proximal and mid LAD lesions were a frequent finding in group-I (18% and 32%). Ke-fei, et al.[14] revealed that proximal LAD also a frequently involved vessel in both premenopausal and postmenopausal women (50.4% vs.38.0%) but involvement of proximal LCX and RCA was higher in postmenopausal women (47% vs. 33.9% and 21.6% vs. 19.3%). LM disease was 9.6% vs.10.8%.These findings were almost similar to the findings of our study.

The vessel score of the study patients showed highest percentage of single vessel involvement in group-I (52% vs.34%) and triple vessel involvement in group-II patients (40% vs. 12%). This observation revealed that single vessel involvement was significantly higher in group-I than group-II (p=0.003). On the other hand, triple vessel involvement was found significantly higher in group-II than group-I (p=0.001). The vessel score of this study was similar to the score in the study done by Ke-fei, et al.[14] where single vessel score in premenopausal

women was, 43.2% vs. 26.9% and triple vessel score in postmenopausal women was, 33.8% vs. 20.4%. Nagamalesh, et al.[16] and Xie, et al.[17] in their studies with premenopausal women found single vessel involvement most frequently (87.05% and 71.8% respectively).

Severity assessment by Friesinger score showed normal (0) and low (1-4) Friesinger score higher in group-I patients (12% vs.2% and 40% vs. 16% respectively) and statistically significant (P=0.04 and P=0.007 respectively). High Friesinger score (11-15) was found higher in patients in group II (32%vs. 32%). High Friesinger score was also significantly higher in group II (p=0.001).

Severity assessment by Gensini score of the study patients revealed mild Gensini score in group-I patients (76% vs. 46%) and significantly higher in compared to group-II patients (P=0.002). On the other hand, severe Gensini score was found in group-II patients (54% vs. 24%) and this severe Gensini score was significantly higher in group II patients than group I (p=0.002).

The binary logistic regression analysis for severe CAD among postmenopausal women showed that age, chewing tobacco, hypertension and diabetes mellitus were significantly related to the degree of severity of CAD ($p<0.05$) with ORs being 2.836, 1.625, 1.235 and 1.837 respectively in 'univariate analysis and 2.426, 1.490, 1.219 and 1.670 respectively in multivariate analysis.

The binary logistic regression analysis for severe coronary artery disease with the risk factors among the premenopausal women revealed that OCP users have 1.932 times the risk of having significant (p=0.01) CAD in compared to those who never used OCP in univariate analysis and 1.792 times the risk of having significant (p=0.02) CAD as those who never used OCP in multivariate analysis. So, OCP use in premenopausal women has a significant association with the severity of CAD.

The logistic regression analysis revealed that not only the withdrawal of protective effect of estrogens in postmenopausal women contribute to put them at increased risk of having acute coronary syndrome but several other risk factors including age, chewing tobacco and diabetes mellitus found in this study were also strongly related to the severity of CAD and on the other hand OCP significantly influenced the severity CAD among the premenopausal women.

Conclusion:

Coronary artery disease is one of the major important problems not only in postmenopausal women but in premenopausal population also. Postmenopausal women suffer from more triple vessels involvement, more diffuse and severe disease. This study results point out that premenopausal women suffer from less severe coronary artery disease and there is a trend to involve mid LAD more frequently in compared to other two major coronary arteries and LM coronary artery in compared to their counterpart, postmenopausal women.

Study limitation:

There was selection bias as assignment of patients to either group was not randomized. Only hospitalized patients were studied here so may not be applicable to the general population. Menopausal status was determined on the basis of menstrual history rather than on the basis of hormonal changes. Angiographic severity of coronary artery disease was evaluated by visual estimation, so chance of interobserver and intraobserver variation is likely to be present.

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Original Article

Comparison of Risk Factors & Angiographic Profiles between Young Patients with ST Segment Elevation Myocardial Infarction and Non-ST Segment Elevation Myocardial Infarction

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Abstract:

Background: Coronary artery disease is the leading cause of death in the world. Advancing age is a well-recognized risk factor for acute myocardial infarction (AMI). Myocardial infarction is less common in young adults. Prevalence of acute coronary syndrome in young individuals is increasing progressively. These patients have different risk profile, presentation and prognosis. Early recognition and risk factor modification in this population sub-set is of key importance. Objectives: The purpose of the present study was to determine the differences in risk factors and coronary angiographic profile of young patients with ST-segment elevated myocardial infarction (STEMI) vs. those with non-ST-segment elevated myocardial infarction (NSTEMI). Methods: In this cross sectional analytical study total 135 patients (70 STEMI and 65 NSTEMI) aged ≤45 years were enrolled to see the differences of risk factors and angiographic profile. Results: The mean age of the study population was 39.39±5.12 years and the study showed male predominance (90.40 % was male and 9.60 % was female). Smoking/tobacco consumption was significantly higher in STEMI patients, whereas diabetes mellitus and hypertension were more prevalent in NSTEMI patients. The frequency of single vessel disease and involvement of left anterior descending artery was significantly higher in young STEMI patients. In case of young NSTEMI patients frequency of triple vessel disease, noncritical coronary artery disease and involvement of left circumflex coronary was significantly higher. The frequency of double vessel disease and involvement of left main coronary artery was also non-significantly higher in young NSTEMI patients. There was no significant difference regarding involvement of right coronary artery. Conclusion: There are significant differences between young STEMI and young NSTEMI patients in respect to risk factors and angiographic profile.

Key words: Young patient, STEMI, NSTEMI, Risk factors, Coronary angiographic profile.

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Introduction

Ischemic heart disease is a major public health problem associated with high morbidity and mortality. Acute coronary syndrome is a common presentation of ischemic heart disease [1]. It is also the single largest

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cause of death in developed countries as well as developing countries[2]. Risk of CAD among Asian Indians is 3–4 times higher than white Americans, 6 times higher than Chinese, and 20 times higher than Japanese counterparts[3].

Coronary artery disease (CAD) is leading cause of mortality worldwide and by the year 2020, will be first in the leading causes of disability[4]. While the death rates have been declining for the past three decades in the west, these rates are rising in India. In the last three decades, the prevalence of CAD has increased from 1.1% to about 7.5% in the urban population and from 2.1% to 3.7% in the rural population[5]. CAD tends to occur at a younger age in Indians, with more extensive angiographic involvement, contributed genetic, metabolic, conventional and nonconventional risk factors[6,7,8].

The alarming face of this eminent issue is that nearly 80% of total CV deaths occur in low and middle income countries including Bangladesh[9]. Bangladesh is experiencing steep and sustained increases in the incidence of CAD during recent decades[10]. The burden of CHD is emerging as a public health concern in developing countries like Bangladesh[11]. The exact prevalence of CAD in Bangladesh is not known. Only a limited number of small-scale epidemiological studies are available. Probably the prevalence of IHD was first reported in 1976, which was 0.33%[12]. More recent data indicates CAD prevalence to be 3.4% in rural and 19.6% in an urban sample of working professionals[13,14]. In Bangladesh, ACS is the major presenting form of CAD and accounts for 45% of all cause cardiac hospitalization[15].

Coronary artery disease (CAD) is relatively less common in subjects below 40 years of age, as it occurs in about 6–10% of them but it has grave medical, social, psychological, and economic consequences in this age group. With rapid civilization changes and increasing prevalence of conventional risk factors for CAD, premature atherosclerosis is a growing problem, occurring in even younger age groups including those in the third and fourth decade of life [16]. Although the aetiology of CAD in young subjects is related to coronary atherosclerosis in 80% of cases, a number of differences regarding both the risk factor profile and clinical and angiographic characteristics exist in comparison to older patients[17,18].

Sedentary life style and higher consumption of calories, saturated fat, tobacco and alcohol contribute to obesity, dyslipidaemia, hypertension (HTN), diabetes mellitus (DM) and hyperuricaemia and increase the risk of early onset MI in Indian population [19].

Like all other developed and developing countries, prevalence and incidence of type 2 DM is increasing in Bangladesh and this will place Bangladesh among the top seven countries in terms of the number of people living with diabetes in 2030[20].

In a study in Bangladesh smoking was found as the most common risk factor of acute myocardial infarction among young patients followed by dyslipidaemia, hypertension & diabetes. Single vessel coronary artery disease was the most common lesion in both male & female followed by double vessel coronary artery disease and triple vessel coronary artery disease. In case of female triple vessel coronary artery disease was more than double vessel coronary artery disease [21]. Another study also revealed the smoking as most frequent risk factor of acute myocardial infarction with majority patients having single vessel disease and most frequently involve vessel is LAD[22].

Tobacco consumption is quite common in Bangladesh: prevalence is 51.0% for any form, 26.2% for smoking and 31.7% for smokeless tobacco[23]. In a recently published study, betel quid chewing was found in 33.2% of rural population[24]. Bangladesh is one of the top 10 countries that make-up two-thirds of the world population of smokers[25].

As a result of socioeconomic transition, lifestyle, as well as, the dietary pattern are changing in Bangladesh. Increasing prevalence of obesity, tobacco use, high intake of processed foods and less physical activity accompany the transition[14]. In general, 21.5% adults (male 21%, female 22%) have body-mass index (BMI) $\geq$25 kg/m^2. Increased waist circumference is alarming, especially in women (33.7%)[23]. Visceral fat typical of android obesity has a greater association with metabolic syndrome, hyperinsulinemia and CAD in both men and women[26].

According to the KAMIR (Korea Acute Myocardial Infarction Registry) study STEMI patients were younger, more likely to be men and smokers, and had poorer left ventricular function with a higher incidence of cardiac death, compared to NSTEMI patients[27]. NSTEMI patients had a higher prevalence of 3- vessel and left main coronary artery disease with complex lesions, and were more likely to have co morbidities[28].

Comparative analysis of young patients from South India with STEMI and NSTEMI revealed that single-vessel disease was significantly more common in the STEMI group, whereas triple-vessel disease was significantly more common in the NSTEMI group. Smoking/tobacco consumption was the most significant coronary risk factor

in both groups. On the other hand, hypertension and diabetes were common among young patients with NSTEMI [29].

It has also been noted that the clinical presentation, risk factor profile, and coronary anatomy of young patients who develop CAD differs to those who develops CAD at an older age [1, 30]. Overall, these studies have indicated that patients with early onset of CAD exhibit preponderance of single vessel disease, and dominance of coronary risk factors such as hypercholesterolemia, family history of CAD, and cigarette smoking as compared to older patients.

However, there have been very limited data to compare demographic and angiographic characteristics in young patients stratified according to the type of acute coronary syndrome. Therefore, this study aimed to identify the differences between risk factors profile and coronary angiographic characteristics of young adults presenting with ST-segment elevation myocardial infarction (STEMI) and non-ST-segment elevation myocardial infarction (NSTEMI). To define "young patient" an age cut-off of 45 years and below was taken, which was based on previous studies [31, 32, 33, 34, 35].

Materials and Methods:

This observational study was carried out in the department of cardiology, National Heart Foundation Hospital and Research Institute, Dhaka from July, 2016 to June, 2017. Patients who got admitted with the clinical diagnosis of STEMI & NSTEMI and underwent coronary angiography at the index event from July, 2016 to June, 2017 were study population. Considering inclusion & exclusion criteria 135 patients were selected having STEMI & NSTEMI. Patients were divided into two groups according to the type of myocardial infarction.

Group 1: patients who were admitted with STEMI & underwent coronary angiography (STEMI group) and

Group 2: patients who were admitted with NSTEMI & underwent coronary angiography (NSTEMI group).

Enrolment of subjects

Inclusion Criteria:

1. Both male & female patients who were admitted with STEMI or NSTEMI and underwent coronary angiography.
2. Age ≤45 years

Exclusion Criteria:

1. Age >45 years
2. Patient with history & evidence of previous ACS (STEMI/NSTEMI/UA).
3. Past History of PTCA or CABG
4. All patients of valvular heart disease and congenital heart disease.
5. Concomitant co-morbid conditions (severe liver & kidney diseases)
6. Patient who did not give consent.

Study Procedure

All patient aged ≤45 years who were admitted in the Department of cardiology, NHFH & RI, Dhaka fulfilling the inclusion and exclusion criteria were considered as study population. Meticulous history was taken regarding symptoms (chest pain, shortness of breath or other features) and detailed clinical examination was performed in each patient. Demographic and anthropometric data such as age, sex, height (cm), weight (Kg), BMI (Kg/m2) were noted. Coronary risk factors of all patients were recorded. Blood sample was taken for Troponin I, CK MB, Blood sugar, Serum creatinine and fasting lipid profile. Patient's baseline 12 lead ECG & Echocardiography were performed. Patients were divided into 2 groups according to clinical diagnosis of STEMI & NSTEMI. After coronary angiogram, findings of involved vessel, site of lesion, % of stenosis, number of vessel involvement were analyzed between the groups.

Data Collection

Data were collected in a predesigned data collection form.

Stastistical Analysis

After processing all available data, statistical analysis of their significance were done. Obtained data were expressed in frequency, percentage, mean and standard deviation as applicable. Comparison between groups were done by Student's T-test for continuous variables. Categorical data were analyzed by chi-square test. The whole analysis was done with the help of computer based SPSS (Statistical programme for social science) programme version 23.0. P-value of <0.05 was considered as significant.

Observation and Results

The purpose of the present study was to determine the differences in risk factors and coronary angiographic profile of young patients with ST-segment elevated myocardial infarction (STEMI) vs. those with non-ST-segment elevated myocardial infarction (NSTEMI). Considering inclusion and exclusion criteria total number of 135 patients (70 STEMI and 65 NSTEMI) aged ≤45 years were studied. Observations and results are presented in different tables and diagrams.

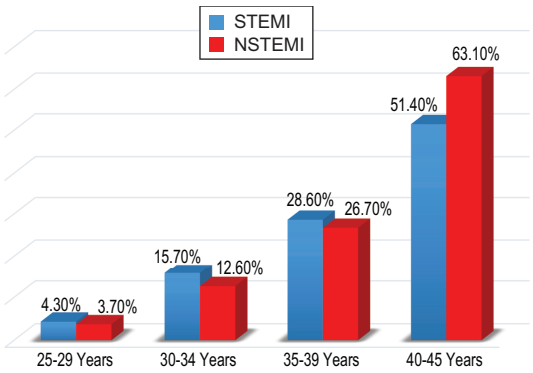

Fig.-1: *Bar diagram showing comparison of age distribution in between study groups (n=135)*

Most of the patients belong to 40-45 years age group (51.4% in STEMI and 63.1% in NSTEMI). The mean age was 39.39±5.12 years and the range was 25-45 years. There was no statistically significant difference between the study groups in terms of age (p>0.05)

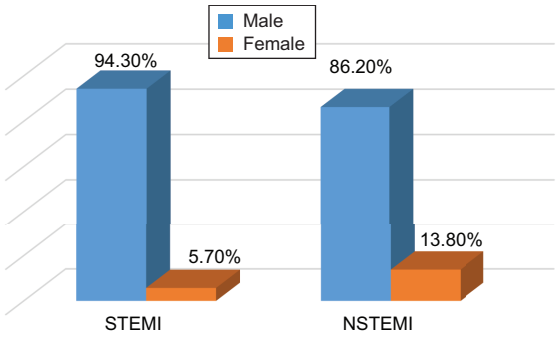

Fig.-2: *Bar diagram showing sex distribution in between study groups (n=135)*

This study shows male predominance, of all patients 90.40 % (122) was male and 9.60 % (13) was female. Analysis revealed there was no statistically significant difference between two study groups (p>0.05)

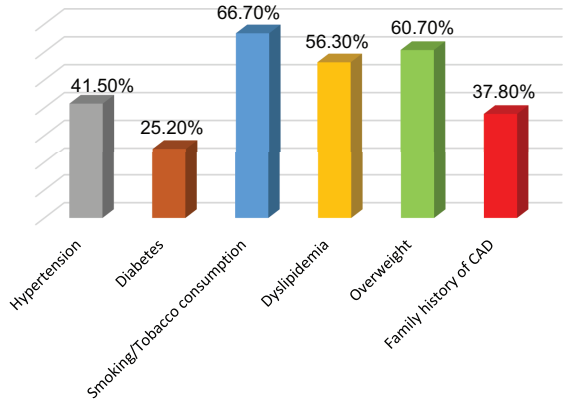

Fig.-3: *Bar diagram showing distribution of risk factors of study population (n=135)*

Smoking/tobacco consumption was 66.7%, dyslipidemia was 56.3%, hypertension was 42.5%, diabetes mellitus was 25.2%, family history of CAD was 37.8% and overweight was 60.7%.

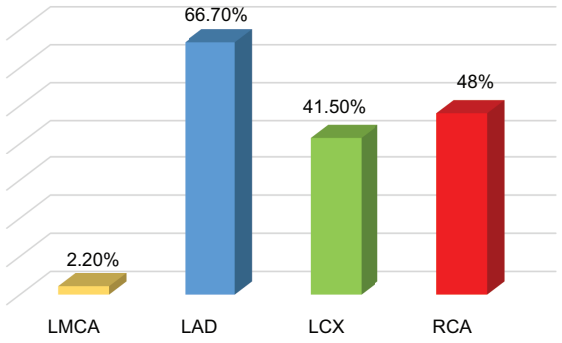

Fig.-4: *Bar diagram showing distribution of involved vessel in study population (n=135)*

LAD (66.7%) was the most commonly involved vessel followed by RCA (48%) and LCX (41.5%). LM (2.2%) was the less commonly involved vessel. Due to multivessel involvement total percentage is more than 100%.

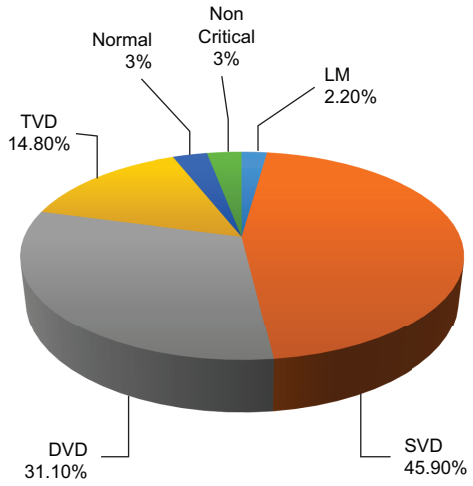

Fig.-5: *Pie chart showing distribution of number of involved vessels in study population (n=135)*

SVD was found in 45.9% cases, DVD was found in 31.1% cases, TVD was found in 14.8% cases, LMCA was found in 2.2% cases, normal coronary artery was found 3% cases and non-critical coronary artery lesion was found in 3% cases. The most common coronary lesion was SVD.

Table-I

Comparison of distribution of risk factors in between study groups (n=135)

Risk factors	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	N	%	
Smoking/Tobacco consumption	49	70	41	63.1	0.040^{S}
Dyslipidemia	44	62	32	42.1	0.134 ^{NS}
Diabetes mellitus	12	17.1	22	33.8	0.025 ^{S}
Hypertension	22	31.4	34	52.3	0.014 ^{S}
Family history of CAD	24	34.3	27	41.5	0.385 ^{NS}
Overweight (BMI ≥25.00 - 29.99)	40	57.1	42	64.6	0.374 ^{NS}

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table-II

Comparison of Echocardiographic findings of the study population between groups (n=135)

Ejection Fraction (%)	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	N	%	
Normal (≥55 %)	2	2.9	35	53.8	0.001^{S}
Mild (45-54 %)	33	47.1	22	33.8	
Moderate (30-44 %)	35	50	8	12.3	
Mean±SD	44.63±4.7		54.14±7.4		0.001^{S}
Range	35-60		35-68		
Presence of RWMA	70	100	40	61.5	0.001 ^{S}

NS= Not significant
S= Significant
*Chi-square test and unpaired t-test were done to measure the level of significance

Table-III

Comparison of vessel involvement in between study groups (n=135)

Involved vessels	STEMI(n=70)		NSTEMI(n=65)		p value*
	n	%	n	%	
LMCA	0	0	3	4.6	0.069 ^{NS}
LAD	55	78.6	35	53.8	0.002 ^{S}
LCX	20	28.6	36	55.4	0.001 ^{S}
RCA	30	42.9	35	53.8	0.202 ^{NS}

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table-IV

Comparison of number of involved vessels in between study groups (n=135)

Number of involved vessels	STEMI(n=70)		NSTEMI(n=65)		P value*
	n	%	N	%	
LMCA	0	0	3	4.6	0.069 ^{NS}
SVD	44	62.9	18	27.7	0.001 ^{S}
DVD	19	27.1	23	35.4	0.301 ^{NS}
TVD	6	8.6	14	21.5	0.034 ^{S}
Normal	1	1.4	3	4.6	0.275 ^{NS}
Non critical	0	0	4	6.2	0.035 ^{S}

NS= Not significant
S= Significant
*Chi-square test was done to measure the level of significance

Table I showing distribution of risk factors between the groups. There were statistically significant difference between the two groups in terms of smoking/tobacco consumption (70% in STEMI group and 63.1% in NSTEMI group), diabetes mellitus (17.1% in STEMI group and 33.8% in NSTEMI group) and hypertension (31.4% in STEMI group and 52.3% in NSTEMI group) ($p<0.05$)

Table II shows normal EF was found only 2.9% patient in STEMI group but 53.8% patents in NSTEMI group. The mean EF of STEMI group was 44.63±4.7 and 54.14±7.4 in NSTEMI group. 100% patients had RWMA in STEMI group whereas 61.5% patients had RWMA in NSTEMI group. Analysis revealed there was statistically significant difference between two study groups ($p<0.05$)

There was statistically significant difference in LAD (78.6% in STEMI group and 53.8% in NSTEMI group) and LCX (28.6% in STEMI group and 55.4% in NSTEMI group) involvement between the two groups ($p<0.05$)

Table IV shows number of involved vessels among the study groups. SVD (62.9% in STEMI group and 27.7% in NSTEMI group), TVD (8.6% in STEMI group and 21.5% in NSTEMI group) and noncritical coronary artery lesion (6.2% only in NSTEMI) had statistically significant difference between the two groups ($p<0.05$). In case of STEMI multivessel involvement (≥2 vessel involvement) was 35.7% and in case of NSTEMI it was 56.9%

Discussion:

This study was conducted to see the differences in risk factors and angiographic profile in young patient with STEMI and NSTEMI. Considering inclusion and exclusion criteria total number of 135 patients were studied. Study population was divided into two groups, STEMI group and NSTEMI group. There were 70 patients in STEMI group and 65 patients in NSTEMI group. This study showed marked differences in between two study group in terms of risk factors and angiographic profile.

Considering distribution of age, it was found that highest percentage was in the group of 40-45 years (51.4% in STEMI & 57% in NSTEMI) and lowest in age group of 25-29 years (4.3% in STEMI & 3.7% NSTEMI). There were no statistically significant difference in age distribution pattern between groups (p value >0.05), which was consistent with previous study[36].

Distribution of male patients in STEMI and NSTEMI group were 94.3% and 86.2% respectively and female patients were 5.7% in STEMI and 13.8% in NSTEMI group respectively. There were no statistically significant difference in sex distribution pattern between the groups (p value >0.05). 90.4% of the patients were male and 9.6% were female. This findings signify that young male have higher chance of developing MI than female. Similar result was found in a Bangladeshi study where 94.7% patients were male and 5.4% patient were female[37]. Maroszynska-Dmoch & Wozakowska-Kaplon, Haque, et al. and Deora, et al. also found similar findings[16,21,29].

Regarding distribution of risk factors in study population, smoking/tobacco consumption was 66.7%, dyslipidemia was 56.3%, hypertension was 42.5%, diabetes mellitus was 25.2%, family history of CAD was 37.8% and overweight was 60.7%. In this study smoking/tobacco consumption was the most common risk factors. These findings were similar with the previous studies of Bangladesh. Haque, et al. (2010) has shown that smoking (64%) was the most common risk factor in young patients, followed by dyslipidemia (50%) and hypertension (37.55%) [21]. In a study Malik, et al. (2016) has also shown similar findings [37]. Schoenenberger, et al. (2011) has also shown that smoking, family history of CAD, dyslipidemia and overweight were the most important cardiovascular risk factors in young patients [38]. Maroszynska-Dmoch & Wozakowska-Kaplon (2016); Tamrakar, et al. (2013) and Zimmeran, et al. (1995) also found similar findings in their studies[16,31,39].

There were statistically significant difference between the two groups in terms of smoking/tobacco consumption, diabetes mellitus and hypertension ($p<0.05$). Smoking/tobacco consumption was 70% in STEMI group and 63.1% in NSTEMI group. Dyslipidemia was found 62% in STEMI group and 42.1% in NSTEMI group. Diabetes mellitus was found 17.1% in STEMI group and 33.8% in NSTEMI group. Hypertension was found 31.4% in STEMI group and 52.3% in NSTEMI group. Family history of CAD was found 34.3% in STEMI group and 41.5% in NSTEMI group. Overweight was found 57.1% in STEMI group and 64.6% in NSTEMI group. Deora, et al. (2016) in their study found that hypertensive, diabetics and obese patients were significantly higher in the NSTEMI group. Smoking/tobacco consumption was identified as the most prevalent risk factor in patients in STEMI group (67.9%) and NSTEMI group (69.9%). In a study Song, et al. (2010) has found that hypertension (54.4% vs 46.1%), diabetes mellitus (31.6% vs 25.1%) and dyslipidemia (28.2% vs 18.2%) were significantly higher in NSTEMI group than STEMI group.

Regarding echocardiography, normal EF was found only 2.9% patient in STEMI group but 53.8% patents in NSTEMI group. The mean EF of STEMI group was 44.63±4.7 and 54.14±7.4 in NSTEMI group. 100% patients had RWMA

in STEMI group whereas 61.5% patients had RWMA in NSTEMI group. Analysis revealed there was statistically significant difference between two study group ($p<0.05$). Deora, et al. (2016) also found similar findings in their study[29].

Considering distribution of involved vessels in this study, LAD (66.7%) was the most commonly involved vessel followed by RCA (48%) and LCX (41.5%). LM (2.2%) was the less commonly involved vessel. These findings are similar with the study done by Maroszynska-Dmoch and Wozakowska-Kaplon (2016); Haque, et al. (2010); Tamrakar, et al. (2013); Malik, et al. (2016) and Sharma, et al. (2014) in young patients[16,27,31,37,40].

Regarding the involvement of vessels, Left main coronary artery disease (LMCA) was not found in STEMI group but 4.6% had LMCA disease in NSTEMI group. 78.6% and 53.8% had disease in LAD in STEMI and NSTEMI group respectively. 28.6% and 55.4% had LCX involvement in STEMI and NSTEMI group respectively. STEMI group had 42.9% and NSTEMI group had 53.8% RCA involvement. There was statistically significant difference in LAD and LCX involvement between the two groups ($p<0.05$). Deora, et al. (2016) has shown similar findings that LAD involvement was more common among STEMI group of patients, while LCX and LMCA involvements were more common among NSTEMI group of patients and no significant difference was observed in case of RCA involvement [29]. Study done by Song, et al. (2010) also found similar findings[27].

In this study the most common coronary lesion was SVD. Younger patients have higher prevalence of SVD (45.9%) followed by DVD (31.1%), TVD (14.8%) and LMCA (2.2%) which is similar to the study results of Maroszynska-Dmoch & Wozakowska-Kaplon (2016); Haque, et al. (2010); Tamrakar, et al. (2013); Malik, et al. (2016) and Schoeneberger, et al. (2011)[16,21,31,37,38].

Deora, et al. (2016) in their study found that SVD (56.6%) was significantly higher in the STEMI group. The NSTEMI group had significantly higher TVD (10.5%) and non-significantly higher DVD (15.3%) and normal coronary arteries[29]. In this study LMCA was not found in STEMI group but found 4.6% in NSTEMI group. SVD was found 62.9% in STEMI group and 27.7% in NSTEMI group, DVD was found 27.1% in STEMI group and 35.4% in NSTEMI group, TVD was found 8.6% in STEMI group and 21.5% in NSTEMI group. Normal coronary was found 1.4% and 3.6% in STEMI and NSTEMI group respectively. Non critical coronary lesion was found 6.2% only in NSTEMI group. SVD was significantly higher in STEMI group, TVD and noncritical coronary lesion were significantly higher in NSTEMI group.

Conclusion:

From this study it may be concluded that young male have higher chance of developing MI than female. Smoking/tobacco consumption is the most common risk factors in young patients, followed by overweight, dyslipidemia, hypertension, family history of CAD and diabetes mellitus. Smoking/tobacco consumption is significantly higher in STEMI patients, where as diabetes mellitus and hypertension are more common in NSTEMI patients. The frequency of SVD and involvement of LAD is significantly higher in young STEMI patients. In case of young NSTEMI patients frequency of TVD, noncritical coronary artery disease and involvement of LCX is significantly higher. The frequency of DVD and involvement of LMCA is also non-significantly higher in young NSTEMI patients. There is no significant difference regarding involvement of RCA.

Limitations of the Study

Although the result of this study is statistically significant and supports the hypothesis, there were some limiting factors which might affect the results:

- It was a single center study.
- Only traditional risk factors were included.

Recommendations

- Early identification and management of modifiable coronary risk factors are the keystone to prevent the occurrence of CAD and myocardial infarction at younger age.
- This study showed presence of more risk factors and more complex coronary artery lesion in young NSTEMI patients than young STEMI patients. So aggressive coronary risk factors modification and special attention to be taken for primary and secondary prevention of NSTEMI.
- Larger studies are required to establish specific associations between risk factors and angiographic profiles in young patients.

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Review Article

High Bleeding Risk (HBR) patients Percutaneous Coronary Intervention-a Challenge to Deal with

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Abstract:

Coronary artery disease (CAD) is one of the leading causes of death in our patient population. In the era of cardiovascular intervention, Percutaneous coronary intervention (PCI) is one of the most important modalities in treating these group of patients. Several CAD risks factors and co-morbid conditions are key responsible factor of procedural success. High bleeding risk (HBR) patients undergoing PCI is not an uncommon phenomenon. Incidences and prevalence of HBR patients with CAD and their management by PCI is not well addressed in our literature. PCI in HBR patients carries potential risk of intracranial hemorrhage (ICH) and life-threatening bleeding. Therefore, careful pre-PCI assessment of possible risk or threats of post-PCI complications in patients with HBR are deem necessitate to understand. We recommend forming multicenter common consensus and to form a guideline in treating HBR patient by PCI. Thus, to reduce post procedural complication and subsequent improvement of mortality and morbidity in HBR patients undergoing PCI in both ST segment elevated myocardial infarction (STEMI) and as well as non-STEMI.

Key word: *CAD, HBR, PCI, ICH and STEMI*

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Percutaneous Coronary intervention (PCI) is an important and popular treating modality in patients with CAD in the settings of ST segment elevated myocardial infarction (STEMI) and non-(STEMI). With the available facilities and advent of interventional procedures, enrichment of well experienced interventionist, PCI in Bangladesh, has reached its level high in national and international arena of interventional cardiology. Patients with acute STEMI are posing potential risk of sudden cardiac arrest and death. Primary PCI is a lifesaving modality in treating acute STEMI patients by primary PCI within 6hrs of MI and provides better myocardial salvages.[1] Many of the big city and district level hospital has cardiac Cath lab, where Primary PCI can be offered. Thus, these subsets of patient are preventing from the major adverse cardiac events like LVF, death, cardiac arrhythmia, and recurrent hospitalization.

Over two and half decades, since our journey towards cardiovascular intervention, many of the centers providing state of the art ACC/AHA and ESC guideline recommended therapy by PCI, in treating STEMI patients and patients with CAD.[2-3] Post PCI stent thrombosis and ischemic stroke and bleeding has not been well addressed or not well known in our patient perspective. Exact data on post PCI bleeding in our population, especially in High bleeding risk (HBR) is not available in the literature.

Patients with high bleeding risk (HBR) are in potential threat to successful PCI and complications. Possible untoward effects with Intra-cranial hemorrhage (ICH) or bleeding might complicate the post procedural survival outcome, along with, the increase of mortality and

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morbidity. Academic consortium for HBR consensus recommend[4] *major criteria* are anticipated use of long term oral anticoagulants (OAC), Severe or End stage CKD (eGFR, <30mL/min, Anemia (Hb <11gm/dl), Spontaneous bleeding requiring hospitalization or transfusion in the past 6 month or anytime , if recurrent, moderate or severe baseline thrombocytopenia <100,000cmm3), Chronic bleeding diathesis, Liver cirrhosis with portal HTN, Active malignancy previous spontaneous ICH at any time, previous traumatic ICH within past 12 month, presence of bAVM, moderate to severe ischemic stroke within past 6 month, nondeferrable major surgery on DAPT, recent major surgery or major trauma within 30 day prior PCI. Among the *Minor criteria* Age>75yrs, moderate CKD (eGFR 30-59mL/min), Hemoglobin 11-12.9g/dl), spontaneous bleeding requiring hospitalization or transfusion within the past 12 month not meeting the major criterion, long-term uses of NSAIDS or Steroids, any ischemic stroke at any time not meeting the major criterion.[4]

Patients with ST-elevation Myocardial infarction (STEMI) who are undergoing primary percutaneous coronary intervention (PCI) are at high risk of ischemic and bleeding events, both of which strongly affect subsequent morbidity and mortality.[5-6] Therefore the selection of optimal antithrombotic in STEMI patients after PCI may requires careful evaluation and offsetting risk of ischemia and bleeding .[7] Usually, highest rate of ischemic events occurs in first few days or weeks after STEMI, a less potent antiplatelet regimen could offer a favorable balance of ischemic protection versus bleeding avoidance.[8-9] Therefore, Identification and managements of patients at high bleeding risk undergoing PCI are of major concern. The academic research consortium for high bleeding risk (ARC-HBR) developed a consensus definition of high bleeding risk. The proposed ARC-HBR consensus definition of HBR in clinical trials evaluating the safety and effectiveness of drugs and devices for patient undergoing percutaneous coronary intervention (PCI).[4]

High bleeding Risk (HBR) is defined as a bleeding academic consortium (BARC) 3 or 5 bleeding risk of >4% at 1 year or a risk of an intracranial hemorrhage (ICH) of >1% at 1 year. Thus, a major criterion for ARC-HBR is defined as any criterion, that in isolation is considered to confer a BARC 3 or 5 bleeding risk of >4% at 1 year or any criterion considered to be associated with a risk of ICH of >1% at 1 year. A minor criterion is defined as any criterion that in isolation is considered to confer increased bleeding risk, with BARC 3 or 5 bleeding rate of <4% at 1 year. The cut-off value of 4% for BARC 3 or 5 bleeding was based on consensus of the participants taking into account that 1 year major bleeding rates in trials of DAPT use after PCI which largely excluded patients at HBR, were <3% and that in DES trial enrolling patients at HBR , 1 year BARC 3 to 5 bleeding rates were 7.2% in LEADERS FREE trial[10] and 4.2% in ZEUS-HBR[11] despite 1 moth uses of DAPT after PCI and in SENIOR trial[12] was 3.5% in which age >75 were only inclusion criteria. The 2017 ESC guideline focused update on DAPT in coronary artery disease (CAD) recommended (class IIb level of evidence A) that uses of scores PRCISE-DAPT (predicting bleeding complications in patients undergoing stent implantation and subsequent dual antiplatelet therapy) and DAPT scores may be considered to guide antiplatelet therapy after PCI.[13]

In our patient perspective, it is not well known about exact number of HBR patients undergoing PCI. Almost 30% of the PCI of all-comers who participated in BIO-RESORT trial were in HBR. They also have an increased risk of ischemic events and thus represents a population with an overall high risk of adverse clinical outcome.[14] Many PCI patients might have an increased bleeding risk, but exact proportion depends on HBR criteria, and many be higher in patients with acute coronary syndrome.[15]

The evolution of percutaneous coronary intervention (PCI) over the last several decades has facilitated treatment for extremely complex patients. Ischemic events after coronary stenting declined over the years with the advent of newer drug eluting thin struts stents. DAPT plays a very important role in preventing post PCI stent thrombosis and In-stent restenosis. Uses of DAPT types and duration is important in this subset of HBR patient with both STEMI and non-STEMI. However, prolong uses of DAPT to have stronger and longer inhibition of platelets, the coincident of bleeding complication is increased specially in patient with HBR. To reduce this complication, optimal patient identification is required before pharmacological and interventional approach. In the early, uses of first-generation DES, DAPT recommended for 3-6 months.[16-18] Later, DAPT extended to 12 months due to possibility of stent thrombosis (ST).[19] Randomized trials comparing DES and BMS with DAPT of 1 month in patients perceived to be increased bleeding risk showed superior safety and efficacy with DES.[10-12] The European Antiplatelet Therapy Guide paved the way for one-month DAPT in patients with stable coronary artery disease and HBR ; and 6 months for ACS (class IIb and II c recommendation).[13] Similarly, the 2016 American

College of Cardiology/ American Heart Association (ACC / AHA) Recommendations consider it reasonable to discontinue DAPT after 6 months for patients with ACS after PCI and HBR (Class IIb recommendation, C-LD level of evidence).[20-22]

Most patients after PCI treated with DES that elute an antiproliferative drug from the polymer coating. Life-long presence of durable polymers may induce vessel wall inflammation, delaying arterial healing with subsequent stent thrombosis or MI.[23] To overcome this thin-strut biodegradable polymer DES. Although guideline recommended contemporary uses of DES over first-generation DES and BMS in patients going PCI.[24] meta-analysis of clinical trials showed no unequivocal benefit of BP-DES over DP-DES, but there might be advantage of BP-DES in high-risk patients.[25] Patients with High bleeding risk who undergo percutaneous coronary intervention also have increased risk of ischemic events and represents an overall high-risk population. In clinical practice, a substantial proportion of PCI patients are at HBR.[26-27]

The absolute risk of ischemic events was highest in early after the PCI, then it exponentially decayed overtime. Thus, it emphasized that the uses of most potent antiplatelet may have greatest utility in improving prognosis. On the other hand, absolute rate of bleeding was high in early after PCI, more potent agent may harm at this time. Literature has documented that procedural and post procedural uses of Bivalirudin rather than unfractionated heparin and GP Inhibitor may results in greater risk for ST but less bleeding. These offsetting risk can be avoided by routine uses of bivalirudin infusion at 1.75mg/kg/h for 3-to-4-hour post PCI, which may eliminate excess acute risk of ST without increasing bleeding.[28,13] Intensification of P2Y12-receptor inhibition by uses of intravenous cangrelor compared with clopidogrel during the PCI procedure and first 2 to 4 hour thereafter favorably reduces the acute and 48-hours rate of MI and stent thrombosis without affecting increasing major bleeding.[29]

Although the uses of prasugrel rather than the clopidogrel in patients with acute coronary syndrome was highly effective in reducing adverse ischemic events early after PCI, the excessive bleeding complication with irreversible agents offset much of its benefit.[30] In the PLATO (Platelet inhibition and patients' outcome) trial, both STEMI and Non-STEMI patients were treated with Aspirin plus Ticagrelor rather than Aspirin with Clopidogrel, experienced a 1-year reduction of stent thrombosis, MI, cardiac mortality and noncardiac mortality, despite a modest increase in non-CABG related major bleeding.[22]

In the HORIZON AMI trial, in patients with STEMI treated with primary PCI on a background of aspirin and clopidogrel for 1 year, the risk for adverse ischemic and bleeding events was highest after the procedure and declined overtime.[31-32]

Coronary stenting in patients who need long-term oral anticoagulant (OAC), poses potential challenges regarding the best antithrombotic strategy. Coronary stenting requires an initial period of DAPT with aspirin and P2Y12 inhibitor to prevent stent thrombosis.[33,13] Yet high risk patient with atrial fibrillation needs OAC to mitigate the risk of stroke or systemic embolism, further amplifying the bleeding risk of DAPT.[34] In fact, called Triple antithrombotic therapy, has been associated with to a greater risk of major bleeding.[35] undergoing coronary intervention is at higher bleeding risk due to the concomitant need for oral anticoagulant and antiplatelet therapy. RE-DUAL PCI trial demonstrated better safety with dual antithrombotic therapy (Dabigatran and Clopidogrel) compared to triple antithrombotic therapy (warfarin, Clopidogrel or Ticagrelor and aspirin).[36]

Therefore, optimum balance of ischemia suppression and implementation of bleeding avoidance strategies also essential, especially in the acute and sub-acute phase of primary PCI. Several risk stratification systems (score) have emerged in HBR patients with increasing data and information on the adverse impact of hemorrhagic incidents on post PCI outcomes. Among them, CRUSADE score, ACTION score, ACUITY / HORIZON MI score and HORIZON-MI score are mentionable. [37] In the PORECISE-DAPT study showed prolong DAPT >6 months post PCI in HBR patients increased bleeding without reducing ischemic events.[38] PLATO-a study of platelet inhibition and patient outcome-Ticagrelor associated with 20% higher risk of non-cardiac bleeding and 30% higher incidence of ICH compared with clopidogrel.[39] I TIMI TRITON-8 prasugrel is associated with 30% higher incidence of major bleeding in patients >75yrs age, with a history of stroke or weight <60kg.[40] Combination of aspirin and clopidogrel or ticagrelor for 6 months after PCI is recommended in ESC guideline for patients with HBR (class IIa, level of evidence B, in the year 2016, ACC/AHA recommendations, use of ticagrelor instead of clopidogrel in this case is class IIa level of evidence B-R.[22]

Since, the journey of PCI to manage both STEMI and non-STEMI patients begun two and half decade ago, interventional cardiology reaches its level high in national and international arena in treating STEMI, non-0STEMI,

CTO lesion, Complex PCI, LM Bifurcation PCI, Retrograde CTO PCI- both ipsi-lateral and contralateral approach. Many of the Center doing round the clock PCI for STEMI. In pandemic, pharmaco-invasive therapy replaces primary PCI, since, in our country covid dedicated Cath lab not available.[41] Treating HBR patient especially post-CABG with background end stage renal disease with or without hemodialysis are presenting with more complex, calcified disease, which are in potential high risk of post PCI bleeding. Treating AF with CAD or patient of post AVR or MVR CAD also in high risk of bleeding due to OAC, is not uncommon in our routine interventional procedure.

To avoid post procedural bleeding or intracranial hemorrhage, in these subsets of population, needs to address well before proceeding to PCI. It is mandatory, to examine HBR patients by careful history taking, assessment of potential threat and preparedness to deal the complication prior to proceed to PCI. Potential risk of ICH or life-threatening bleeding might jeopardize the success of PCI.

In the literature, exact percentage of Bangladeshi patient with HBR going for PCI is not well addressed or known. Therefore, we recommend forming a common consensus to develop a national guideline through cardiovascular and interventional society, if possible, to categorize Bangladeshi HBR patients prior PCI. Also, need randomized multicenter comparative study to assess better survival outcome with reduction of major adverse cardiac events after PCI in this subset of Bangladeshi patients. No doubt, this will help to take care of HBR patient in a safer way to intervene when needed without any potential life-threatening complication. Also, need to set the DAPT protocol with or without OAC with possible shorter duration, thus, to avoid ICH or bleeding after PCI.

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Case Report

A Case Report on Chronic Digoxin Toxicity

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Abstract:

Digitalis glycosides are among the oldest drugs used in cardiology. Nowadays, due to the limited indications for their use (advanced heart failure, usually concomitant with atrial fibrillation), cases of toxicity induced by this class of drugs are rarely observed. Digoxin produces a positive inotropic and bathmotropic effect on the heart, but has a negative chronotropic and dromotropic effect. Cardiac glycosides have a narrow therapeutic window, so digitalis treatment can easily lead to symptoms of overdose. In patients taking digoxin, the drug therapeutic level should be maintained at 1-2 ng/ml; the toxic effects occur at concentrations > 2.8 ng/ml and are mainly related to disturbances of cardiac function and of the circulatory system, as well as gastrointestinal symptoms and CNS disturbances. Here, a 65-years-old patient who was hospitalized following chronic ingestion with acute renal impairment. In spite of rapidly applied gastric irrigation and administration of activated charcoal, the drug level in the patient's blood was estimated at 8.5 ng/ml. During her stay on the ward, typical symptoms of severe toxicity were observed: from gastric symptoms (severe nausea, vomiting) to conduction disturbances. Type I, moitz type 1 and 2 AV blocks were detected, as well as some supraventricular extrasystoles. These conduction disorders required the use of temporary endocardial pacing. Due to the unavailability of specific antidotes (antidigitalis antibodies) and lack of efficient methods of extracorporeal elimination of the drug, symptomatic treatment comprising the correction of electrolyte disturbances and heart rate control remains the most effective.

Keywords: *Poisoning, digitalis. Atrioventricular block. Antidigoxin antibodies.*

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Introduction:

Digoxin is a centuries old drug which continues to be used in congestive heart failure and cardiac rhythm disorders particularly atrial fibrillation. But indications are increasingly restricted day by day. A therapeutic concentration of digoxin is reported as 0.8-2.0 ng/mL[1-2]. Because of its narrow therapeutic index, patients on digoxin are at risk for toxicity. Digoxin-specific antibody fragments serve as a therapeutic option in patients with digoxin toxicity; however, the indications for digoxin-specific antibody fragments are inconsistent. In a review of the literature, Lloyd et al., in 2014, reported the efficacy of digoxin-specific antibodies as ranging from 50%-90%[3]. Here discussion on a case of a symptomatic elevated digoxin level of 8.5 ng/mL secondary to a dosing error and AKI due to urosepsis, who was managed without digoxin-specific antibody fragments as well as a brief information about digoxin toxicity.

Case report:

A 65-year-old diabetic, normotensive woman presented to Evercare hospital dhaka emergency department with

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a chief complaint of loose motion and vomiting for 3 days. She was also experiencing dizziness, drowsiness, fatigability and nausea for two weeks. She has a history of myocardial infarction 3 months back and treated with thrombolytic. Coronary angiogram was done which revealed left main and triple vessel disease and CABG was done in the same setting. Hospitalization two months prior to current presentation, patient was treated for heart failure with paroxysmal atrial fibrillation. Her medication list revealed that she had been discharged on digoxin. Her past medical history was pertinent for heart failure with a reduced ejection fraction with LVEF 30%. Due to nausea, she discontinued digoxin which was advised by physician.

She presented with mild disorientation. Initial vitals included blood pressure 80/60 mmHg, heart rate 48 beats per minute, respiratory rate 18 breaths per minute, and oxygen saturation of 94% on 3 L/min of oxygen via a nasal cannula. EKG showed 2:1 atrioventricular block with ventricular rate of 48 bpm (Figure 1). Lab results included potassium 3.5 mmol/L (normal range 3.5-5.0 - mmol/L), creatinine 1.5 mg/dL (normal range 0.7-1.3 mg/dL), troponin 0.03 ng/mL (normal <0.03 ng/mL), and digoxin 8.7 ng/mL (therapeutic window 0.8-2.0 ng/mL). After a discussion with the family and patient, the decision was made to treat the patient with supportive care in the emergency department (ED). After initial management, she was admitted into CCU and Inj. Noradrenalin was started for hypotension. Inj. Atropine failed to revert AVB. With conservative management her condition stabilized. Oral potassium was given with the target of level of > 4 mmol/L. Her digoxin concentration trended down at the expected rate She remained asymptomatic during her hospital stay with normalization of ECG (Figure 2). It was recognized that raised blood digoxin level was due to acute renal impairment. She was discharged against medical advice on hospital Day 4 due to financial constraint (Digoxin level 3.2ng/mL).

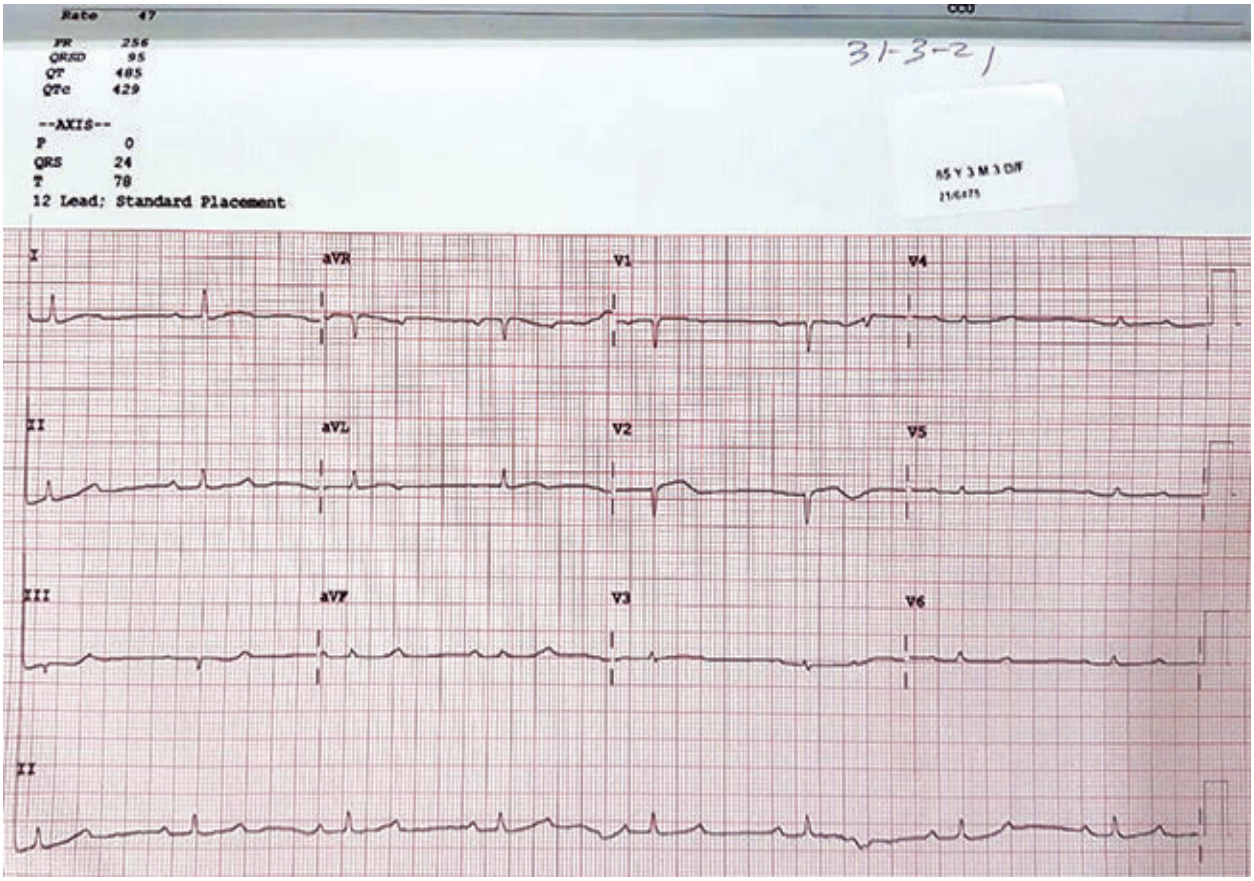

Fig.-1: *12 lead ECG showing 2:1 AV block.*

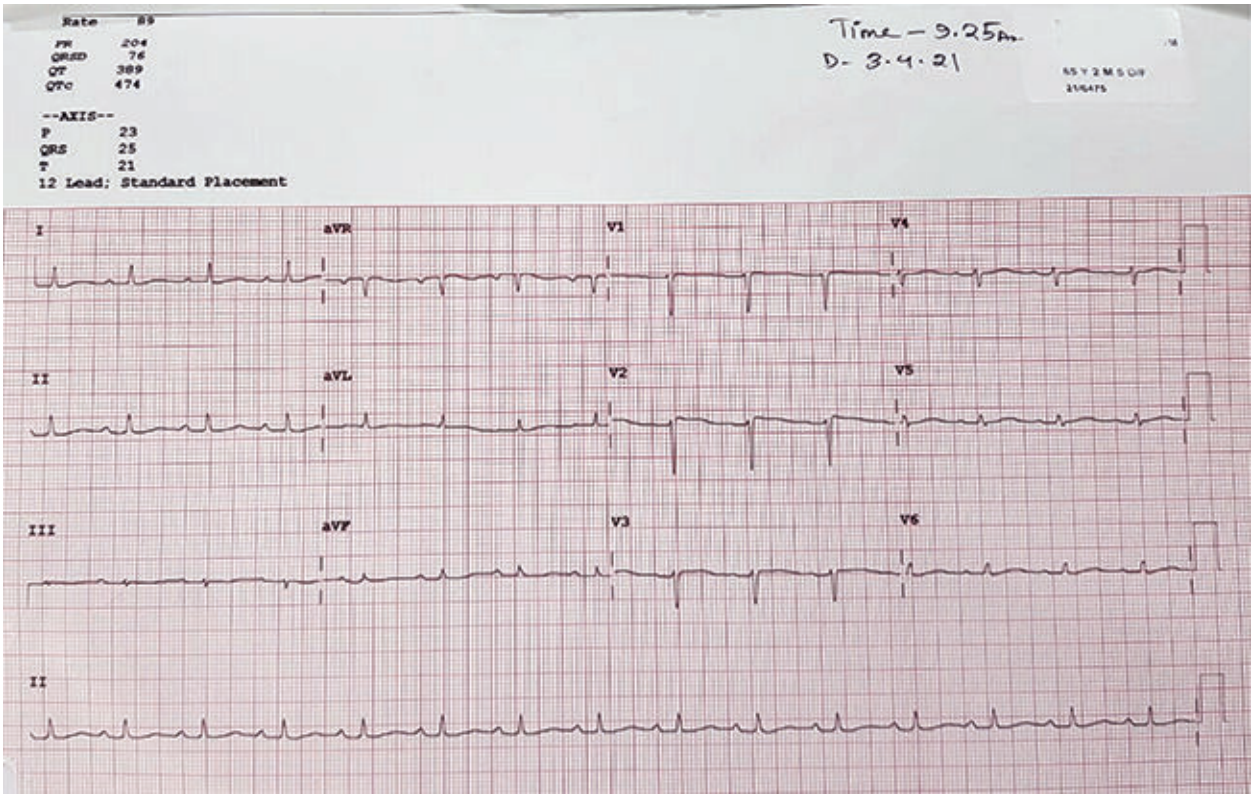

Fig.-2: *12 lead ECG showing normal sinus rhythm.*

Discussion:

Digoxin is one of the common cardiac drug used in past and present. Digitalis toxicity, particularly in persons under long-term digoxin therapy, is a reason for repeated visits to hospital. Acute poisoning is rare but may occur as a result of attempted suicide or the intake of plants that contain cardiac glycosides. This glycosides found in plants like Digitalis purpurea (foxglove) and Digitalis lanata (woolly foxglove). Below in table I pharmacologic profile was given[4].

In acute poisoning the patient may present initially asymptomatic for 1-2 hours before symptoms such as

Table-I

Bioavailability	65-80%
Protein binding	20-25%
Metabolism	Liver (10-20%)
Elimination half-life	35-45 hours
	3.5 - 5 days (if renal failure)
Excretion	Kidney (75-80%)
Solubility	water
Mechanism of action	Inhibit the sodium-potassium-ATPase
Effect begins	30-90 minutes
Peak effect	4-6 hours
Serum threshold Dose	0.8-2.0 ng/mL.
Volume distribution	
• Adult	4-7 l/kg
• Child	16 l/kg
Lowest Reported Toxic Dose·	
• Adult·	7500 mg
• Child	0.05 mg/Kg and 4 mg

nausea, vomiting, diarrhea and abdominal pain appear. Then followed by lethargy, confusion and weakness, regardless of the hemodynamic situation. Chronic toxicity produces less specific initial symptoms, such as loss of interest in daily life activities, anorexia, nausea, vomiting, diarrhea, abdominal pain, weight loss, delirium, confusion, drowsiness, headache, hallucinations, visual disturbance (chromatopsia, particularly xanthopsia), instability, syncope or fainting due to low cardiac output associated with altered heart rate[5]. One third of patients who die do so because of bradyarrhythmia and two thirds because of ventricular arrhythmia, but bradycardia that is unresponsive to atropine may be premonitory of ventricular fibrillation[6].

Table-II
Arrhythmias found in digitalis poisoning

Bradyarrhythmia	Tachyarrhythmia
Sinus bradycardia	Atrial tachyarrhythmia
Sinoatrial block	Junctional tachycardia
Mobitz type ll 2nd degree AVB	Ventricular extrasystole
Atrioventricular dissociation	Bigeminy
Slow Atrial fibrillation	Ventricular tachycardia
Atrial flutter with AVB	Ventricular fibrillation

Diagnosis is done by history, clinical symptom, compatible ECG findings and serum digoxin level. Other laboratory tests are includes kidney function test, liver function test, serum electrolyte calcium, ABG and serum magnesium.

Specific treatment for digoxin toxicity is administration of digoxin-specific Fab fragments (antibodies) who are hyperkalemic or have Life-threatening situations (table III). For acute toxicity with an unknown digoxin concentration and unknown amount ingested, 10 vials can be empirically administered for adults, or 5 vials for children. For chronic toxicity, these doses will likely over-estimate the amount of digoxin immune Fab fragment needed. One vial of digoxin immune fragments binds to 0.5 mg of digoxin. If the digoxin concentration is known, and the patient has ingested digoxin, the following formula can be used:

Number of vials = (serum digoxin concentration) x (patient weight in kilograms)/100[7].

For the supportive management the first priority is ensuring the patient has an adequate airway and breathing. An intravenous line should be established, with supplemental oxygen supplied if necessary and intravenous fluid therapy with control of central venous pressure (CVP). In chronic toxicity, digoxin and any other antiarrhythmic should be discontinued.

Table-III
Life-threatening situations where anti-digoxin antibodies was indicated[8]

Bradycardia with HR < 40 bpm and no response to atropine.	PVC with risk of VT or VF
Ventricular tachycardia. Asystole.	Ventricular fibrillation. Digoxin plasma levels > 6 ng / mL (> 6 hour post-ingestion).
Cardiogenic shock.	Potassium > 5 mEq/L in acute intoxication.

In acute poisoning (<6h) gastrointestinal decontamination with activated carbon to prevent absorption should be considered. Hypokalemia is treated with supplementary potassium until it is > 4 mEq/L. Hyperkalemia(K+ > 5 mEq/L) should be corrected with extreme caution using insulin-glucose, bicarbonate or exchange resins and Hyperkalemia may also be corrected with calcium salts, but in digitalis toxicity they may induce asystole or malignant arrhythmias so are not recommended. Neither is it advisable to treat hyperkalemia with beta-adrenergic because of their arrhythmogenic potential. Hyperkalemia in the presence of renal failure is an indication for hemodialysis[9].

Hypomagnesemia is common in chronic poisoning due to the frequent use of diuretics in these patients. In theory, magnesium reduces myocardial irritability and improves conduction; it is indicated if sustained ventricular arrhythmia is present, but this benefit has not been confirmed in controlled studies. Magnesium is contraindicated in the presence of renal failure, bradyarrhythmia or AVB[11]. The correction of hypocalcemia is controversial and uncertainty about its cardiac effects; in cases of digitalis toxicity, calcium salts should not be administered[12].

In hypotension, plasma volume should be increased within limits[1] and correction of hypoxemia if present. Dopamine or dobutamine are potentially arrhythmogenic and should be avoided. In refractory cases, noradrenaline is the drug of choice. Hypertension is rare and if needed then one should use drugs with a short half-life.

Management of arrhythmias is shown in figure 3.The use of pacemakers has very limited indications, since they do not guarantee control of rhythm disorders, and intra-cardiac placement is nowadays totally contraindicated, especially in acute poisoning, since they can induce malignant arrhythmias[13]. But some authors have obtained good results in cases of chronic poisoning, and recommend temporary pacemakers in patients with

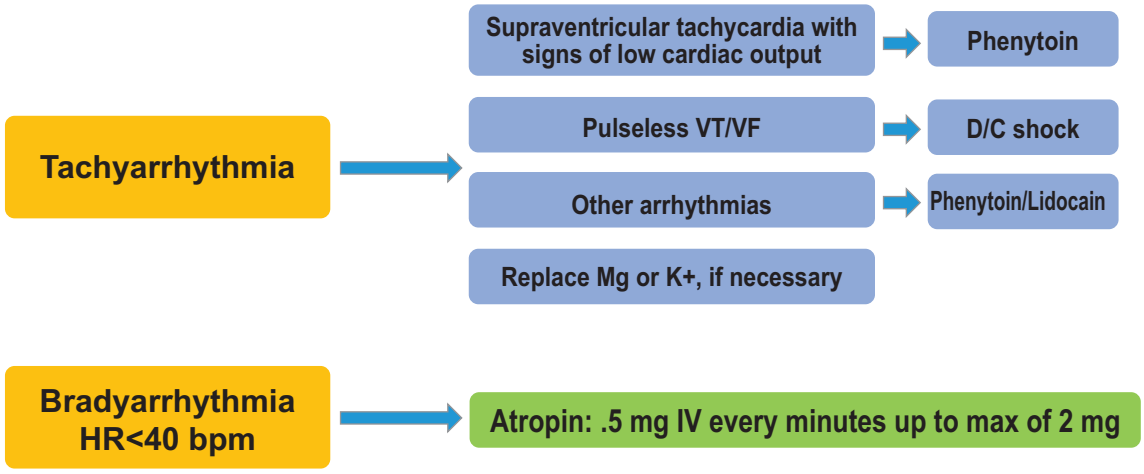

Fig.-3: *Management of arrhythmias in digoxin toxicity*[10].

advanced AVB or symptomatic bradycardia, programmed at low frequencies (55-60 beats/min) to minimize their arrhythmogenic effect[14].

Direct cardioversion to reverse supraventricular tachyarrhythmia has been associated with fatal ventricular arrhythmia and should not be used. However, cardioversion or defibrillation is indicated in situations of unstable or pulseless ventricular tachycardia and ventricular fibrillation. In these situations it is recommended to start with low energy (10-25 J) and pre-treat, if possible, with lidocaine or amiodarone[15].

For renal and extra-renal clearance, diuresis and hemodialysis or hemoperfusion are ineffective at significant extraction of digoxin, mainly due to its extensive volume of distribution. Once over the period of major risk period, with no signs, symptoms and ECG changes related to digitalis poisoning and with digoxin concentrations < 2 ng/mL, the patient can be discharged.

Conclusion:

Digitalis toxicity is serious and, from the beginning, the patient must be monitored continuously while risks are evaluated, treatment administered and until risk of death is considered improbable. Digoxin-binding antibody is the only drug which can reverse the effect of digoxin toxicity. In perspective of Bangladesh, unfortunately this antidote is not easily available medicine. Due to the unavailability of specific antidotes (antidigitalis antibodies) and lack of efficient methods of extracorporeal elimination of the drug, symptomatic treatment comprising the correction of electrolyte disturbances and heart rate control remains the most effective.

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Case Report

Redo MIDCAB in a Septuagenarian in our Setting, Fantasy or Fact? - A Case Report

Saikat Das Gupta[1], Md Ali Haider[2], Mohammed Kamal Uddin[3], Bhabesh C Mandol[4], P K Chanda[5].

Abstract:

Worldwide growth in elderly population has led to an upsurge in the number of septuagenarian (>70 years of age) patients requiring surgical treatment for coronary artery disease. Elective coronary artery bypass grafting (CABG) in the older patients are associated with acceptable risks of adverse events and should be undertaken for appropriate indications without unnecessary hesitation. Redo coronary surgeries carries one of the highest mortality rates amongst redo cardiac surgeries, both separately or in combination with other pathologies. As a result, minimally-invasive direct coronary artery bypass (MIDCAB), was preferred to avoid the complications of re-sternotomy. We hereby present a case report of a septuagenarian patient with post CABG (2014) unstable angina with old myocardial infarction (extensive anterior) who was treated successfully, by us and to our best knowledge in the published articles this is probably the first time, a re-do MIDCAB technique has been implemented in our country.

(Bangladesh Heart Journal 2021; 36(2): 145-150)

Introduction:

The expansion of the elderly population worldwide has led to a dramatic increase in the number of patients of older age requiring surgery for coronary artery disease[1,2]. Although advanced age has long been considered a risk factor for mortality and morbidity following coronary revascularization[1,2], the current thought is that there is no justification for refusing a patient a cardiac surgery just because of age. Elective coronary procedures are associated with acceptable risks of adverse events and should be undertaken for appropriate indications without any reluctance. Older patients undergoing coronary artery bypass grafting (CABG) often have significant comorbid illnesses like prior stroke, renal insufficiency, pulmonary disease, which may escalate postoperative morbidity[1].

Although, recent advancement in percutaneous coronary interventions (PCI) have led to a decline in repeat coronary artery bypass grafting[3], certain patient (patient with unfavorable coronary anatomy, CKD, etc) may not be proper candidate for repeat PCI, in whom surgery is only option left. Redo coronary surgeries increases the risk of mortality due to the increased risk of graft injury and subsequent myocardial injury upon sternal re-entry and carries one of the highest mortality rates amongst redo cardiac surgeries, both separately or in combination with other pathologies. Hence, the establishment of a solid indication is required, in the absence of any other alternative, along with specific work up to obtain the

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relationship between different anatomical structures, including previous graft patency and location of grafts[4,5,6] should be done.

Case report:

A 71 years old, hypertensive, non-diabetic gentleman got admitted into SHL through ER with the complaints of central compressive chest pain for one day prior to admission. Pain radiated to right arm and was associated with mild shortness of breath.

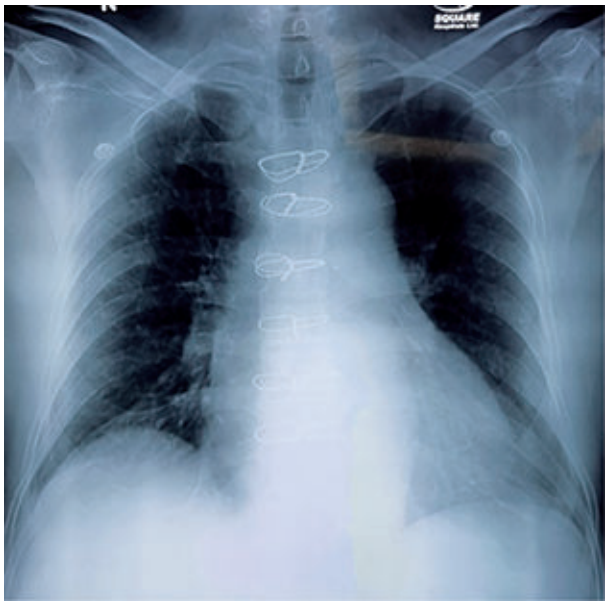

Fig.-1: *Pre-operative chest X-ray showing cardiomegaly and suture from previous surgery*

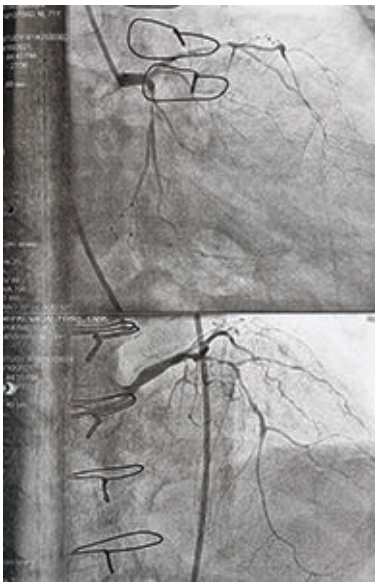

Fig.-2: *Pre-operative CAG*

He is known patient of IHD with OMI (Ext. Ant), for which he underwent CABG in 2014. Patient has no H/O CVD, CKD, COPD or Bronchial Asthma.

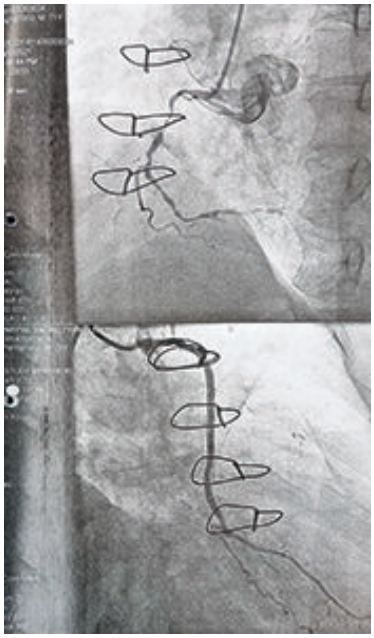

Fig.-3: Pre-operative CAG

Biochemical investigations revealed ALT 127 IU/L, ALP 199 IU/L, CRP 23.1 mg/L, S. Creatinine 1.2 mg/dl, ESR 60 mm at the end of 1st hour, NT-proBNP 619.6 pg/ml.

Pre-operative Color Doppler echocardiogram showed, thin, echogenic, akinetic mid anterior wall, mid anteroseptum & apex with severely hypokinetic mid basal inferior wall. Severe LV dysfunction (LVEF-30%). Dilated LV. Mild MR. Trivial TR (PASP-30 mm of Hg). Normal RV function. No pericardial effusion or intra-cardiac thrombus seen.

Coronary Angiogram showed LMCA: Mild distal LM stenosis. LAD: 50% Ostial stenosis followed by 95% stenosis in late proximal LAD. LCx: Non dominant artery having 70% stenosis in proximal LCx. OM_1 is 100% occluded from proximal segment. RCA: Dominant artery, 100% occluded from distal RCA. RSVG to OM & PDA widely patent. RSVG to LAD: 100% occluded from origin. LIMA: Normal. Native triple vessel coronary artery disease.

Pre-operative carotid Doppler showed, atherosclerotic changes with intima-medial thickening and hard plaques formed in both CCAs and soft plaques formed in the left CCA. Features of total occlusion of the right ICA and partial occlusion in the distal right CCA with thrombus. Features of ≥70% but less than near occlusion in the left ICA.

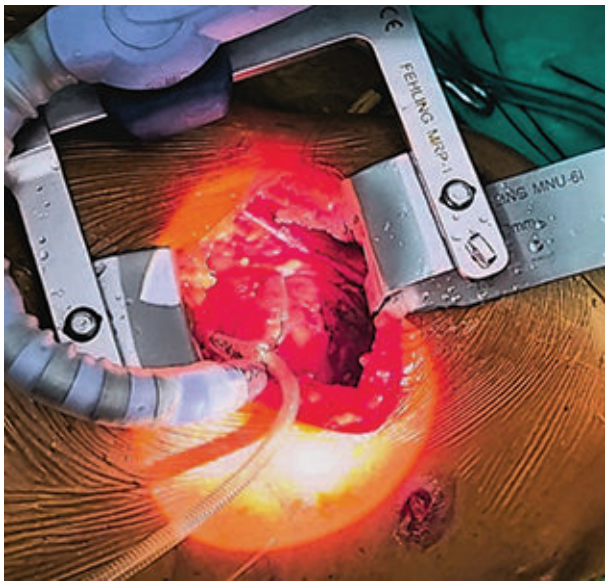

Fig.-4: Per-operative picture of IMA harvesting

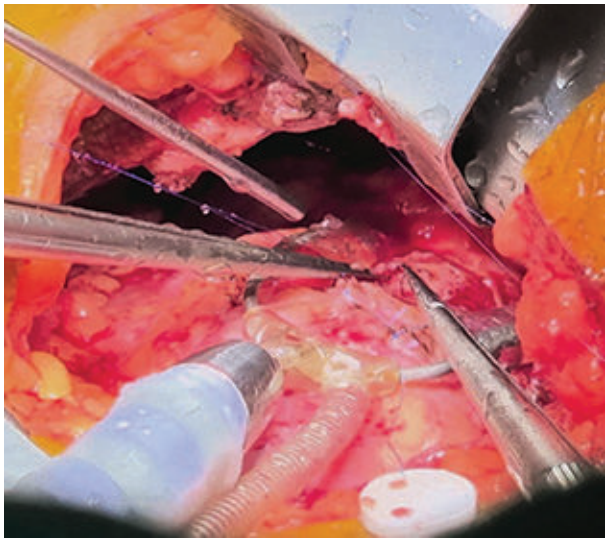

Fig.-5: Per-operative picture of LIMA-LAD anastomosis

His pre-operative EUROScore II was 41.84%.

After optimization of patient's status, under all aseptic precautions, under GA and proper positioning (30° right lateral) patient was operated by thoracotomy at 5th inter-costal space with single lung ventilation (right). Mild to moderate adhesion was found around heart and left lung, with the surrounding structures. Careful dissection was done to identify LIMA and harmonic scalpel assisted LIMA harvesting was done. After heparinization previous RSV to LAD (distal) identified. LIMA to LAD anastomosis done,

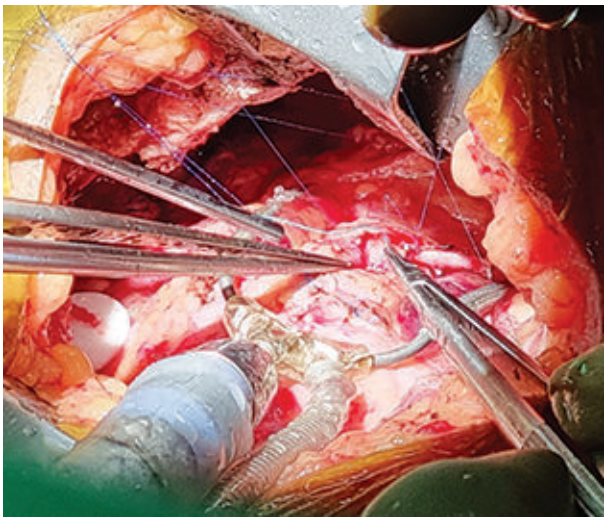

Fig.-6: *Per-operative picture of LIMA-LAD anastomosis*

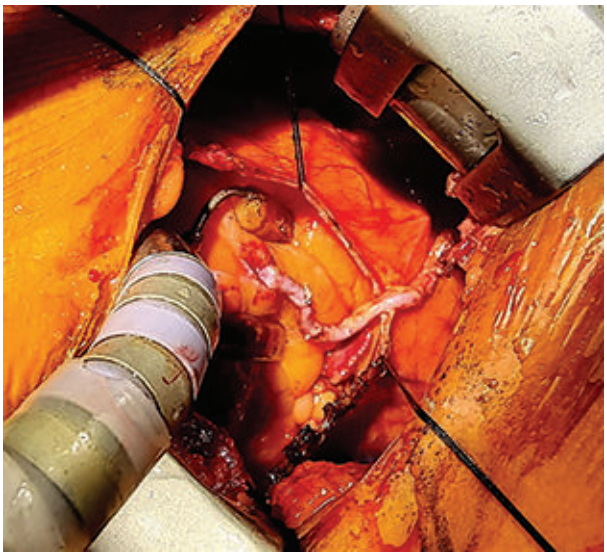

Fig.-7: *In-situ LIMA-LAD graft just before chest closure*

distal to previous distal anastomosis with suction stabilizer. After protaminization hemostasis achieved and wound closed in layers keeping chest drain tube in situ.

Total operative time was 110 minutes.

Patient was shifted to ICU without any inotropic support. He was extubated after six hours of ICU admission. His subsequent post-operative days were eventless.

Post-operative Color Doppler echocardiogram showed, akinetic mid anterior wall, mid anteroseptum & apex with hypokinetic mid basal inferior wall. Moderate LV systolic dysfunction (LVEF-35%). Dilated LA & LV. Mild MR. Trivial TR (PASP-40 mm of Hg). Good RV function. No pericardial effusion or intra-cardiac thrombus seen.

Fig.-8: *Post-operative picture showing left sub-mammary scar of MIDCAB and a large median sternotomy scar of previous surgery*

Fig.-9: *Post-operative picture showing left sub-mammary scar of MIDCAB and a large median sternotomy scar of previous surgery*

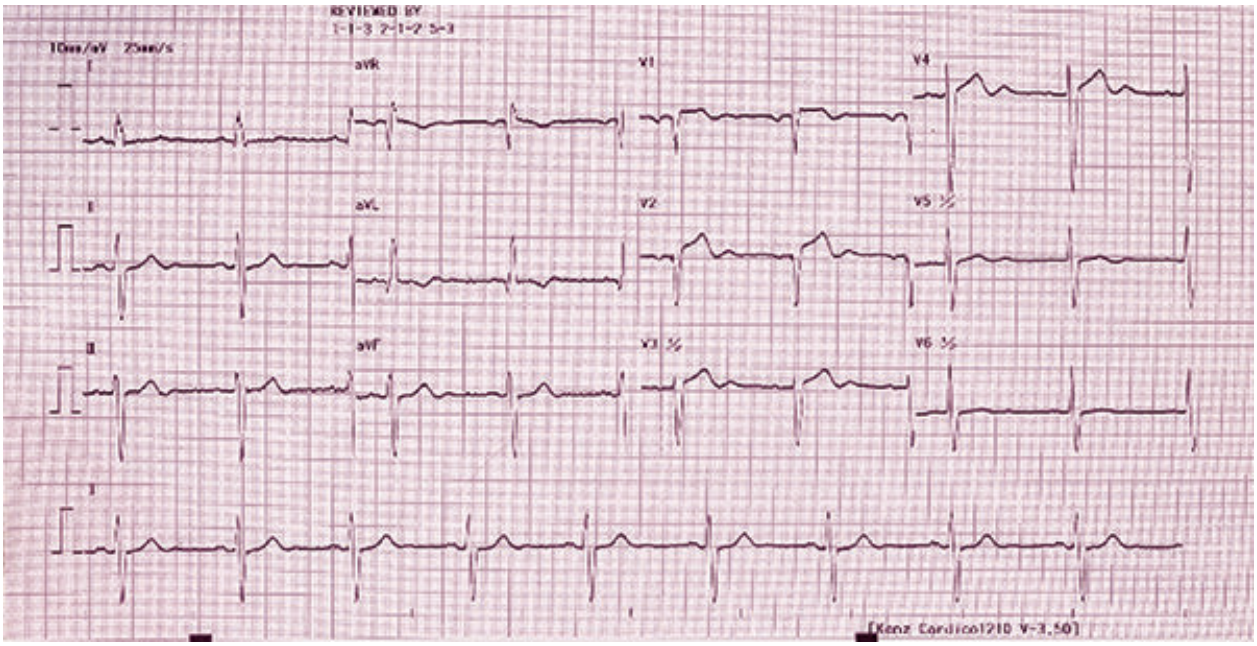

Fig.-10: *Post-operative ECG*

Patient was discharged on 7th POD without any complications. At follow after one-month patient was doing extremely well at routine daily activities.

Discussion:

In a redo coronary surgery, the previous grafts normally remain surrounding the heart, and connects the

ascending aorta to the coronary targets. This is important as, these would normally cross the midline at different levels and will inadvertently lie closely to the sternum, exposing grafts to the risk of injury during redo sternotomy. The biggest risk with a redo CABG is typically associated with the repeat sternotomy. Because of the scaring and adhesions after an initial sternotomy, surgeon usually loses the definitive planes and anatomical clarity they may have experienced during the primary surgery. Complications of repeat sternotomy and dissection can include damage to the heart itself, the coronary vasculature (including patent bypass grafts), the great vessels, the lungs, and any surrounding nerves[7]. Moreover, repeat CABG is often associated with higher operative times, likely because of more extensive dissections, adhesion, increased bleeding, inability to identify the target vessels. Consequently, increased operative time leads to increased inflammatory response, increased risk of infection, increased risk of transfusion reactions and increased coagulopathy[8,9]. As a result to avoid many of the negatives of re-do sternotomy we preferred MIDCAB procedure for our patient.

Patent grafts isolation is essential for a successful redo CABG[10], as it can contravene the protective effects of cardioplegia by maintaining a continuous flow of normal warm blood with low pottasiun. Moreover, in redo coronary surgery where previous venous graft is present, intraoperative myocardial infarction may occur due to thrombus dislodgment during manipulation of venous grafts[11].

To overcome the complications of CPB in redo coronary surgery various techniques are described including off-pump approach. Ascione[12] et al, demonstrated that performing coronary surgery on the beating heart without CPB reduces morbidity in elective patients when compared with conventional technique[12].

Minimally-invasive direct coronary artery bypass (MIDCAB) technique is now-a-days a popular procedure, that commonly include a left internal mammary artery to the left anterior descending coronary artery graft, which supplies the interventricular septum and a significant area of the anterior surface of the heart via a small left, lateral thoracotomy approach[13]. The LIMA graft is considered the most important as patency rates are excellent compared to other types of grafts. In our case all three grafts done previously were venous grafts, so previously untouched LIMA was harvested meticulously with harmonic scalpel and LIMA to LAD graft was done.

When performed off-pump MICS-CABG is associated with a reduction in perioperative stroke rates due to less or no ascending aortic manipulation[14]. In our case no aortic technique was obligatory as the patient had bilateral carotid stenosis. In addition MIDCAB also provide the patient with other already known benefits of MICS[15].

Proper planning with such complex cases like early exposure of femoral vessels to allow emergency cannulation if required and availability of appropriate instrument provides the team with the confidence to deal with any complications that may arise.

Conclusion:

More patients will need redo revascularization day by day and the complexity of coronary artery disease is on the rise as the population ages. In the aging population, the risk profile of the patients increases, that creates a challenging situation for the surgical team. Neverthless, MICS-CABG procedures are technically challenging, have a steep learning curve, and requires longer operation time. Currently we are running dedicated MICS program in our hospital and MIDCAB is one of the strong tool in our armamentarium to serve the grieving myocardium. Yet again, in cardiac surgery teamwork is essential to achieve the desired outcome for every surgical procedure especially in this type of challenging procedure.

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Case Report

A Case Report on Spontaneous Coronary Artery Dissection Managed by Percutaeneous Coronary Intervention (PCI)

Kajal Kumar Karmoker[1], Bijoy Dutta[2], Mohammad Bazlur Rashid[3], Mohammad Ashraful Alam[4], A.B.M. Riaz Kawsar[5], Khandaker Aisha Siddika[6], Mohammad Walidur Rahman[7]

Abstract:

Background: Spontaneous coronary artery dissection (SCAD) is frequently underdiagnosed and often considered as a rare cause of acute coronary syndrome (ACS). Although it predominantly affects young women in the peripartum period, it can also occur in men. Most of the reported dissections have occurred in the left anterior descending coronary artery. The optimal treatment modalities are yet to be defined. Case Summary: A 50-year-old man who presented to us at National Institute of Cardio-Vascular Diseases (NICVD), Dhaka with an acute Non-ST-elevation myocardial infarction secondary to a spontaneous dissection of the Left anterior descending coronary artery. Due to ongoing chest pain, percutaneous coronary intervention (PCI) was done with drug eluting stent (DES) successfully, and the patient was discharged from the hospital on medical therapy. Conclusion: All clinicians should remain vigilant and aware of this condition, as patient outcomes and treatment guidelines differ substantially from conventional atherosclerotic ACS. Although initial conservative strategy is preferred strategy in SCAD management but timely intervention is warranted in selected cases.

Keywords: *Spontaneous coronary artery dissection, acute coronary syndrome, percutaneous coronary intervention.*

(Bangladesh Heart Journal 2021; 36(2): 151-157)

Introduction:

SCAD is defined as a non-iatrogenic, non-atherosclerotic coronary artery dissection, resulting in formation of a false lumen or intramural haematoma in the coronary artery wall that compresses the true lumen, often compromising myocardial blood flow.[1] In early literature, the incidence of SCAD in acute coronary syndrome (ACS) was underestimated. Recent advances in awareness and widespread early angiographic investigation in ACS has led to important shifts in our understanding of the prevalence, predisposing causes, natural history, aetiology, clinical and angiographic features, management, and prognosis of SCAD.

Case Report: A 50-year-old hypertensive and smoker gentleman without any prior cardiac event presented to the emergency department with severe crushing retrosternal chest pain for 6 hours with accompanying sweating. He had no family history of heart disease. Physical examination revealed pulse 104 beats/min, blood pressure 150/90 mm Hg with no additional sound on auscultation of

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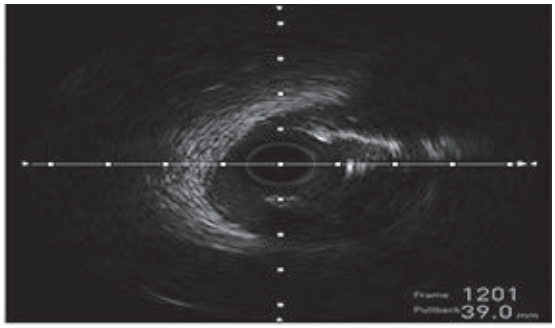
heart and lung bases. All the peripheral pulses were clearly palpable. His initial ECG showed ST depression in leads V1 to V4 and troponinI level was raised.

He received 300 mg aspirin and clopidogrel, intravenous morphine, nitrate, subcutaneous heparin, beta blocker, angiotensin converting enzyme inhibitor and statins

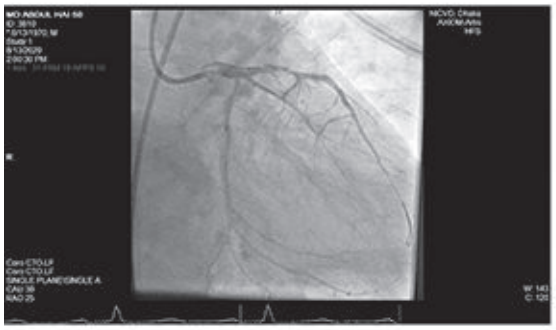
Despite of getting optimum medical management, patient was having ongoing chest pain. So, coronary angiogram was planned immediately which revealed a radiolucent linear defect in spiral fashion involving the proximal part of left anterior descending artery (LAD) suggestive of coronary artery dissection with thrombolysis in myocardial infarction II (TIMI II) flow (Figure: 1-A).

Due to ongoing symptom and compromised coronary flow PCI to LAD was planned. Extra back up coronary catheter (6 FR) was engaged in the left main coronary ostium. 0.014 inch floppy guidewire was passed across the lesion. Adequate precaution was taken to keep the guide wire in the true lumen. IVUS was done(Figure:1B) to differentiate SCAD from atherosclerotic plaque, and to demonstrate the extent of false lumen thrombosis. Pre-dilatation was done with 2.5×15 mm noncompliant PTCA balloon. 3×48 mm Everolimus-Eluting stent (Xience Xpedition) 3X48 mm was deployed in the target lesion with adequate coverage of the two edges. Post-dilatation was done with 3.5×15 mm noncompliant PTCA balloon. TIMI III was achieved immediately with resolution of chest pain .(Figure: 1C-F)

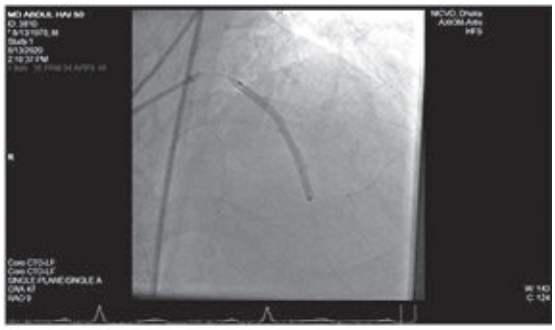
A) An spiral radiolucent linear defect in proximal LAD



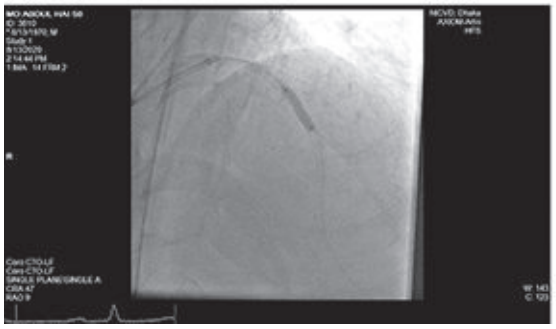
B) IVUS: Showing dissection flap with true & false lumen



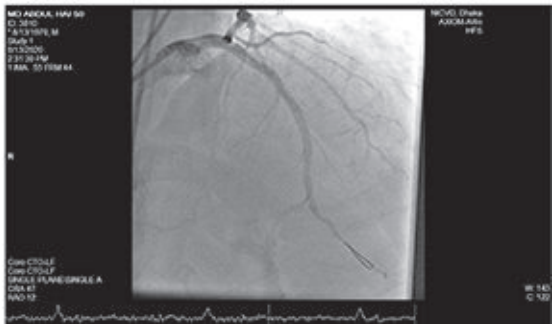
C) Predilatation with 2.5X15 mm SC balloon



D) Stenting with Xience Xpedition 3X48 mm



E) Postdilatation with 3.5X15 mm NC balloon



F) TIMI-III flow achieved

Fig.-1: *Steps of Percutaneous Coronary Intervention in Cath lab*

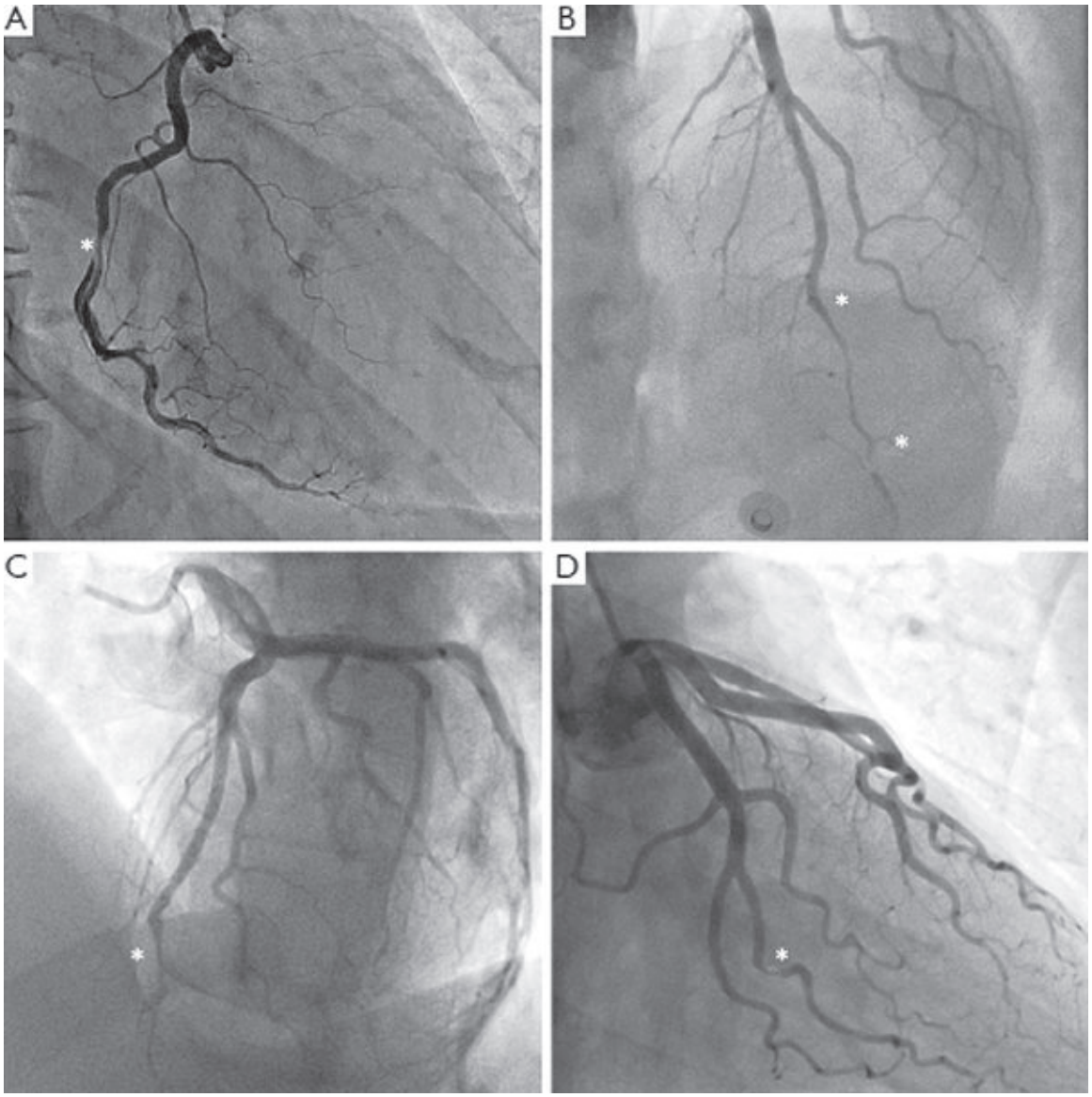


Fig.-2 : *Angiographic classification of SCAD. (A) shows Type 1 SCAD of the right coronary artery, characterised by a double lumen illustrated by contrast hold-up. (B) and (C) show Type 2 SCAD of the left anterior descending artery, which involves abrupt narrowing of the coronary artery with a diffuse tubular stenosis, either for a section of the artery in Type 2a (B), or to the distal end of the artery in Type 2b (C). (D) shows Type 3 SCAD of the second obtuse marginal branch of the left circumflex artery, mimicking atherosclerotic disease. In this case, SCAD was confirmed by optical coherence tomography. Asterisks denote the locations of dissection. SCAD, spontaneous coronary artery dissection*

Discussion:

Definition: SCAD is defined as a non-iatrogenic, non-atherosclerotic coronary artery dissection, resulting in formation of a false lumen or intramural haematoma in the coronary artery wall that compresses the true lumen, often compromising myocardial blood flow.[1]

Epidemiology: SCAD is an under-diagnosed entity and accounts for 1.7% to 4% of ACS cases.[2] It was first described in 1931.[3] The true prevalence of SCAD remains uncertain. Missed diagnoses are due to low suspicion of ACS in young women even in the presence of classic presenting symptoms, limitations of current

coronary angiographic techniques, and lack of clinician familiarity with the condition.[4] It predominantly affects young female patients with few or no traditional cardiovascular risk factors.

Pathophysiology: The pathophysiology of SCAD remains unknown.[5] It is likely that a combination of predisposing factors increase susceptibility such that a relatively minor trigger event is sufficient to precipitate SCAD. The vast majority of SCAD patients (90%) are women. The associated conditions are pregnancy, fibromuscular dysplasia, inflammatory conditions, connective tissue disorders.[5] The precipitants for SCAD are intense exercise, emotional stress, Valsalva, pregnancy, toxins.[5]

Clinical presentations: Although there are wide ranges of clinical presentations and severities of SCAD, patients who survive and present for initial evaluation almost universally experience ACS and increased levels of cardiac enzymes. Among available series of patients presenting for evaluation, 26% to 87% of patients with SCAD present with ST-segment–elevation MI, and 13% to 69% present with non–ST-segment–elevation MI.[9,10] Presenting symptoms are consistent with atherosclerotic ACS, with chest pain being the most prevalent (95.9%).[11] Ventricular arrhythmias or sudden cardiac death account for SCAD presentation in 3% to 11% of reported series.[9,10] Delayed diagnosis is common and SCAD should be actively considered in the differential diagnosis of ACS presentations in low risk patients.

Differential diagnosis: The differential diagnosis for SCAD includes atherosclerotic ACS, coronary artery spasm, Takotsubo cardiomyopathy, coronary thromboembolism, and myocardial infarction with non-obstructed coronary arteries (MINOCA).

Diagnostic modalities: There are no currently identified specific blood biomarkers for SCAD. Coronary angiography represents the principal tool for the diagnosis of SCAD in clinical practice. Intracoronary nitroglycerin should be given, where blood pressure allows, to ensure complete vasodilation and to rule out the possibility of associated coronary spasm. With experience most SCAD cases can be diagnosed on angiography alone, with intracoronary imaging reserved for cases where diagnostic uncertainty exists.[12] In the Saw angiographic SCAD classification, type 1 refers to the classic appearance of multiple radiolucent lumens or arterial wall contrast staining (Figure 2A).[8,13] Type 2 refers to the presence of diffuse stenosis that can be of varying severity and length (usually >20 mm; Figure 2B): Variant 2a is diffuse arterial narrowing bordered by normal segments proximal and distal to the IMH, and variant 2b is diffuse narrowing that extends to the distal tip of the artery(Figure 2C). [8, 13] Type 3 is focal or tubular stenosis, usually <20 mm in length, that mimics atherosclerosis (Figure 2D); intracoronary imaging is required to confirm the presence of intra mural haematoma and to diagnose SCAD. [8, 13]

Most SCAD can be diagnosed angiographically and in scenarios where a conservative approach to management is feasible, coronary instrumentation should, if possible, be avoided. However, where diagnostic uncertainty exists or to guide coronary intervention when required, careful intracoronary imaging can be invaluable and appears safe. Intravascular ultrasound (IVUS) and OCT provide tomographic images of the vessel wall and the coronary lumen that have proved to be of major value in the diagnosis of SCAD.[14, 15, 16] Intracoronary imaging can also help to guide decision-making on stent size. Although there are relative advantages to each technology, OCT is generally favored for SCAD imaging because of its higher spatial resolution.[14, 15, 16]

Management:

Acute management

Previously, the treatment of SCAD was largely extrapolated from management of atherosclerotic coronary disease, although this has now been brought into question. Although an early invasive strategy with revascularization is widely advocated in ACS secondary to atherosclerotic disease, there are no randomised data to support coronary revascularisation with percutaneous coronary intervention (PCI) in ACS caused by SCAD.

Recent studies show that the majority of SCAD will first stabilize and then heal completely over time if managed conservatively.[17,18] Revascularization in patients with SCAD is very challenging due to the presence of an underlying disrupted and friable coronary vessel wall. This is widely reported to lead to worse outcomes for PCI than in atherosclerotic coronary disease.[17,18] For this reason where revascularization is not mandated (i.e. in haemodynamically stable patients with maintained distal flow in the culprit coronary and without demonstrable ongoing ischaemia) a conservative strategy is generally favoured.[19, 20] The US Mayo Clinic series reported on 59 patients (from 95 managed conservatively) who underwent repeat angiography for a range of reasons a median of 2.4 years after the index event. In all, 73% (43/59) were described as 'healed'.[20]

Percutaneous coronary intervention

Published studies consistently show an increased risk of coronary complications with PCI.[20,11, 22] In the Canadian series, revascularization procedural success was only achieved in 64% of patients and, in addition to that, only 30% of patients maintained durable results at long term follow-up.[19] Where ongoing ischaemia or infarction mandates intervention, interventional cardiologists should be mindful of specific additional risks associated with SCAD interventions.

These include:

- Increased risk of secondary iatrogenic dissection
- Guidewire passage into the false lumen
- Proximal and/or distal false lumen propagation during stent deployment
- Persistent distal dissection
- Major side branch restriction or occlusion by propagation of haematoma

Where stents are deployed, second generation drug-eluting stents (DES) are advised. Significant rates of in-stent restenosis are reported. [5]

Coronary artery bypass grafting

Coronary artery bypass grafting (CABG) in SCAD is generally used as a bail-out strategy either for a failure of PCI with ongoing ischaemia or infarction of a significant at-risk myocardial territory (e.g. failure to wire the true lumen distal to a SCAD occlusion) or because the site and extent of the dissection (usually involving the left main stem or the presence of multiple dissections in different vessels) is felt to pose a prohibitive risk with either a conservative or a PCI strategy.[5]

Medical management

Thrombolysis: Thrombolysis is contraindicated for the acute management of SCAD.[5]

Antiplatelet therapies: The use of antiplatelet therapies and the duration of treatment remains an area of controversy in SCAD.[5] Patients who undergo stenting should receive dual antiplatelet therapy for 12 months and prolonged or lifelong monotherapy (usually with aspirin) in accordance with current ACS guidelines.[23] In patients managed conservatively, high grade stenosis sometimes are associated with true luminal thrombus in SCAD. This provides justification for antiplatelet therapy in the acute phase and most authors advocate acute dual antiplatelet therapy (usually with aspirin and clopidogrel rather than the newer P2Y12 inhibitors and avoiding intravenous antiplatelet therapies).[5, 23] The optimal duration of dual and subsequent monotherapy remains unknown with some authors advocating lifelong aspirin.[5]

Anticoagulant therapies: Anticoagulation should probably be limited to acute administration during revascularization procedures while chronic use should be restricted to situations where there is an unequivocal clinical indication (such as left ventricular thrombus or thromboembolism) which should over-ride what is at present a theoretical risk.[12]

Angiotensin converting enzyme inhibitors, angiotensin receptor antagonists, mineralocorticoid receptor antagonists, beta-blockers, and vasodilator therapies: Medical management of SCAD patients with significant impairment of left ventricular systolic function should follow current guidelines aimed at maximizing angiotensin converting enzyme inhibitors(ACEI) or angiotensin receptor blocker (ARB) and b-blocker doses and adding in a mineralocorticoid receptor antagonist (MRA) as indicated. [23,24]

Statins: The rationale for prescribing statins for a condition whose pathophysiology has no known association with cholesterol is unclear.[5]

Prognosis:

In patients surviving SCAD, long-term mortality is low. In the US Mayo Clinic series 10-year survival from Kaplan-Meier estimates is reported at 92%.[25] The overall major adverse cardiac events (MACE) rate in SCAD patients is significant but with considerable variation between published series. Recurrence in SCAD has been widely reported.[19, 20, 21,22, 25] The US series reported SCAD recurrence in 17% of patients across a median follow-up period of 47 months with a 10-year recurrence rate of 29.4% [the median time to a second event was 2.8 years (ranging from 3 days to 12 years)][6]

Conclusions:

SCAD is a challenging clinical entity that most commonly presents with ACS. Further research must be carried out to establish the ideal pharmacological and interventional management of SCAD, and its underlying predisposing factors, including the importance of genetics. At last, all the cardiologists should remain vigilant and aware of this condition, as patient outcomes and treatment guidelines differ substantially from conventional atherosclerotic ACS.

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Case Report

Aneurysm of Left Atrial Appendage: Report of two repaired cases

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Abstract:

Left atrial appendage aneurysm is a rare heart defect; Most often diagnosed incidentally but may be potentially hazardous when presented with a systemic embolization or arrhythmia. So early diagnosis and treatment is indicated. We have successfully operated two cases of left atrial aneurysm in recent past and sharing our experiences through this case reports.

Key words: *Left atrium (LA), Left atrial appendage (LAA), aneurysm, embolization.*

(Bangladesh Heart Journal 2021; 36(2): 158-163)

Introduction:

Left Atrial Appendage aneurysm (LAAA) is a very uncommon anomaly, where there is out pouching of LAA, either diffuse or localize. It is also named as heart's 'Fifth Chamber'[1], or 'Third Ventricle[2]. Although controversy exists on what constitutes a true LAAA, there is universal consensus on its treatment plan. It can present at any age, even detected in fetuses [3,4] and have wide range of presentation, from absolutely asymptomatic to palpitation[5,6], heart failure[7], embolism[8,9,10], mitral regurgitation[11], even chronic hiccups[12]. Surgical excision offer best treatment [13]

Here we discuss two cases, presented over a two year period, and treated with surgical excision with expected outcome.

First Case:

This was an 18 years old female, presented with a month long history of palpitation and chest pain. She was in functional class I. Physical examination revealed her pulse rate of 90 bpm and a BP of 100 over 50 mmHg. Thyroid was of normal size.

ECG showed normal sinus rate of 100bpm. A Chest X-ray showed cardiomegaly of LV type and a CT ratio of 0.65. Other lab investigation findings were normal including thyroid function test.

Transthoracic echocardiography showed a giant cavity communicating with LA. It measured 60x90 mm. The neck of the sac was about 20mm. There was no echo contrast noted within the cavity. Left ventricle was of normal size with intact function. left atrium was not dilated. Visceral pericardium was intact and rest of the study was normal.

She was taken to surgery and procedure performed through right sub-mammary incision and femoral

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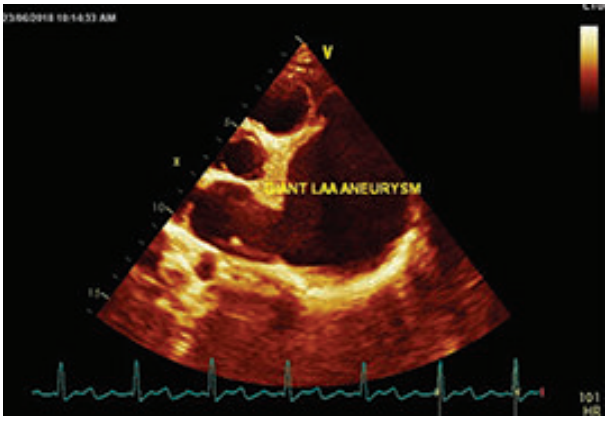

Fig.-1: *Giant aneurysm of LAA*

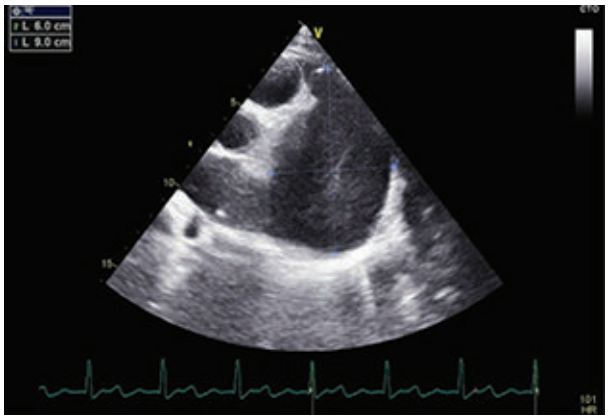

Fig.-2: *Large sac measuring 90mmX60mm.*

cannulations for arterial return and inferior vena caval drainage. SVC cannula was drained through separate incision. Aneurysmal sac was clearly seen through this incision. After cardioplegic arrest and classical LA opening and pathology identified from within the LA cavity. Mitral valve was found competent. There were no thrombus and aneurismal cavity was obliterated plication from inside and left atrial appendage orifice was separated with a piece of glutaraldehyde treated pericardium. LA closed and rest of the procedure completed uneventfully. Post-operative course was smooth and echo showed absence of LA aneurysm and good LV function and no pericardial effusion. There was sinus rhythm in ECG. Her follow up at 3 months and 1 year showed normal ECG, CXR, Echo and no symptoms.

Second Case:

This was 13 kg; 5 years old male referred to our hospital for evaluation of palpitation and suspected LAAA. He was otherwise a playful young child with moderate growth failure. Physical examination revealed a pulse rate of 100, BP of 89/70mmHg, dynamic precordiam and an apical holosystolic murmur. Thyroid was not enlarged. Other clinical findings were unremarkable. ECG showed mostly normal sinus rhythm intervened by occasional atrial fibrillation

Chest X-Ray revealed a shadow flanking with LV border, encroaching on the left lung field with a CT ratio over 0.65. Enlarged Left atrium can be determined by identifying double right sided shadow. There was prominence of hilar pulmonary vasculature too.

Echo revealed giant LA aneurysm with spontaneous echo contrast and hugely dilated LA. The Sac was connected through a wide neck. There was moderate Mitral regurgitation due to dilated annulus with prolapsed of AML. The LV was significantly dilated with good biventricular systolic function and moderate diastolic dysfunction. The PA pressure was normal. Other findings were unremarkable.

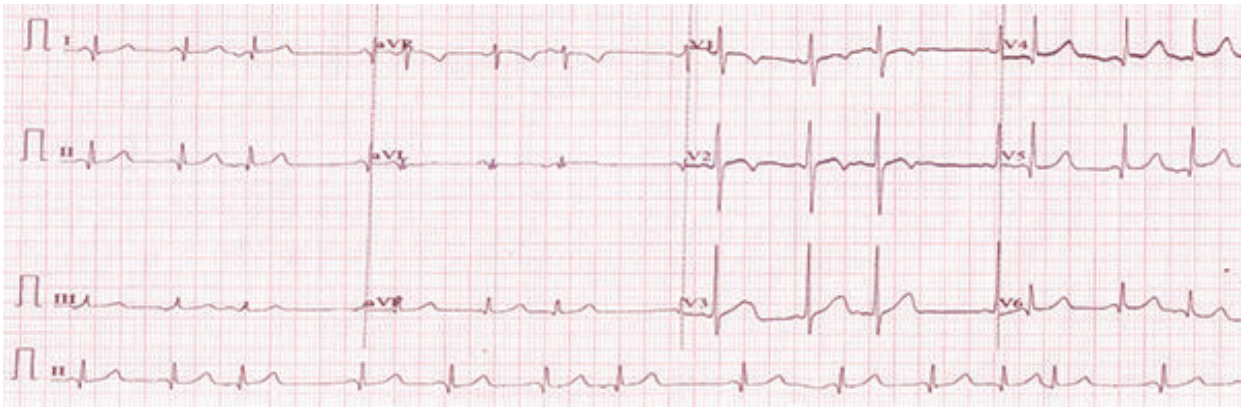

Fig.-3: *Atrial fibrillation*

Fig.-4: *CXR. Double right border*

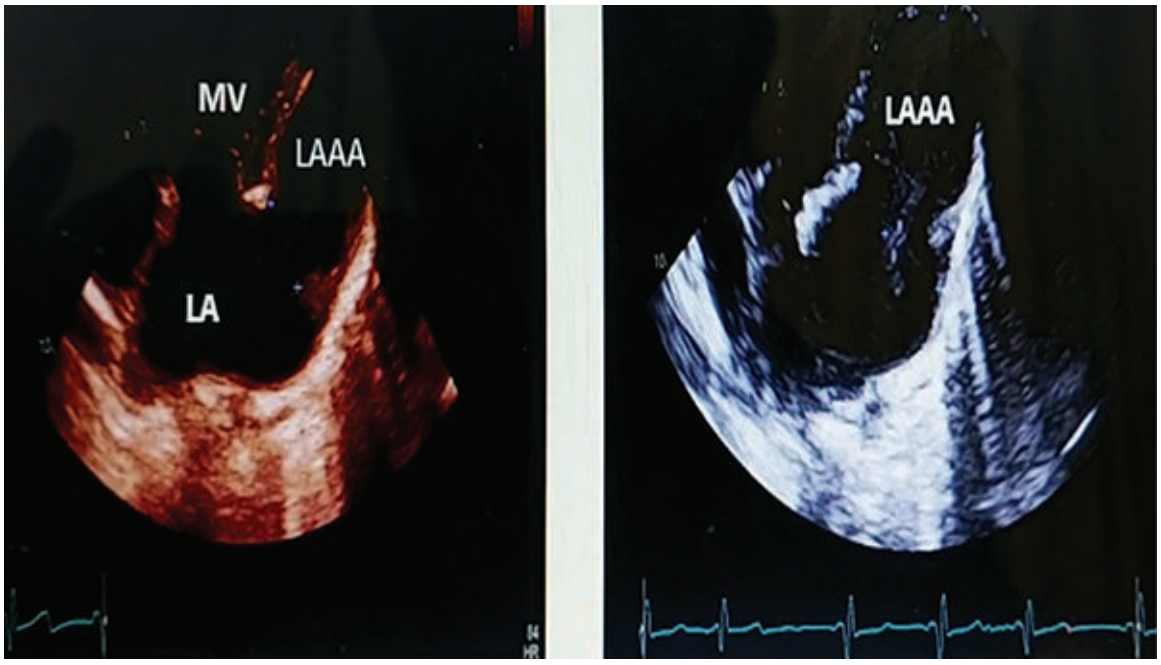

Fig.-5: *Echo revealed Sac parallel to LV with large neck with LA.*

Contrast CT revealed hugely dilated left atrium with one big aneurysm in the left atrial appendage with thrombus formation (65.3mmX35.9mmX45mm). Left atrium was hugely dilated. The sac was lying parallel and on the left side of left ventricle, Coronary arteries pursued a normal course.

Surgical excision was planned through median sternotomy and on CPB. At operation large aneurysmal sac was noted lying parallel to LV and was lying free of any adhesion to surrounding structure.

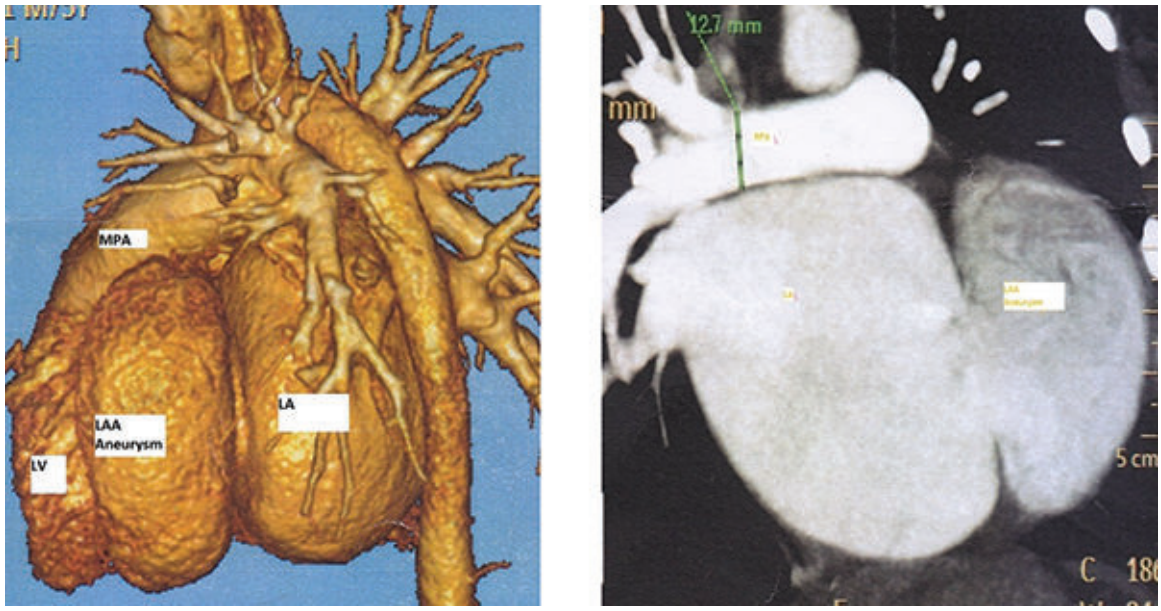

Fig.-6: *Dilated left atrium appendage aneurysm*

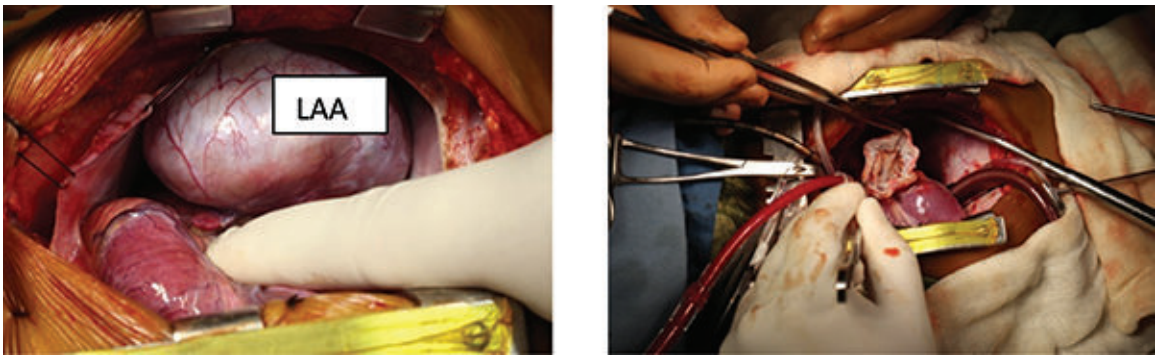

Fig.-7: *Per operative findings*

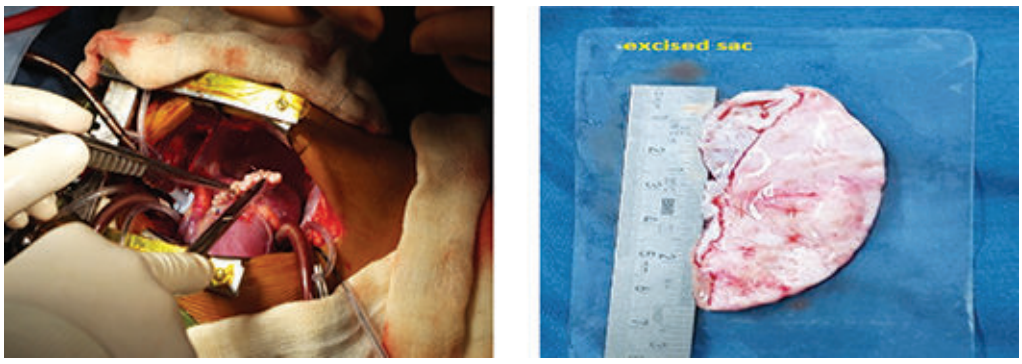

Fig.-8: *Surgical resection of aneurismal sac*

Aortic and bi-caval cannulation was performed for Cardiopulmonary bypass.The procedure was performed on an arrested heart. We were able to put a large clamp at the neck of the sac and excise it. Later the large neck was roofed with a pericardial patch. Next,the LA was entered through classical incision. There were signs of jet lesion on posterior LA wall with thinning of its wall, but no thrombus was noted. Mitral valve was found leaking and annulus dilated, which was repaired and electro cautery MAZE procedure was done to electrically isolate the atriums, rest of the procedure was uneventful. LA size was surgically reduced.

Discussion:

Although it is a rare entity, number of reported cases are increasing. So far over 100 cases have been reported in the literature[14].The exact definition of true LAA aneurysm are divergent[15]. In literature[16], a diagnostic criterion for congenital LAAA was proposed that includes,

1. LA chamber should be of normal size.
2. The sac should have clearly defined communication with LA cavity, and
3. It should be located intra-pericardialy with resultant distortion of the adjoining LV wall.

These outpouching are thought to be due to dysplasia of pectinate muscle and usually do not affect the whole auricle. But from studied literature, it becomes clear that the above definition falls short in many of the claimed cases. Cases have been claimed secondary to extra pericardial herniation, orin mitral Regurgitation, or in patients with supra-ventricular tachycardia. LAAA was also reported to be associated with congenital heart disease. These are included in acquired type of LAAA[15].

The 1st case fulfills the criteria of congenital origin as the aneurismal sac in her case was intra-pericardial had normal LA dimension and no MR. In the 2nd case, the sac was large, intra-pericardial location with part of the normal auricle visible at the base. The remarkable thing about the 2nd case is the presence of moderate MR and a very large LA. Whether this is congenital or acquired remains uncertain, but can be an altogether separate entity, where giant LA and LA Appendage aneurysm co-exist from birth.

Although most patients present in 3rd decade of life with no gender difference[14], our cases presented earlier, one male child presented at 5yrs. and the other female at 18yrs. of age.

Most common symptom among reviewed patients were reported to be palpitation in 44.6% cases, followed by dyspnea on exertionin 28.7% cases, and chest pain in 11.9% of cases [14]. In both of our cases, palpitation was a common symptom. Beside this, the older one had chest pain and the younger one had shortness of breath on exertion. ECG in the older patient showed normal sinus tachycardia but the kid showed rhythm disturbance and AF interval of normal sinus rhythm.

There was no feature of thrombo-embolism in either of these cases, although there was CT finding in one case one suggesting thrombus within the cavity. The reported incidence of thrombo-embolism is about 6% [14].Once the diagnosis is made, it is customary to proceed with surgical excision, as it offers excision of pathology and removal of symptom [15].

Medical management is also reported to delay surgery for avoiding operative risk[17].Catheter ablation also been reported in a patient with paroxysmal AF and a congenital giant LAA who was successfully treated by percutaneous pulmonary vein antrum isolation (PVAI)[18].Surgery is focused on excision ofthe sac and Correct any added pathology, like closure of neck repair of mitral valve, anti-arrhythmia procedure.

Median sternotomy was noted to be the preferred procedure although left thoracotomy and minimally invasive endoscopic resection has been reported, even without cardiopulmonary bypass[19]. Our first case was done through right sub-mammary cosmetic incision. It could have been done through left thoracotomy. We were anticipating closure of sac with possible LA reduction. Cosmesis was also kept in mind as the patient demanded little scar. As the patient was a young girl the thoracotomy was preferred although LA reduction was not deemed necessary on table. TEE confirmed complete collapse of the cavity as was in pre-discharge echo. For the second case, median sternotomy and CPB was performed. After cardioplegic arrest, sac was excised and neck closed with a piece of pericardium and resected margin over sewn. LA reduction not done in spite of large LA to prevent possible distortion of growing pulmonary veins. Electrocautery lesions were produced around the LAA orifice to isolate auricular foci. LA remained as a very large cavity as documented in post-operative echocardiography.

Mitral valve repair was done - a cleft closure in P2 segment and posterior annuloplasty performed using Paneth-Hetzer technique. There was tethering of the posterior mitral leaflet caused AML to appear prolapsed.

After follow up both patients were asymptomatic and with sinus rhythm. Patient with large LA and mitral regurgitation need further follow-up to see progress in LA reduction and persistence of mitral competency, which was trace at discharge.

Conclusion:

Although left atrial appendage aneurysm is a rare heart defect, early diagnosis and prompt surgical resection can bring good outcome as in our cases.

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Case Report

Extremely Late Stent Thrombosis in a First Generation Drug-Eluting Stent 10 Years After Stent Deployment: A Case Report.

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Abstract:

Stent thrombosis is one of the gravest complications of percutaneous coronary intervention which usually manifest as ST-segment elevation myocardial infarction or sudden death. There are a very few case reports in the literature regarding extremely late stent thrombosis in a drug-eluting stent. Here we report a case of extremely late stent thrombosis in a first generation drug-eluting stent in a 54 year old gentleman. To the best of our knowledge, this is the first case report with the longest duration (10 years) after sirolimus eluting first-generation DES in Bangladesh.

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Introduction:

Stent thrombosis (ST) is a potentially life-threatening complication of percutaneous coronary intervention (PCI) as in most cases it manifests as ST-segment elevation myocardial infarction (STEMI) or sudden death. Stent thrombosis is defined as the complete occlusion of a coronary vessel in place of previously implanted stent[1]. Very late stent thrombosis (VLST) is defined as thrombosis that occurs more than 1 year after stent implantation[2] and accounts for 20% of new cases of myocardial infarction (MI) after index PCI[3]. A new term "extremely late stent thrombosis" was suggested for cases of stent thrombosis which occur ≥5 years after stent implantation[4]. First-generation drug-eluting stents (DES) are more prone to develop VLST than BMS, and the majority of VLST occur within 1-4 years of stent implantation. VLST is extremely rare after 5 years of stent implantation, and the first case was reported in 2009[5]. In the literature, there are a very few case reports regarding extremely LST due to first-generation DES with the longest reported period being 12 years[6-8]. To the best of our knowledge, this is the first case report with the longest duration (10 years) after sirolimus eluting first-generation DES in Bangladesh and 3rd case report with the longest duration in the literature (first longest duration 12 years and second longest duration 11 years)[7,8]. We report a case of extremely LST occurring 10 years after first generation DES implantation in a patient presented with acute inferior ST-segment elevation myocardial infarction (STEMI).

Case presentation:

A 53-year-old gentleman first reported on 7th October in the year 2010 with acute onset of retrosternal chest pain of 24-hour duration in Thailand. Electrocardiogram showed ST segment elevation in the inferior leads with normal sinus rhythm. Among the conventional risk factors for ischemic heart disease (IHD) he had hypertension, smoking, dyslipidemia, and family history of IHD.

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Echocardiogram revealed inferior wall hypokinesia with an ejection fraction of 50% with no mitral regurgitation.

Coronary angiography revealed a normal left main artery (LM), left circumflex artery (LCX), and 80% stenosis of left anterior descending artery (LAD). The right coronary artery (RCA) had a total occlusion from the distal segment (Figure 1A) and the patient underwent PCI to RCA with implantation of a 2.5 X 13 mm Cypher stent (first generation DES) in the mid-RCA (Figure 1B). His LAD was also stented with another DES (2.25 X 15 mm). He was on dual antiplatelet therapy (daily aspirin and clopidogrel) for long time. The patient remained asymptomatic and was on a regular medical follow-up by a local cardiologist.

On April 2021, patient suddenly discontinued both antiplatelets (aspirin and clopidogrel). On May 2021, the patient presented to us with sudden onset compressive chest pain radiating to the both arms with sweating of 14 hours duration. His electrocardiogram showed ST-segment elevations in leads II, III, and aVF (Figure 2). ST-segment depression with T wave inversion in leads I, aVL, V2-V4.

Laboratory investigations revealed WBC : 15.4 (x 10^3/mcl), lymphocyte:16%, neutrophil:80%; Hemoglobin: 14 gm/dl; Troponin I: 31.82 ng/ml; CK-MB: 406 U/L; Serum Creatinine: 0.9 mg/dl; SGPT: 94 unit/L; Random blood sugar:8 mmol/L; HbA1c: 5.3%; Serum electrolytes: Na^+ - 138.7 mmol/L, K^+ – 4.02 mmol/L; chlorides – -99.6 mmol/L and Fasting lipid profile: Total cholesterol- 217 mg/dl, LDL-166 mg/dl, HDL- 48 mg/dl, Triglyceride-184 mg/dl. His chest X-ray was normal. Echocardiography revealed akinetic basal-mid inferior wall, mild left ventricular (LV) systolic dysfunction (Ejection Fraction: 45%).

Coronary angiogram revealed left main coronary artery free of disease, LAD free of significant disease with patent stent, 60-70% stenosis at the distal segment of LCX. RCA was dominant vessel having total occlusion from mid segment with thrombus (Figure 1 C).The right coronary artery was engaged with a Judkins right guiding catheter (6 French, 3.5), and the lesion was crossed (Figure 3A) using a 0.0143 Runthrough guidewire (TERUMO Corporation, Tokyo, Japan) and manual thrombus aspiration (Figure 3B) was done using a 6 French thrombus suction catheter Eliminate (TERUMO Corporation, Tokyo, Japan). The lesion was predilated aggressively (Figure 3C) with a 3.0 × 12mm NC Euphora

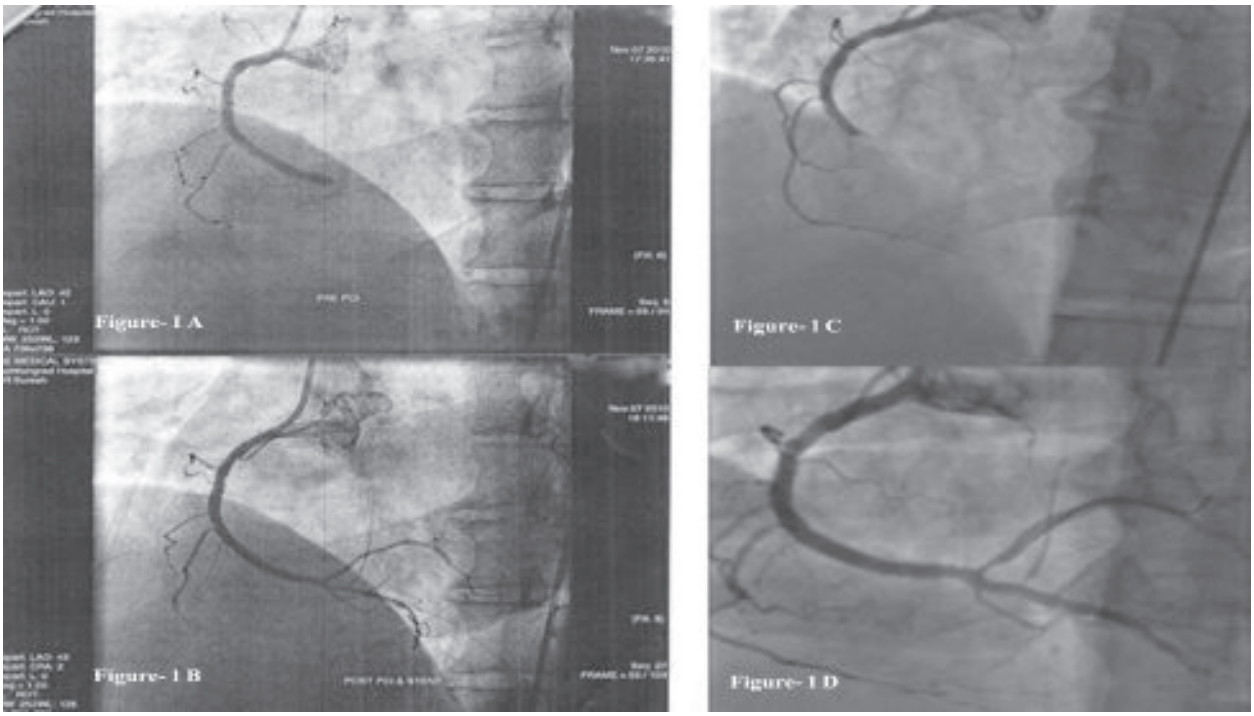

Fig.-1: A) Total occlusion of right coronary artery (RCA) from distal segment; B) Final image after stent deployment in distal RCA; C) Total occlusion of RCA from mid segment; D) Final image after stent deployment from mid to distal RCA.

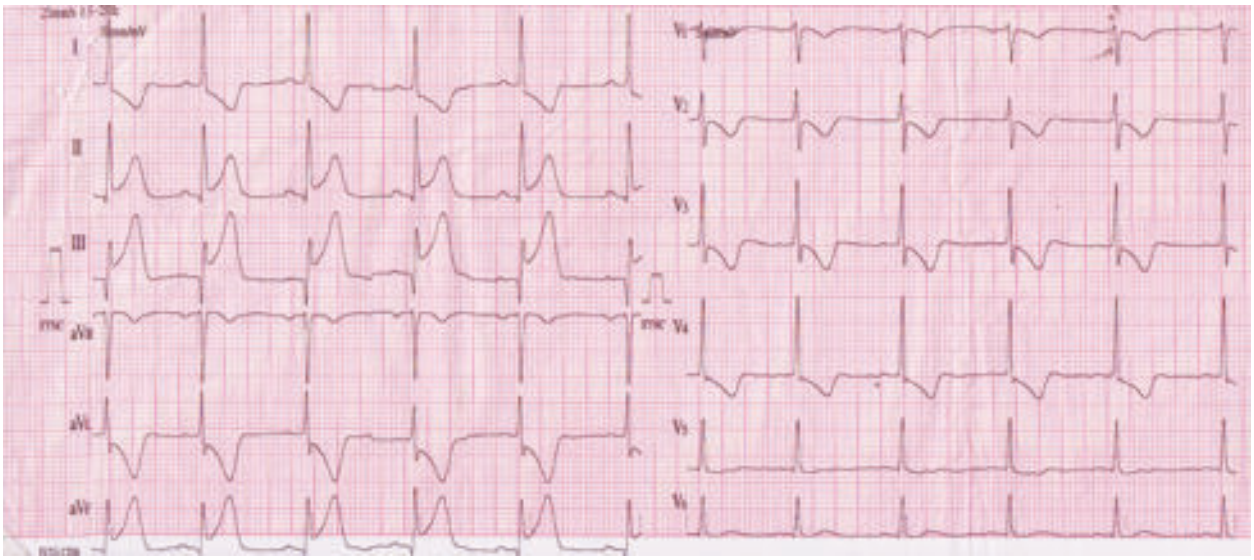

Fig.-2: *ST-segment elevations in leads II, III, and aVF. ST-segment depression with T wave inversion in leads I, aVL, V2-V4.*

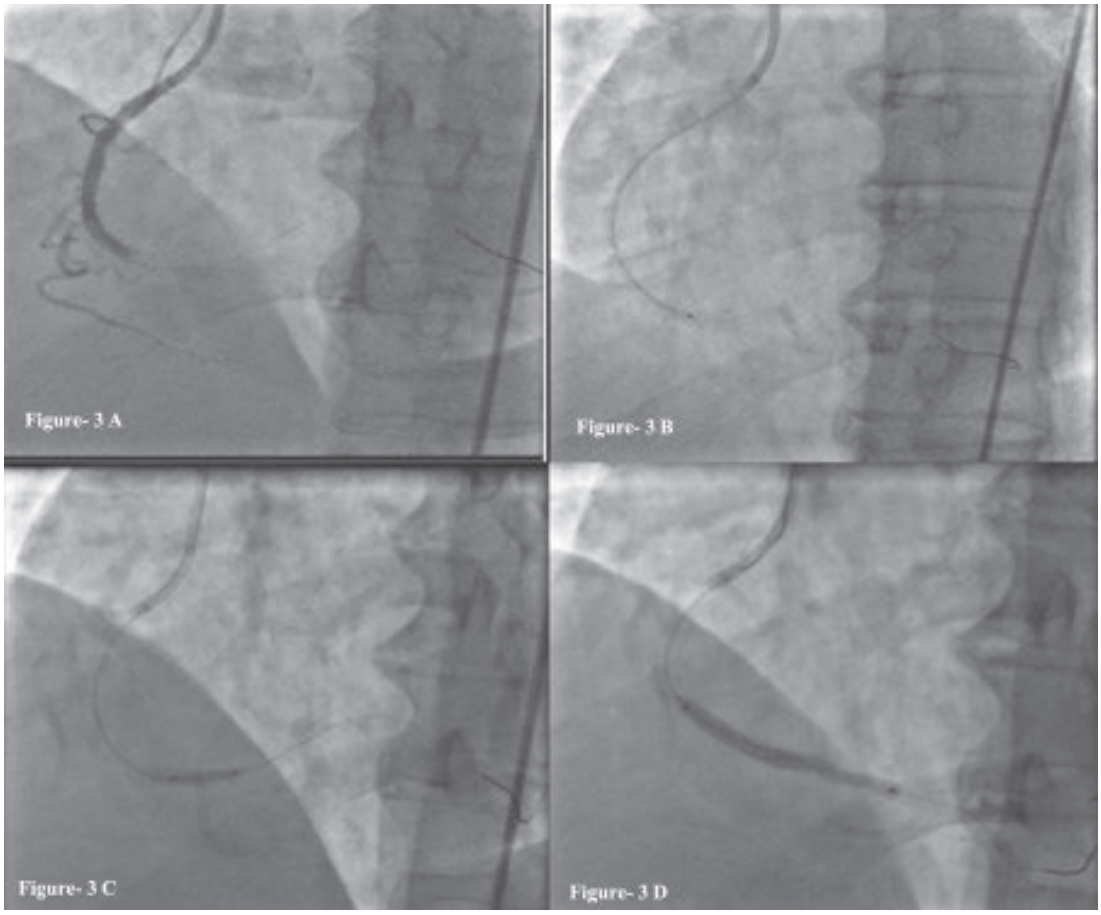

Fig.-3: *A) the lesion of the right coronary artery was crossed using a guidewire; B) manual thrombus aspiration; C) aggressive pre-dilatation; D) stent deployment.*

balloon (Medtronic, USA) distal RCA in previous stent portion at 16-18 ATM. The 3rd generation stent Ultimaster Tansei (3.0 × 38mm) (Sirolimus-eluting), TERUMO Europe N.V. (Leuven, Belgium) was deployed in mid-RCA to distal RCA at 14 ATM (Figure 3D). Postdilatation was done using 3.5x12 mm NC Euphora noncompliant balloons (Medtronic, USA) successively at 14-20 ATM. Postprocedure angiography showed TIMI III flow (Figure 1D). The patient was discharged in a stable condition on dual antiplatelets and statins.

Discussion:

ST occurring at any time (early, late or very late) is a grave complication carrying a significant risk of death. There is a limited data in the literature regarding extremely LST as it is a very rare incidence. Our patient fits the criteria of having a definite ST (either angiographic or post-mortem evidence of thrombotic stent occlusion) according to the definition of ST by the academic research consortium[2]. Incidence of VLST between 1 and 5 years is in 0.5% of BMS-treated patients, 1.8% of first-generation DES (DES_1)-treated patients, and 0.9% of second-generation DES (DES_2)-treated patients[9].

Risk factors of VLST are divided into 3 broad categories: patient and lesion-related factors, procedural and stent-related factors, and pharmacotherapy-related factors[10]. Patient- and lesion- related factors are: Black race, younger age, diabetes, hypertension, hyper-cholesterolemia, present malignancy, current smoking, renal dysfunction, prior PCI, previous coronary artery bypass graft (CABG), previous MI, high platelet reactivity, hypercoagulable state, presentation with acute coronary syndrome (ACS), impaired left ventricular ejection fraction (LVEF), postprocedural Thrombolysis In Myocardial Infarction (TIMI) <3, multivessel disease, bifurcation lesions, long lesions, lesions within left descending artery (LAD)[10]. Procedural and stent-related factors are: Underexpansion, malapposition, PCI of vein graft, multiple stents, longer stented length, overlapping stents, small stent diameter, stent type, large residual stenosis[10]. Pharmacotherapy-Related Factors are: antiplatelet therapy (APT) discontinuation, hyporesponsiveness to APT, choice of APT[10]. Our patient had several risk factors for the development of VLST (hypertension, dyslipidemia, current smoking, prior PCI, previous MI, presentation with ACS, impaired LVEF and discontinuation of antiplatelet therapy one month back). The mechanisms underlying the development of VLST are multifactorial: (1) late stent malapposition, (2) uncovered struts, (3) neoatherosclerosis, (4) hypersensitivity and inflammation reactions, (5) changes in shear stress, and (6) plaque rupture and neointimal erosion[10].

The first generation drug-eluting stent (DES) was introduced to reduce the incidence of restenosis and other complications following the implantation of bare metal stent (BMS)[11]. But risk of ST was increased with first generation DES.

An increased incidence of very late ST following implantation of first-generation DES led to development of second-generation DES which were coated with antiproliferative drugs that were less toxic, polymer coatings that were more biocompatible, and thinner stent struts made of modern alloys[12]. These improvements resulted in a reduced risk for the occurrence of late and very late ST.

There are 3 types of treatment for the treatment of VLST: (1) balloon angioplasty, (2) thrombus aspiration, and (3) additional stent deployment[13]. Perfusion balloon angioplasty is a novel modification of balloon angioplasty which has the unique characteristic of maintaining blood flow during balloon inflation and can be inflated for a longer period of time as compared to conventional balloons[13].We treated our patient with combination of thrombus aspiration, aggressive balloon dilatation and additional stent deployment.

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We Mourn

Prof. M Amanullah
(1941 - 2021)

Prof. M Amanullah was born in a respectable Muslim family in 1941 in the village of Mahmudpur, Bhaluka in the district of Mymenshing. His father Dr. Safayetullah was a renowned physician. Prof Amanullah was a brilliant student from school life . He passed Matriculation and Higher Secondary examination with distinction. He passed MBBS from Dhaka medical college in 1963. With commonwealth scholarship he went to UK for higher education and did MRCP from Ireland in 1974 and MRCP from London in 1975. After finishing MRCP he worked as registrar and lecturer of cardiology in Freeman Hospital, University of Newcastle UK and senior registrar and lecturer cardiology in Western Infirmary University of Glasgow UK.

After working in cardiology field for long five years in England he came back in Bangladesh and joined Institute of Cardiovascular Disease (ICVD) in 1981 as Associate Professor. Professor M. Amanullah was one of the architects of the national institute. Professor Amanullah was the pioneer invasive and interventional cardiologist in Bangladesh. He was involved and had significant contribution for the development and propagation of invasive an intervention cardiology in Bangladesh. He started diagnostic cardiac catheterization in late 80's. He did pulmonary valvuloplasty in 1986, first in the country. Prof Amanullah retired from the government service as the Professor of Cardiology in 1993.

He was the Secretary General of Bangladesh Cardiac Society and later became its President. When SAARC Cardiac Society was formed he became the first Secretary General of that society. For some time he was the Editor of Bangladesh Heart Journal. In 1994,

He was a man of great human quality and professional honesty .He always thought about poor patients, I learned a lot about how to handle patient with empathy. Because of his good human quality with special intention to help the poor, he joined national politics and became a Member of Parliament in 1997. He became the State Minister of Health and Family Welfare and contributed in making many health policies at that time.

Prof M Amanullah passed away on 11th March 2021 leaving behind his wife Prof Syeda Akhter a gynecologist, a son Dr. Monasyr and a beloved daughter. We all mourn for the death of Prof.M Amanullah a pathfinder of many cardiologists including me and many others.