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01

Journal of Invasive and Clinical Cardiology

INSTRUCTION TO AUTHORS

A. Introduction

The Journal of Invasive and Clinical Cardiology is a biannual, peer-reviewed journal and aims to publish work of the highest quality from all sub-specialties of Cardiology. The aim of the publication is to promote research 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. 3 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). Number of 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 15 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 Journal of Invasive and Clinical Cardiology 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 up to 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 are appropriate, 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 Journal of Invasive and Clinical Cardiology 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 Journal of Invasive and Clinical Cardiology and suggestions may be made to the authors by the Editorial Board to improve the scientific value of the journal.

D. Editorial Process

Journal of Invasive and Clinical Cardiology 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. Journal of Invasive and Clinical Cardiology follows the guidelines on editorial independence produced by the International Committee of Medical Journal Editors (ICMJE). All manuscripts correctly submitted to Journal of Invasive and Clinical Cardiology 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 Journal of Invasive and Clinical Cardiology, if the paper does not meet the submission requirements, or if the paper is not deemed to have a sufficiently high priority. All papers considered suitable by the Editors for progress further in the review process, undergo peer review by at least two reviewers. If there is any gross discrepancy between the comments of two reviewers, it is sent to a third reviewer. Peer reviewers' identities are kept confidential; authors' identities are also not disclosed to the reviewers. Accepted articles are edited, without altering the meaning, to improve clarity and understanding. Decision about provisional or final acceptance is communicated within 8 weeks.

E. Cover Letter

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

1. Category of manuscript (original research, review article, case report, cardiovascular image, letter to the Editor)
2. Statement that the material has not been previously published or submitted elsewhere for publication (this restriction does not apply to abstracts published in connection with scientific meetings.)
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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 lowercase 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 U.S. 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*

The authors are responsible for the accuracy and completeness of the references and their citations in the text.

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;42 Suppl 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;66 Suppl 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. Proc Natl Acad Sci 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.
8.

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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In-Stent Restenosis: Where We are Now

Md. Afzalur Rahman

J Inv Clin Cardiol 2019; 1(2): 57-61

Although the use of new stents has improved the results after coronary angioplasty, the development of in-stent restenosis (ISR) is still one of the leading problems following percutaneous coronary interventions. ISR is defined as a stenosis > 50% developing in a segment or border of the stent (up to 5 mm). It is often due to progressive neointimal proliferation and has been reported in up to 30% of the patients with conventional stents and 10% of drug-eluting stent carriers. [1-3]

ISR can be due to several factors associated with the patient, the lesion morphology and the procedure [1,4,5]

Restenosis rates of current second-generation DESs are < 10% [6-8]; however, restenosis can still be a major clinical issue in some patients, as it is associated with an increased risk of myocardial infarction and death.[6,7]

Risk Factors for Restenosis [8-10]

Imaging guidance at the time of treatment for de novo lesions may reduce the occurrence of procedure-related factors, especially when treating complex lesions. Hong et al[11] randomly assigned 1,400 patients with long coronary lesions to either intravascular ultrasound (IVUS)- or angiography-guided percutaneous coronary intervention (PCI) and found that IVUS-guided PCI reduced ischemia-driven TLR (2.5% vs 5.0%; *P* = .02). ISR itself is also a risk factor for ISR [8]; thus, optimized stenting is necessary when treating de novo lesions to avoid re-intervention.

Table-I

Risk factors for restenosis

Patient-related factors	• Diabetes mellitus • Chronic renal failure • Resistance to stent drug • Hypersensitivity to stent components
Lesion-related factors	• Chronic occlusion • In-stent restenosis • Bifurcation • Ostial lesion • Small vessel diameter • Long segment lesion • Edge dissection • Severe calcification • Saphenous vein graft
Procedure-related factors	• Stent underexpansion • Stent fracture • Long stenting • Small reference diameter • Residual plaque at the stent edge

Senior Consultant, United Hospital Ltd. Dhaka, Bangladesh.

The most widely used system to describe ISRs is the Mehran angiographic classification. Although it was developed for conventional stents it is used in all types of stents. It is divided into 4 types: I: focal; II: diffuse; III: proliferative; IV: occlusive and it has prognostic value.[12]

In-stent restenosis (ISR), defined as >50 percent diameter stenosis, accounts for about 10 percent of all percutaneous coronary interventions (PCIs) according to the National Cardiovascular Data Registry (NCDR).[13] While rates of ISR have declined with the use of drug-eluting stents (DESs), the optimal treatment for DES-ISR remains unknown. Several techniques are available for the treatment of ISR, but not all therapies are available for commercial use in the United States such as drug-coated balloons (DCBs). The preferred therapy for bare-metal stent (BMS) ISR is DES implantation, a Class I indication according to the American College of Cardiology (ACC)/American Heart Association (AHA) guidelines; however, recurrent restenosis rates range from 10–30 percent.[14-17] Recurrent ISR, defined as restenosis occurring after the implantation of ≥2 stents, remains a challenge with limited data regarding optimal therapy.

How we treat ISR:

1. **Define the pattern of ISR.** BMS and DES have different patterns of ISR. BMS-ISR, classified by Mehran et al, tends to be diffuse and is predominantly due to neointimal hyperplasia (NIH).[12] DES-ISR tends to be focal, secondary to both NIH and neoatherosclerosis (NA).[2]

2. **Image — identify the underlying mechanism.** All in-stent luminal loss is not due to restenosis. It is possible the stent is undersized and/or underexpanded. Intravascular ultrasound (IVUS) or optical coherence tomography (OCT) can be used to determine the presence of underexpansion, NIH, NA, and calcification, thus guiding the appropriate treatment modality, as outlined in Figure 1.

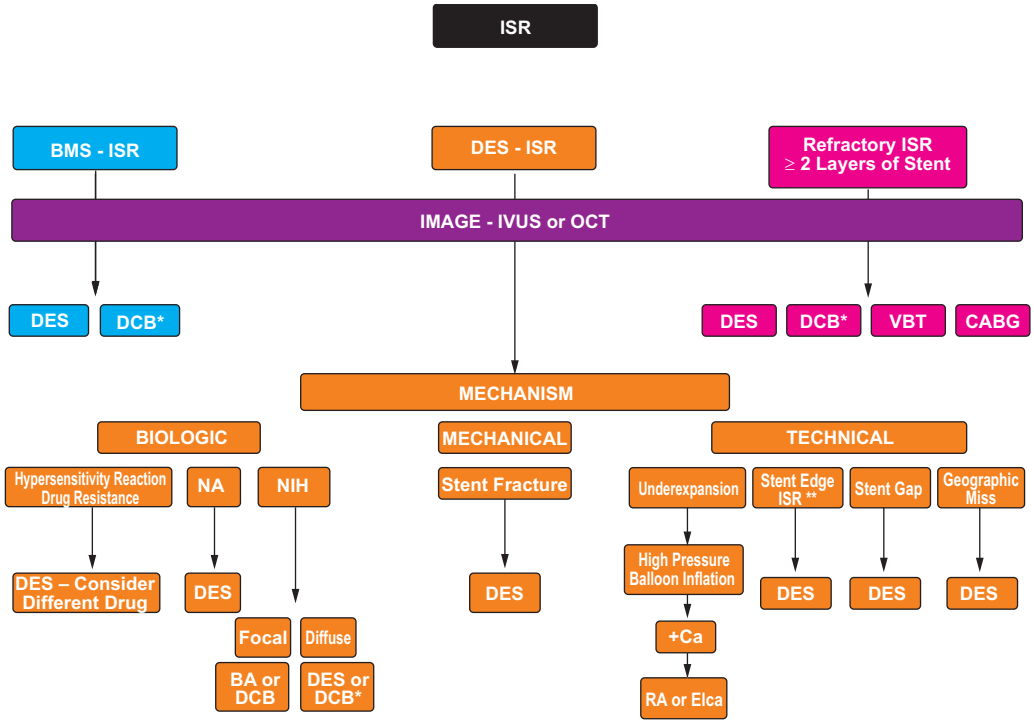


Fig:1

Not FDA approved for use in the United States

**Secondary to barotrauma, edge dissection, or oversized stent on initial stent implantation

ISR—in-stent restenosis, DES—drug-eluting stent, BMS—bare-metal stent, DCB – drug-coated balloon, VBT – vascular brachytherapy, CABG – coronary artery bypass graft surgery, NA—neoatherosclerosis, NIH—neointimal hyperplasia, Ca—calcium, BA—balloon angioplasty, RA—rotational atherectomy, ELCA—excimer laser coronary angioplasty

3. **Know your techniques and when to use them in the management of ISR.** In general, DESs for the treatment of ISR demonstrate superior results compared to balloon angioplasty, BMS, or brachytherapy.[14-16] While DCBs demonstrate favorable results in the treatment of ISR without the addition of more metal, they are not available in the United States.[18] Waksman et al proposed an algorithm for the treatment of ISR, which has been adapted in Figure 1.[13]

   a. **Balloon angioplasty (BA) –** BA should be performed for focal lesions, stent underexpansion, or if short dual antiplatelet therapy (DAPT) duration is favored. Balloon slippage, also known as "watermelon seeding," is sometimes encountered during balloon inflation and can cause damage to the vessel wall. Tips to limit balloon slippage include the placement of a buddy wire, use of a noncompliant balloon, a shorter balloon length, slow inflation, or use of a scoring/cutting balloon.[13] In the setting of stent underexpansion, high-pressure noncompliant balloon inflations are the preferred strategy.

   b. **Scoring/cutting balloons –** One trial demonstrated lower rates of restenosis with the use of a scoring balloon compared with a conventional balloon prior to a DCB [19] Scoring/cutting balloons help prevent balloon slippage, but their higher profile may limit deliverability.

   c. **Rotational atherectomy (RA) –** RA compared to BA has demonstrated mixed results for the treatment of ISR.[20, 21] IVUS and OCT studies confirmed the presence of calcium within neoatherosclerotic plaques, and RA might be indicated for lesions refractory to high-pressure balloon inflation. Case series have also demonstrated the successful use of RA for undilatable underexpanded stents.[22]

   d. **Excimer laser coronary angioplasty (ELCA) –** ELCA is approved for the use in ISR by the U.S. Food and Drug Administration (FDA). Observational studies have demonstrated improved stent expansion facilitated by an ELCA with contrast injection in ISR, secondary to stent underexpansion refractory to high-pressure balloon inflation.[23]

   e. **DCBs –** Several trials and meta-analyses have demonstrated similar outcomes of DCBs compared to DESs in the management of ISR, with everolimus-eluting DESs coming out slightly ahead.[24] While not available in the United States, the European Society of Cardiology (ESC)/European Association for Cardio-Thoracic Surgery (EACTS) guidelines give DCBs a class I indication for the treatment of ISR.[25] DCB outcomes may be improved with prolonged inflation times >60 seconds and a balloon:artery ratio >0.91.[26] DCBs may also play a role in recurrent ISR, but more investigation is needed.

   f. **Brachytherapy –** Brachytherapy use declined after trials demonstrated superior outcomes with DESs for the treatment of BMS-ISR. However, brachytherapy has had a resurgence for recurrent ISR, with several observational and prospective trials recently published.[27, 28] In the setting of recurrent DES-ISR, referral to a brachytherapy center can be considered.

   g. **Coronary artery bypass graft (CABG) –** In patients with risk factors for restenosis or recurrent ISR, referral for a CABG should be considered via a Heart Team approach.

   h. **Saphenous vein graft (SVG) ISR –** When recurrent ISR develops within an SVG, a DES or brachytherapy can be considered, but if feasible, PCI to the native vessel chronic total occlusion (CTO) may be a better option.[29]

Conclusion:

Although ISR is much less common now a days still it is an important complication after PCI and remains as a challenge to manage. Many cases of ISR in the modern era are focal in nature and can be treated in a simple fashion; however, the optimal approach for treating ISR must be determined on a case-by-case basis. We need to customize the strategy of treating the individual patient with consideration of lesion characteristics. Intracoronary imaging may suggest the underlying mechanism of ISR, which can also help with clinical decision-making.

Adequate lesion preparation, image guidance, and high-pressure balloon post-dilatation during initial stent implantation should be standard to prevent ISR.

However, if restenosis occurs, the majority of ISR should be treated with DES implantation. Optimal therapy for recurrent ISR is unknown and includes repeat DESs with or without a different drug, brachytherapy, or DCBs.

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Impact of Glycated Haemoglobin on In-Hospital Clinical Outcomes In Diabetic Acute Coronary Syndrome Patients Undergoing Percutaneous Coronary Intervention

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Abstract:

Background: There is limited data on the association between glycemic control and clinical outcomes after percutaneous coronary intervention in diabetic patients. **Objective:**The aim of the study was to assess the impact of good glycaemic control on in-hospital clinical outcomes in diabetic acute coronary syndrome (ACS) patients undergoing PCI, from a Bangladeshi health service perspective. **Materials and methods:**This prospective cohort study was conducted in UCC, BSMMU included 365 consecutive diabetic ACS patients who underwent PCI at department of cardiology, BSMMU. Diabetic patients were categorized into two groups based on their admission HbA1c levels: 182 (49.86%) diabetics with good glycaemic control (HbA1c < 7%) and 183 (50.14%) diabetics with poor glycaemic control (HbA1ce" 7%).The outcome was major adverse cardiovascular events (MACEs), defined as cardiac death, myocardial infarction (MI), definite stent thrombosis, target vessel revascularization and stroke. **Results:**Patients with poor glycaemic control group had a significantly higher incidence of in-hospital MI (4.4% vs. 0.5%; p=0.037). However incidence of cardiac death, stent thrombosis, target vessel revascularization and stroke were not different between the groups (p>0.05). **Conclusion:**Good glycaemic control to obtain HbA1c level <7% in diabetic ACS patients undergoing coronary artery stenting may be beneficial in reducing the risk of MACEs and improvement of in-hospital clinical outcomes.

Keywords: Percutaneous coronary intervention (PCI), Acute coronary syndrome (ACS), Diabetes mellitus (DM), Major adverse cardiovascular events (MACEs).

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Introduction:

Coronary artery disease (CAD) is an increasingly important medical and public health problem, and is the leading cause of mortality in Bangladesh. Like other South Asians, Bangladeshis are unduly prone to develop CAD, which is often premature in onset, followsa rapidly progressive course and angiographically more severe[1].Diabetes is a major risk factor for CAD. It accelerates the natural course of atherosclerosis, has tendencies for plaque rupture and involves a greater number of coronary vessels with more diffuse atherosclerotic lesions[2]. Chronic hyperglycemia induces vascular endothelial injury, inflammatory reactions, reactive oxygen species, which leads to accelerated neointimal proliferation,hypofibrinolysis and prothrombotic state[3]. There is consistent evidence that optimal glycaemic control (defined as HbA1c < 7%) results in a lower incidence of microvascular complications in both type 1 and type 2 diabetes mellitus[4]. However, the hypothesis that optimal glycaemic control in diabetic patients would lead to asimilar improvement in clinical outcome of PCI has notbeen extensively investigated.

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HbA1c level is less influenced by acute stress. It is an indicator of average blood glucose concentrations over the preceding 2-3 months and it is also recommended as the preferred method for monitoring glycemic control in diabetic patients according to American diabetic association[5,6,7]In this study, we sought to investigate a pre-procedural glycaemic control in diabetic ACS patients, as reflected by plasma HbA1c levels prior to coronary stenting in relation to MACEs.

Method:

Study population: In this prospective cohort study, 365 diabetic ACS patients (age >18 years and d" 75 years) who underwent PCI from November 2018 to, October 2019 at UCC, BSMMU, Dhaka were consecutively enrolled after exclusion of following criteria: patients with chronic coronary syndrome, prior MI, prior revascularization, severe anaemia, pregnancy, any malignancy, chronic kidney disease, connective tissue diseases and patients receiving steroids and other drugs causing high blood glucose level. The study was approved by the institutional ethical committee and all patients gave written informed consent.

Methodology:

The baseline characteristics, clinical presentation, detailed medical history, cardiovascular risk factors, associated comorbidities, relevant physical examination findings and investigation findings including baseline HbA1c data collected from patient's file and recorded in a semi structured data collection sheet. Based on HbA1c level study population were divided into 2 groups; 182 patients were in good glycaemic control (HbA1c<7%) and 183 patients were in poor glycaemic control (HbA1ce"7%) group. Coronary angiogram (CAG) and PCI were performed by respective consultant according to current practice guidelines. Two experienced cardiologists who were blinded to patient information reviewed the cine angiograms. Less than thirty percent (<30%) residual stenosis and TIMI grade 3 flow after procedure were counted as successful PCI. Study patients received pre and post procedural medication according to guideline directed medical therapy (GDMT). During hospital stay in-hospital MACEs (Myocardial re-infarction, definite stent thrombosis, target vessel revascularization, stroke and cardiac death) were observed and recorded.

Statistical analysis: Statistical analyses were planned and reviewed by the investigators and guide. After editing, data analysis was carried out by using the Statistical Package for Social Science (SPSS) version 23.0 windows software. Numerical data were expressed as mean (SD) and analyzed by Student's t-test. Categorical data were expressed as frequency and percentages and analyzed by Chi-Square test. Value of p less than 0.05 was considered significant.

Result: The mean age of the participants of good and poor control group were 54.66 ± 10.03and 55.82 ± 10.00years respectively (Table I). A male predominance (80.8% vs.75.4%)was observed in either group (Figure 1).Majority of patients of both group were overweight (mean BMI: 23.25 ± 2.70 vs. 23.05 ± 2.25, BMI>23 is considered overweight in Asian). Overall, hypertension was the most prevalent risk factor in both groups. Hypertensive patients were more prevalent in poor control group than good control group (66.1% vs. 56%, p=0.048) which was statistically significant. Dyslipidaemia, smoking and family history of coronary artery disease were found in 44.3% vs41.2%, 45.4% vs47.8% and 27.9% vs23.6% in poor and good glycaemic control group respectively (Table I).About 48.4% of patients of good glycaemic control group and 47.5% in poor glycaemic control group presented with STEMI (Table III). Left ventricular ejection fraction was e" 40% in 89.6% patients of good glycaemic control and 86.3% in the poor glycaemic control group. Mean HbA1c was 6.41 ± 0.46% in good glycaemic control group and 9.44 ± 1.24% in poor glycaemic control group (Table II). Triple vessel disease was found in 21.3% of patients of poor glycaemic control group and 12.6% in good glycaemic control group which was statistically significant (p=0.036). Single vessel disease was more common in good glycaemic control group (49.5%) than poor glycaemic control group (33.9%) which was statistically significant (p=0.002) (Figure 2).During hospital stay, patients with poor glycaemic control had a significantly higher incidence of MI (4.4% vs0.5%, p=0.037). Other adverse events (cardiac death3.8% vs1.6%; p=0.372, stent thrombosis 2.2% vs0.5%, p=0.372, TVR 1.6%vs 1.1%, p=1.000) were also higher in poor glycaemic control group but were not statistically significant (Table IV).

Table-I

Baseline characteristics of the patients enrolled in the two groups (N=365)

Variables	Good glycaemic control (HbA1c < 7)(n=182)	Poor glycaemic control (HbA1c ≥7)(n=183)	p-value
Age (Mean ± SD)	54.66 ± 10.03	55.82 ± 10.00	0.271^{ns}
Gender			
Male	147 (80.8)	138 (75.4)	0.216^{ns}
Female	35 (19.2)	45 (24.6)	
BMI (kg/m^2)	23.25 ± 2.70	23.05 ± 2.25	0.447^{ns}
SBP	122.20 ± 18.79	125.22 ± 17.95	0.117^{ns}
Heart rate	76.26 ± 9.71	78.22 ± 8.85	0.045^{s}
Hypertension	102 (56.0)	121 (66.1)	0.048^{s}
Dyslipidaemia	75 (41.2)	81 (44.3)	0.555^{ns}
Smoker	87 (47.8)	83 (45.4)	0.639^{ns}
Renal insufficiency	24 (13.2)	37 (20.2)	0.072^{ns}
Family history of CAD	43 (23.6)	51 (27.9)	0.354^{ns}
PVD	4 (2.2)	4 (2.2)	1.000^{ns}

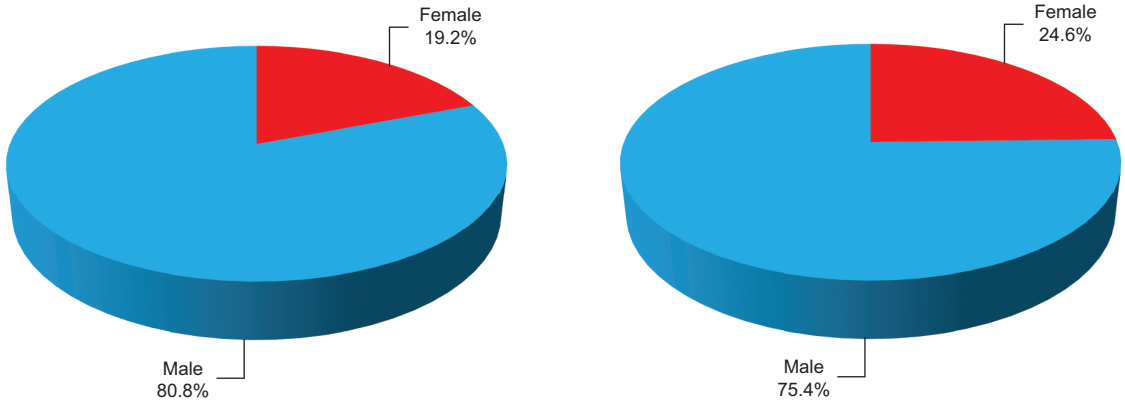


Fig.-1: *Distribution of the study subjects according to gender in good and poor glycaemic control groups*

Table-II

Pre procedural investigation of the study subjects (N=365)

	Good glycaemic control (HbA1c <7)(n=182)	Poor glycaemic control (HbA1c ≥7)(n=183)	p-value
LVEF%			
<40	19 (10.4)	25 (13.7)	0.422^{ns}
≥40	163 (89.6)	158 (86.3)	
Troponin I	5.70 ± 6.45	7.48 ± 9.79	0.042^{s}
S. creatinine (mg/dl)	1.12 ± 0.44	1.17 ± 0.43	0.252^{ns}
Hb (g/dl)	11.57 ± 0.94	11.56 ± 1.08	0.962^{ns}
HbA1c	6.41 ± 0.46	9.44 ± 1.24	<0.001^{s}

Table-III

Clinical presentation of the study subjects (N=365)

	Good glycaemic control (HbA1c <7)(n=182)	Poor glycaemic control (HbA1c ≥7)(n=183)	p-value
Unstable angina	10 (5.4)	17 (9.3)	0.165^{ns}
NSTEMI	84 (46.2)	79 (43.2)	0.565^{ns}
STEMI	88 (48.4)	87 (47.5)	0.887^{ns}

Table-IV

In-hospital clinical outcomes following PCI (N=365)

In hospital	Good glycaemic control (HbA1c <7)(n=182)	Poor glycaemic control (HbA1c ≥7)(n=183)	p-value
MI	1 (0.5)	8 (4.4)	0.037^{s}
Definite stent thrombosis	1 (0.5)	4 (2.2)	0.372^{ns}
Target vessel revascularization	2 (1.1)	3 (1.6)	1.000^{ns}
Stroke	1 (0.5)	0 (0.0)	0.499^{ns}
Cardiac death	3 (1.6)	7 (3.8)	0.372^{ns}

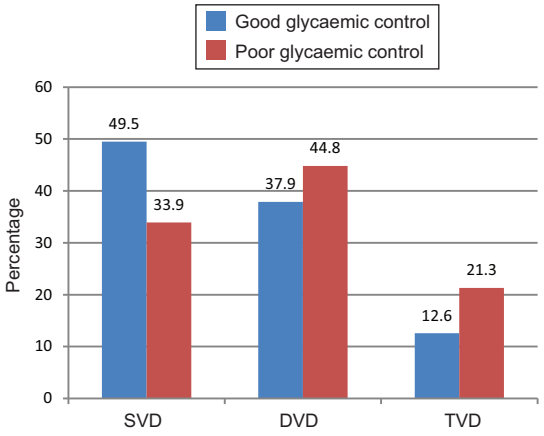


Fig.-2*: Number of coronary vessel involvement of the study subjects (N=365)*

Discussion:

In this single-center observational study, we investigated the association between glycemic control and in-hospital clinical outcomes in patients with type 2 diabetes mellitus. Good glycemic control, as reflected by plasma HbA1c measured during PCI, was associated with improved clinical outcomes: the HbA1c<7.0 group had a lower rate of MACEs than the HbA1ce"7.0 group. This was mainly because of a decrease in MI. Hwang et al, 2017 demonstrated the 2-year incidence of MACEs were lower in the HbA1c<7.0 group than in the HbA1ce"7.0 group (27.5% versus 37.4%; hazard ratio, 0.71; 95% confidence interval, 0.52–0.97; P=0.03), mainly because of a reduction in repeat revascularization[8]. In this study we triple vessel disease was found more in patients of poor glycaemic control group and single vessel disease was more common in good glycaemic control group. During hospital stay, patients with poor glycaemic control had a significantly higher incidence of MI (4.4% vs0.5%, p=0.037). Other adverse events (cardiac death3.8% vs1.6%; p=0.372, stent thrombosis 2.2% vs0.5%, p=0.372, TVR 1.6%vs 1.1%, p=1.000) were also higher in poor glycaemic control group but were not statistically significant. Several potential mechanisms might explain our findings. Hyperglycemia might have disturbed endothelial function through a reduction in the release of nitric oxide and increased superoxide production in vessel walls. Our population had higher troponin levels and a higher prevalence of STEMI, which might have affected the clinical outcomes and resultant discrepancy compared to previous studies. Clinical trials have already demonstrated that therapies that improve glycemic control decrease the risk of microvascular disease, including retinopathy, nephropathy, and neuropathy[9]. However, trials attempting to decrease macrovascular events have been unsuccessful; in the Action to Control Cardiovascular Risk in Diabetes (ACCORD)[10], Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE)[11], and Veterans Affairs Diabetes Trial (VADT) studies[12], improved glycemic control showed no reduction in the rate of

cardiovascular events and in ACCORD[11] trial even it was associated with increased risks of death from any cause and death from cardiovascular events. The following facts might explain the discrepant results between our study and these 3 major trials. First, we included only patients who underwent PCI, whereas the majority of patients in those trials did not. Second, patients in our study had a lower HbA1c level compared to those enrolled in the above 3 trials. Third, duration of diabetes mellitus was almost 10 years in the VADT and ACCORD trials and 8 years in the ADVANCE trial. Therefore, patients in the 3 major trials might have more advanced diabetes than our patients.

Limitation:

The sample was taken from a single center. So findings may not represent the whole country. The study sample was taken consecutively, which might have affected the outcome of the study. Finally the current analysis presents in-hospital outcome only. Longer-term follow up will add further insight into the problem.

Conclusion:

In conclusion, these data suggest that good glycaemic control (HbA1c levels < 7%) in diabetic ACS patients undergoing coronary artery stenting may have lower risk of MACEs and improvement of in-hospital clinical outcome after PCI.

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ORIGINAL ARTICLE

'Tombstone' ST Segment Elevation in Acute Myocardial Infarction and its Correlation with Coronary Angiography- An Analysis of 31 Cases

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Abstract

Background: Tombstone ST elevation is an unusual morphological electrocardiographic (ECG) appearance of acute myocardial infarction. The ST segment is convexed upwards and the peak of the convexed ST segment is often higher than the preceding R wave, which is less than 0.04 s and small in amplitude. The aim of this analysis is to outline the profile of tombstoning ST-elevation myocardial infarction (STEMI) by reviewing the ECGs, clinical, angiographic characteristics in detail and the treatment outcome of such patients.

Methods: During past 4 years 31 patients were documented to have tombstoning STEMI in a tertiary care cardiac hospital. Tombstoning STEMI in ECGs were diagnosed by using standard criteria.[1,2] All the patients admitted with tombstoning STEMI had extensive anterior myocardial infarction (MI), ST elevation noted in LI, aVL and all the chest leads. Coronary angiogram was done in 27 cases (87.1%), 2 patients (6.5%) declined to undergo any invasive procedure and the remaining 2 patients (6.5%) died before the procedure.

Results: All the 27 patients who underwent coronary angiogram, were documented to have left anterior descending (LAD) coronary artery stenosis. 22 patients (81.5%) had critical stenosis in the proximal LAD before first diagonal (D1) branch, 3 patients (11.1%) had mid LAD lesion and the remaining 2 patients (7.4%) had angiographic evidence of recanalization without significant residual stenosis. Inferior MI with tombstoning STEMI was not reflected in this series. All (n-31) had anterior MI. Out of the 31 patients in this series 5 patients (16.1%) died.

Conclusion: Tombstoning STEMI usually indicates extensive anterior myocardial infarction (MI) with ST elevation in LI, aVL and all the chest leads. This pattern of STEMI is mostly due to proximal LAD stenosis before D1 branch (81.5%). Mortality is also high in this group of patients.

Key words: Tombstone ST segment elevation, ECG, Coronary angiogram

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Introduction:

Wilmalaratna was the first to term this characteristic as tombstone-like and convex ST segment elevation in MI patients as tombstoning.[2] Later on, Guo et al. modified the tombstoning criteria. The criteria of tombstoning ST segment elevation are as follows: a) Absent R wave or an R wave duration <0.04 s with minimal amplitude, b) convex upward ST segment merging with the descending R or the ascending QS/QR, c) the peak of the ST segment is higher than the R wave and d) the ST segment merges with the T wave.[1] This type of tombstone pattern is associated with reperfusion polymorphous ventricular tachyarrhythmias and is thought to represent extensive and rapid myocardial damage after the ischaemic episode. At coronary angiography, patients with tombstoning are likely to have high grade stenosis of the proximal left anterior descending artery.[3-4]

Methods:

This analysis is a prospective survey of consecutive patients admitted to a tertiary care cardiac hospital

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with the diagnosis of STEMI. During past 4 years 31 patients were documented to have tombstoning STEMI. The diagnosis of AMI was made when two of the three following criteria were fulfilled: (1) Typical history of ischaemic chest pain > 30 min, (2) 2 mm ST elevation on chest leads or 1 mm ST elevation on limb leads, and (3) elevated cardiac enzymes .[5-7] Patients were excluded if they had significant valvular or congenital heart disease, if ECGs were not recorded within 24 h of the onset of symptoms, or if bundle-branch block, left ventricular hypertrophy, or a mixture of ST-segment characteristics defined as borderline cases were seen on the admission ECGs. Patients with history of previous MI, percutaneous coronary intervention (PCI) and coronary artery bypass graft (CABG) surgery were excluded from the study. The admission ECG or ECG done during first medical contact played the pivotal role in the diagnosis of tombstone STEMI. We prospectively evaluated 31 consecutive patients with ECG features of tombstone STEMI who were admitted to the coronary care unit (CCU) of our hospital and treated as such. The tombstone pattern was identified according to modified criteria of Wimalaratna (Figs1-2) .[1,2] Demographic data and the clinical history concerning risk factors such as age, sex, diabetes mellitus (DM), hypertension, hyperlipidemia, smoking, family history for coronary artery disease (CAD), myocardial infarction, and previous drug use were obtained from patients and medical records. A physical examination was also performed. Blood values for cardiac markers were determined at initial presentation. Bedside transthoracic echocardiography (TTE) was performed routinely on all patients immediately after admission in CCU. The left ventricular ejection fraction (LVEF) at the time of admission was documented in all the patients. Angiographic data was obtained from the records of the cardiac catheterization laboratory. Flow in the infarct related artery was graded according to the Thrombolysis in Myocardial Infarction (TIMI) classification. A coronary artery stenosis of more than 50% was considered clinically significant. All eligible patients were offered for primary percutaneous coronary intervention (PPCI). Otherwise all patients were immediately thrombolysed with either streptokinase or tenecteplase. PPCI was performed with standard techniques along with using the appropriate strategy.

Results: All the patients admitted with tombstoning STEMI had extensive anterior myocardial infarction (MI), ST elevation noted in LI, aVL and all the chest leads. Inferior MI with tombstoning is not reflected in this series (Table-1). Among the 31 patients, 22 subjects (71%) were male and 9 (29%) were female. The mean age of the patients was 47+/-11 years. 20 patients (64.5%) had diabetes, 15(48.4%) had past history of hypertension and 17 patients (54.8%) were current smoker (Table 1). Mean LVEF of the patients was 35+/-8%. 7 patients (22.5%) presented in the state of cardiogenic shock.

Coronary angiogram was done in 27 cases (87.1%), 2 patients (6.5%) declined to undergo any invasive procedure and the remaining 2 patients (6.5%) died before the procedure. 27 patients who underwent coronary angiogram, all were documented to have LAD lesion. 22 patients (81.5%) had critical stenosis in the proximal LAD before first diagonal (D1) branch, 3 patients (11.1%) had mid LAD lesion and the remaining 2 patients (7.4%) had angiographic evidence of recanalization without significant residual stenosis (Table II) . Among the 27 patients who underwent CAG, single vessel disease was documented in 15 patients (55.6%), double vessel disease in 7 patients (25.9%) and 5 patients (18.5%) had triple vessel disease (Table III). Out of 31 patients 29 patients (93.5%) were suitable for both PPCI or thrombolysis. 11 patients (35.5%) opted for PPCI, thrombolysis followed by PCI was done in 14 patients (45.2%), in another 2 patients (6.5%) in the thrombolytic group, CAG revealed recanalized non critical lesion in the proximal LAD. Reperfusion therapy was not feasible in 2 patients (6.5%) as they presented very late (Table IV) . Total 18 patients (58.1%) received thrombolytic agents, streptokinase in 14 patients and remaining 4 patients were treated with injection tenecteplase (Metalyse). In these high risk cohort, out of the 31 patients 5 patients died, overall mortality 16.1%. 1 patient (9.1%) in PPCI group died and 2 patients (14.2%) in the thrombolysis followed by PCI group died. Another 2 patients who died did not receive any form of reperfusion therapy and received conservative treatment only, as they presented late. CAG in 2 patients in the thrombolytic group showed recanalized vessel and both of them received tenecteplase as thrombolytic agent.

Table I

Selected baseline characteristics of study population (n-31)

Parameters	Number	Percentage
Male	22	71%
Female	9	29%
DM	20	64.5%
Hypertension	15	48.4
Smoking	17	54.8%
Anterior Infarction	31	100%
Inferior Infarction	0	0

Table II

Site of LAD occlusion (n-27)

Site	No	Percentage
Proximal	22	81.5%
Mid	3	11.1%
Distal	0	0
Recanalized Vessel	2	7.4%

Table III

Angiographic Results (n-27)

No of vessel involved	No	Percentage
Single Vessel Disease	15	55.6%
Double Vessel Disease	7	25.9%
Triple Vessel Disease	5	18.5%

Table IV

Reperfusion Strategies in the Patients (n-31)

Type of Reperfusion	Number	Percentage
PPCI	11	35.5%
Thrombolysis followed by PCI	14	45.2%
Thrombolysis but no PCI	2	6.5%
Only thrombolysis but no CAG	2	6.5%
No reperfusion therapy	2	6.5%

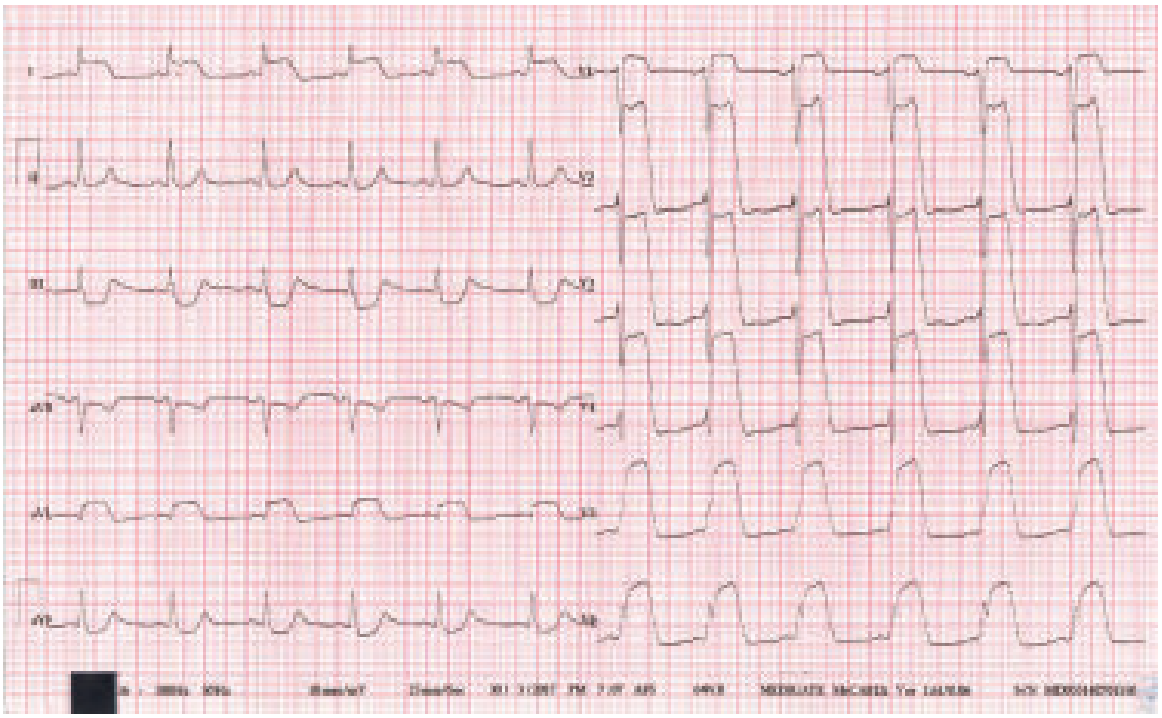


Fig.- 1: *ECG shows typical Tombstone ST elevation in anterior STEMI. Please note (1) the R wave is either absent or, if present, its duration is < 0.04 s with a minimal amplitude and there is no trough following the R wave. (2). The peak of the convex ST segment is higher than the R wave (3) The ST segment is convex upward and merges with the descending limb of the R wave. 4. The convex ST segment merges with the ascending limb of the following T wave. Note also reciprocal ST depression in LIII and aVF.*

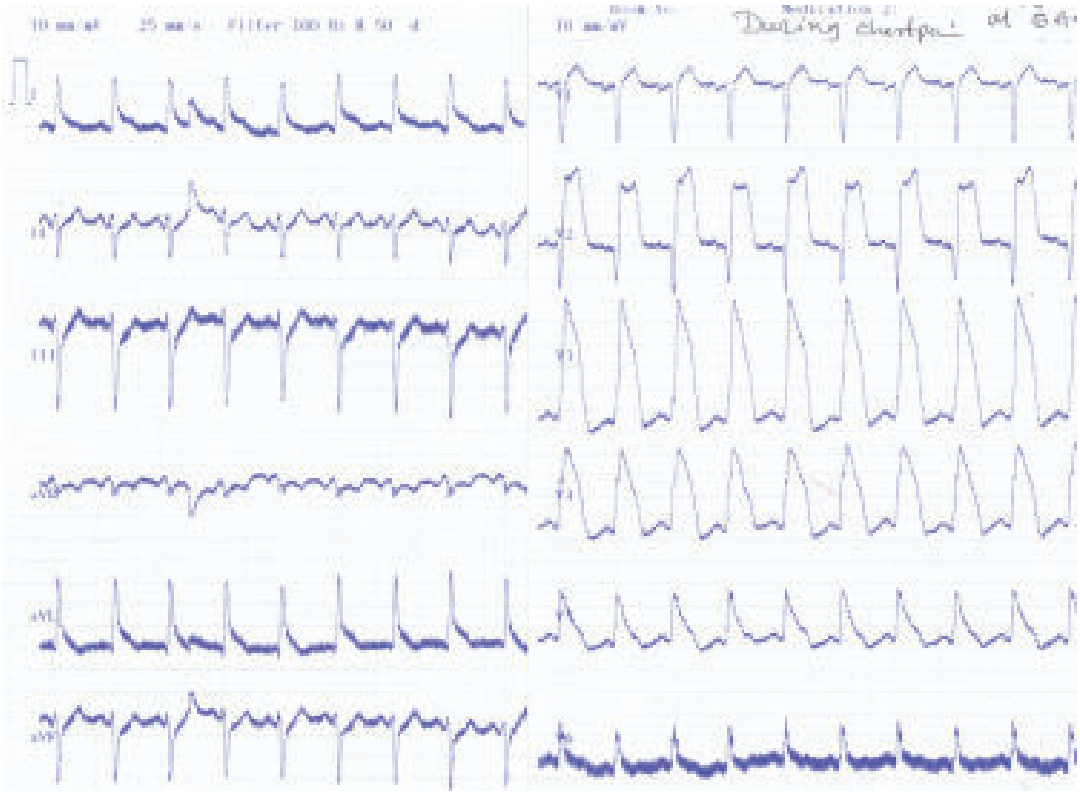


Fig.-2: *ECG shows features of Tombstone ST elevation in anterior STEMI.*

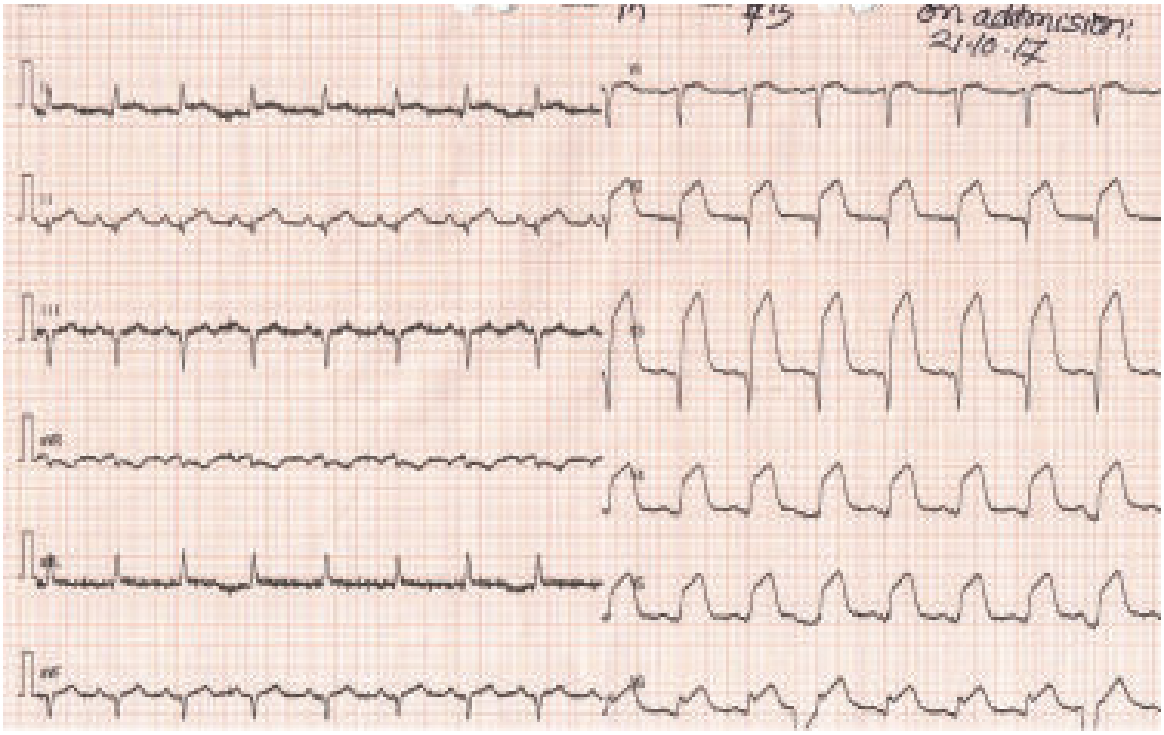


Fig.-3: *ECG shows features of Tombstone ST elevation in anterior STEMI. The ST segment is convex upward and merges with the descending limb of the R wave or the ascending limb of QS wave (leads V2,V3). The convex ST segment merges with the ascending limb of the following T wave.*

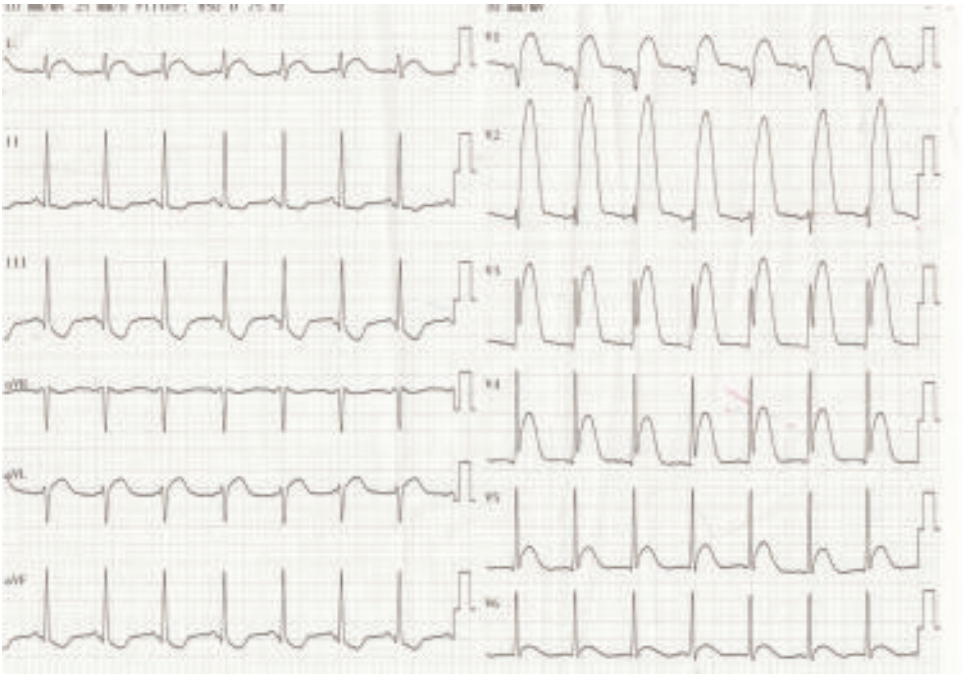


Fig.-4: *Tombstone ST elevation in anterior STEMI. The peak of the convex ST segment is higher than whatever remains of the R wave. The convex ST segment merges with the ascending limb of the following T wave.*

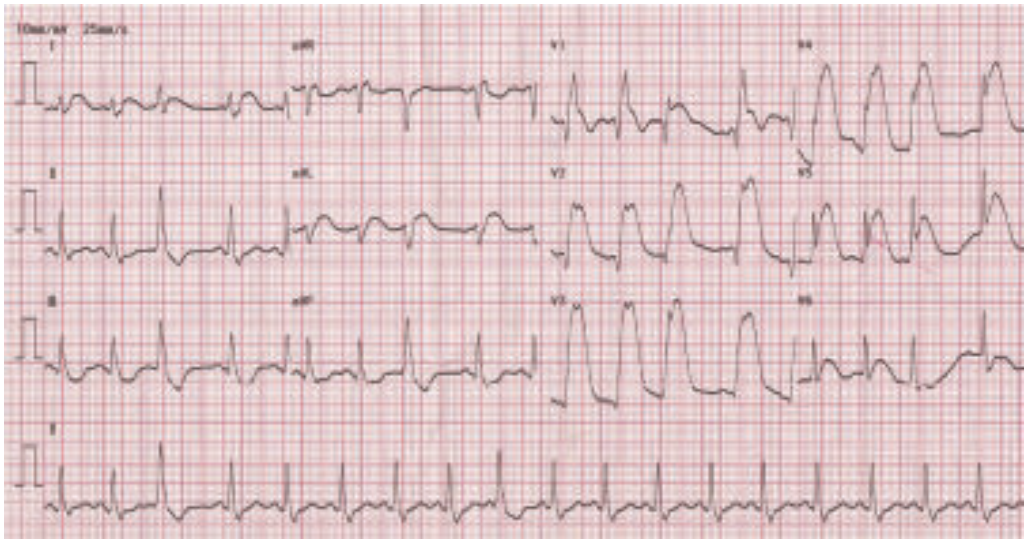


Fig.-5: *Tombstone ST elevation in anterior STEMI with RBBB pattern. The ST segment is convex upward and merges with the descending limb of the R wave. The peak of the convex ST segment is higher than that of the R wave. The convex ST segment merges with the ascending limb of the following T wave.*

Discussion:

In current practice, ECG is the most commonly used test for the early diagnosis of STEMI. In addition to its important role in diagnosis, an ECG may provide additional information to further risk stratify patients. During the early phase of acute anterior wall STEMI, some variant changes in the amplitude and morphology of ST segment elevation may be observed in some patients. [8,9] Tombstoning ST segment elevation (Tomb ST) in anterior precordial leads is one such morphologic variant that may indicate massive myocardial damage. In the current literature, a few observational studies have reported that patients with Tomb ST have a poor short term prognosis in addition

to having a higher risk of in hospital adverse events.[10,11]

Previous studies have demonstrated that ECGs might be used for risk stratification in patients who present with STEMI [9,12]. Several ECG parameters have been examined, including the magnitude of ST segment elevation, the T wave morphology and fragmented QRS, on admission in patients with acute MI.[13-15] Tomb ST is an ECG pattern of ST segment elevation in which the QRS complex, the ST segment, and the T wave merge to form a large upright monophasic deflection called a "tombstone". [2]

Tomb ST is not an infrequent event; it is detected among 25%–30% of STEMI patients.[1,16] This ECG pattern is commonly seen in anterior infarction (83.3%), even though it may sometimes be found in inferior localization.[1] In the present series, all the patients had anterior STEMI and inferior STEMI is not represented in this study population. But inferior tombstone ST elevation may be seen up to 10.6% cases of STEMI.[16] It is very easy to recognize and discriminate tombstoning ECG from others (Figs.3-5). The magnitude of ST elevation is determined fundamentally by the severity of epicardial damage. Nevertheless, amplitude of the ST elevation is affected by myocardial zone, chest structure, and distance of the electrode to the myocardial zone.[16] At coronary angiography, patients with tombstoning are likely to have high grade stenosis of the proximal LAD.[1] In the present series 22 patients (81.5%) had critical stenosis in the proximal LAD before D1 branch which is in agreement with the other data published in recent past.[1,4]

Since it was defined, tombstoning ST-segment elevation has been associated with poor prognosis, but the reasons are still not fully understood. A few complementary hypotheses have been proposed. Several of the proposed mechanisms are as follows: extremely rapid myocardial damage, poor collateral flow and/or diffuse coronary artery disease, inadequate myocardial protection effect of preinfarct angina, and elevation of wall tension.[1,10,17] Although the underlying mechanisms that are responsible for a tombstone's appearance are mostly unknown, some investigators have suggested that this type of ST segment elevation usually occurs due to the presence of multivessel disease with poor collateral circulation and lower LVEF.[1,8] But in this study 55.6% patients had single vessel disease and 44.4% had multivessel disease. Before PPCI era in hospital mortality in tomb -STEMI was around 26-38.2% .[10,17] But in the PPCI era in-hospital mortality in this condition has been reduced to around 13%.[4,18] In the present study in-hospital mortality is (16.1%).

Conclusion

Pattern of the ST elevation has been shown to be a strong prediction factor in STEMI. The present study suggests that the tombstoning pattern is more strongly associated with anterior than inferior infarction, and that patients with tombstoning have severe occlusion of the LAD artery, mostly located in the proximal segment. In hospital mortality is high in this high-risk group of patients and timely performed PPCI may reduce the incidence of fatality.

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ORIGINAL ARTICLE

Pharmacoinvasive Strategy to Treat ST-Elevated Myocardial Infarction (STEMI) in Bangladesh- COVID-19 Perspective

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Abstract

Background: Patient with Covid-19 and pre-existing cardiovascular diseases have increased risk of further aggravation and death. COVID-19 infection is usually associated with multiple direct and indirect cardiovascular complications, such as acute myocardial injury, myocarditis, arrhythmias, heart failure.

Objective: In the era of COVID-19, exact data on managing STEMI patient in our Bangladeshi patient population is not well understood. Primary PCI, the golden standard in managing acute STEMI patient, has dramatically fall in our center. Since, the potential threat for non-Covid patient and hospital staff to expose to potential danger of COVID infection, we at our hospital developed a set protocol of Pharmacoinvasive strategy in treating STEMI patient and carried out this prospective cohort of observational study.

Methods: STEMI Patients who were admitted in our coronary care unit from March 20 to July 20, enrolled in this study. Total 40 patient (F 5: Male 35) with acute ST Elevated Myocardial Infarction, presented to our ER were studied. Average age for female 47 vs Male 57 years. Positive for COVID-19, were 6 (15%) patients and excluded for intervention and managed conservatively in Covid-19 dedicated ward. Pharmacoinvasive strategy was initiated by streptokinase (STK) or Tenecteplase (TNK).

Results: COVID-19 test was carried out on all studied patient. Among them, Covid-19 positive were in 6 (15%) patient and managed conservatively in dedicated Covid ward, Covid-19 negative were 34(80%). Primary PCI was performed in 7 (17.5%) patient. Rest are managed by Pharmacoinvasive therapy. Thrombolysis by Tenecteplase done in 6 (15%), Streptokinase in 11 (27.5%) patent, 14 (35%) patient did not received any thrombolysis due to late presentation. On average 3.4 days after Fibrinolysis, elective PCI carried out. At presentation of STEMI; Ant Wall MI 15 (37.5%), Inferior Wall MI 15 (37.5%), Antero-septal MI 5 (12.5%), Infero-Posterior wall MI 3 (7.5%), Antero-lateral MI 1 (2.5%), Antero-Inferior wall MI 1 (2.5%). Total coronary angiogram was done in 30(75%) patient; Radial 23(76.6%), Femoral 7 (23.3%). Total, 28 stents were deployed in 24 territory of 24 patients. CABG recommended for 2 (6.7%) patient, PCI in 24 (80%), defer PCI 1 (3.3%) and medical management 3 (10%) patients. Stented territory was LAD 13 (54.2%) and RCA 11 (45.8%). Common stent used; Everolimus 13 (46.4%), Sirolimus 7 (25%), Progenitor cell with sirolimus 3 (10.7%) and Zotarolimus 6 (21.4%).

Conclusion: In the era of COVID-19, in this prospective cohort study on STEMI patient management, we found that Pharmacoinvasive therapy by Tenecteplase and Streptokinase, followed by interventional treatment on a later date is safe, simple and effective alternative to treat STEMI and reduce the possible risk of exposure of Covid-19 for both patients and healthcare providers.

Key Words: COVID-19, STEMI, Pharmacoinvasive, PPCI

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Introduction:

Coronavirus disease (COVID-19) caused by the novel severe acute respiratory syndrome corionavirus2 (SARS-CoV-2) is a major threat to global health including Bangladesh. Since, its recognition in Wuhan, China in December 2019, COVID-19, has

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rapidly spread throughout the world and become a pandemic.[1] It is associated with increased morbidity and mortality mainly due to severe acute respiratory syndrome 2(SARS-Cov-2). Cardiac manifestations related to Covid -19 include Fulminant myocarditis, Ischemia, Myocardial infarction, and arrhythmias.

The world is currently in the midst of the global COVID-19 pandemic, which has rapidly resulted in significant morbidity and mortality.[2] It has placed enormous stress, safety risk of exposure to harmful effects for both patient and healthcare providers along with huge financial expenditures for healthcare resources and providers. There have been significant restrictions on routine medical care to comply with public health on physical distancing and help to preserve limited resources.

Cardiovascular diseases especially, Acute ST Elevated Myocardial Infarction (STEMI) encompass a spectrum of clinical conditions associated with significant morbidity and mortality. In US most of the invasive cardiovascular procedures and diagnostic test deferred for interim triage and management of patients on waiting list.[3] Untreated patients are at increased risk and delays in treatment will be detrimental.[4]

Like, other parts of world, in Bangladesh densely populated country, where many are affected, died and those who recovered, are suffering from life threating complications. Although the pathophysiologic mechanism of STEMI in COVID-19 patient has not been clearly established, some hypothetical thoughts in developing STEMI include plaque rupture secondary to systemic inflammation, increased pro-coagulants, endothelial dysfunction, impaired fibrinolysis and impaired oxygen utilization leading to demand /supply mismatch and myocardial Ischemia.[5]

In the past several months, since first detection of COVID-19 in the beginning of March 8, 2020, admission of STEMI patients for primary PCI at our center has dramatically fall as compared to pre-Covid several months.

Therefore, we have carried out this prospective cohort of acute STEMI patient, those who were admitted in our CCU. We found, that Pharmacoinvasive strategy is safe, an effective alternative to primary PCI in this global pandemic and reduce the risk of infection of non-COVID patients as well as healthcare providers.

Methods:

We conducted this prospective observational study, at our center, a tertiary care hospital opens round the clock 24/7 for primary PCI services for STEMI patient admitted from March 8, 2020 to Jul 31, 2020. Patient were admitted in Grey zone of CCU from ED, where Pharmacoinvasive therapy either by Streptokinase or Tenecteplase done. Covid-19 test were sent. COVID-19 positive cases were relocated to dedicated COVID-19 ward and managed medically. Patient with no history of COVID-19 exposure or any symptoms, and whom primary PCI were deemed necessitate, were sent from ED to Cath lab. Later, Covid-19 test of these group of patients, found negative.

The diagnosis of STEMI was established by a typical history of chest pan, diagnostic ECG changes and serial; elevation of cardiac biomarkers.[24] Blood samples drawn pre-PCI. Primary PCI performed in patients with ongoing symptoms <12 hrs. in duration. Complications like cardiogenic shock or need for IABP, need for emergent CABG, mechanical ventilation or heart failure episodes treated conservatively, clinically significant arrhythmia requiring pacemaker or major bleeding requiring blood transfusion and were excluded from study.

PCI Procedures:

A team of 24 hour on call interventional cardiology performed PCI according to standard clinical practice by using standard 6F guide catheter, guide wires, balloon catheters mostly via the Radial routes. Patient received 5000 unit bolus of heparin, followed by an additional 2000 units during the procedure. Coronary stenting was performed with standard technique, contrast dose left to individual operator discretion. Further, smoothening was done by post-dilatation whenever required. Successful PCI was defined as a visually assessed 20-30% residual stenosis with TIMI III distal flow. IVUS not done. After the pPCI or elective PCI, patients were shifted to CCU. Patient were pre-loaded with either Ticagrelor or clopidogrel along with Aspirin and loading and maintenance doses of gpIIb/IIIa receptor blocker abciximab.

Laboratory parameters

Serum hS Troponin-I and baseline ECG done presentation to ER with the c/o chest pain and ECG evidenced STEMI and post PCI in intensive care unit stay. Other, routine biochemical test were measured by standard analyzer at our center.

Statistical analysis

All data were summarized and displayed as mean +/- standard deviation and in percentage.

Results:

In this global perspective of COVID-19 pandemic, Pharmacoinvasive strategy to treating STEMI patient at our center were studied. Total 40 patient (F 5: Male 35) with acute ST Elevated Myocardial Infarction were studied. Average age for female 47 vs Male 57. COVID-19 test was carried out on all patients., among them, COVID-19 positive in 6 (15%) patient and managed conservatively in dedicated Covid ward, COVID-19 negative in 34 (85%). Primary PCI was performed in 7 (17.5%) patient. Rest are managed by Pharmacoinvasive therapy followed by elective PCI on an average of 3.4 days after thrombolysis. Thrombolysis by Tenecteplase done in 6 (15%), Streptokinase in 11 (27.5%) patent, 14 (35%) patient did not received any thrombolysis due to late presentation.

Table I. Shows the profile of studied patients in this prospective observational study. In the studied population average ages are (male 57.0+ 11.5 vs female 45.4+10.6 year.). COVID-19 test was carried out on all STEMI patient. Table II. Showed that high Sensitivity troponin-I were more released in male than female (male 24236 vs female 9567), LVEF (male 41% vs Female 45%) and HbA1C (male 6.8 vs female 8.3). Common CAD risk factors; as shown in Fig 1., that 22 (53.7%) were hypertensive, 20 (48.8%) were Diabetic, 14(34.1%), Smoker 10 (24.4%) and FH positive for CAD were 7 (17.1%) and hypothyroidism 2(4.9%). According to the involvement of myocardium infarction as shown in Fig 2., that STEMI diagnosis of Ant Wall MI 15 (37.5%), Inferior Wall MI 15 (37.5%), Antero-septal MI 5(12.5%), Infero-Posterior wall MI 3 (7.5%), Antero-lateral MI 1 (2.5%), Antero-Inferior wall MI 1(2.5%). Figure 3., showed the percentage distribution of management or recommendation at presentation to ED, were Pharmacoinvasive therapy by Tenecteplase done in 6 (15%), Streptokinase in 11(27.5%) patent, Primary PCI 7 (17.5%) patient, 14 (35%) patient did not received any thrombolysis due to late presentation and Elective PCI in 17 (42.5%) patient. Total coronary angiogram was done in 30(75%) patient; Radial 23 (76.6%), Femoral 7 (23.3%). As shown in Figure 4, the Percentage distribution of recommendation after coronary angiogram, were for PCI in 24 (80%), CABG 2 (6.7%) patient, defer PCI 1 (3.3%) and medical management 3 (10%) patients. Total, 28 stents were deployed in 24 territory of 24 patients. As shown in Figure 5, Different type stents used; Everolimus 13(46.4%), Sirolimus 7(25%), Progenitor cell with sirolimus 3 (10.7%) and Zotarolimus 6(21.4%). Fig 6. Showed common stented territory LAD 13 (54.2%) and RCA 11(45.8%). Figure 7., showed the angiographic number of vessels involved and stent used in the study.

Table-I

Demographic Profile of the patients

	Female	Male
Number	5 (12.5%)	35(87.5%)
Age (yrs)	45.4±10.6	57.0±11.5
SBP(mmHg)	123.0±23.0	120.0±21.0
DBP(mmHg)	76.0±12.0	74.0±9.6
CAD Risk Factor	2.0±0.1	2.3±0.8
COVID-19 +ve	2	4
COVID-19 -ve	3	31

Data were presented as Mean ± SD

Table-II

Hs Trop-I, HbA1C and LVEF

	Female	Male
hS Troponin-I level	9567±1233	24236±20891
LVEF (%)	45.0±13.2	41.1±10.5
HbA1C	8.3±0.4	6.8±1.7

Data were presented as Mean ± SD

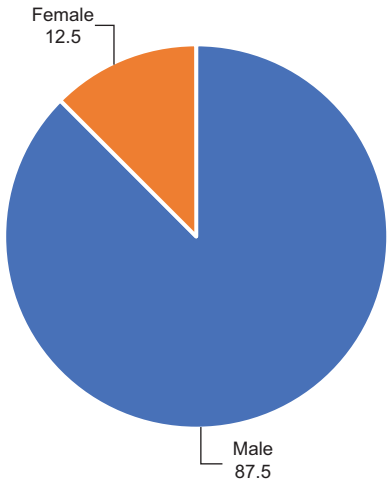


Fig.-1: *Percentage Distribution of Male and Female*

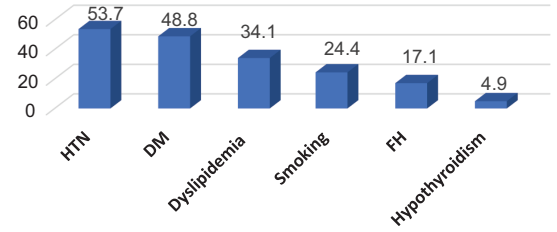


Fig.-2: *Percentage distribution of CAD Risk factors*

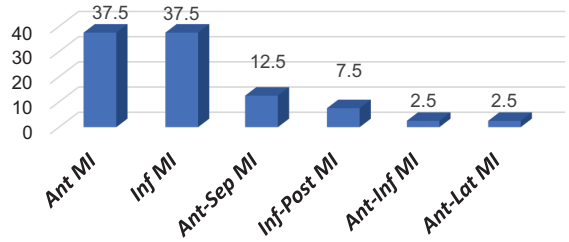


Fig.-3: *Percentage distribution of STEMI*

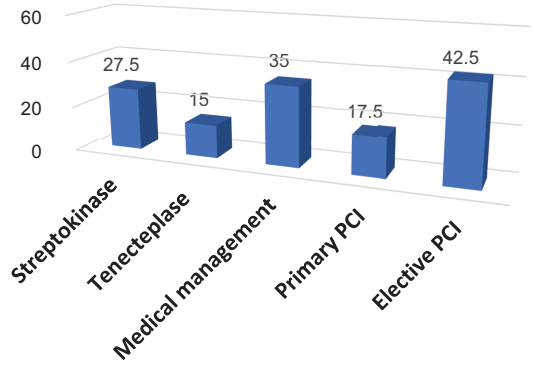


Fig.-4: *Percentage distribution of treatment strategy*

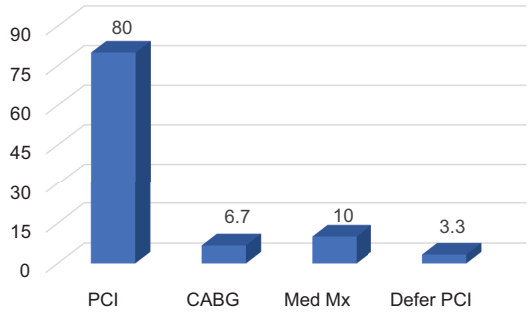


Fig.-5: *Recommendation after Coronary Angiogram*

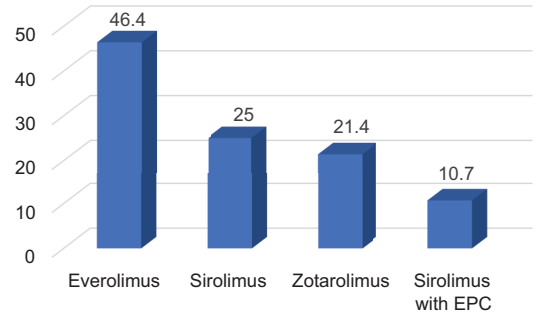


Fig.-6: *Percentage distribution of type stents used*

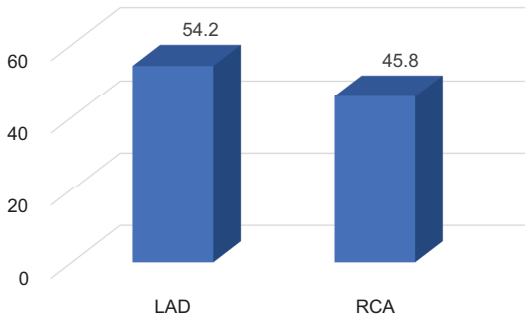


Fig.-7: *Common Stented Territory*

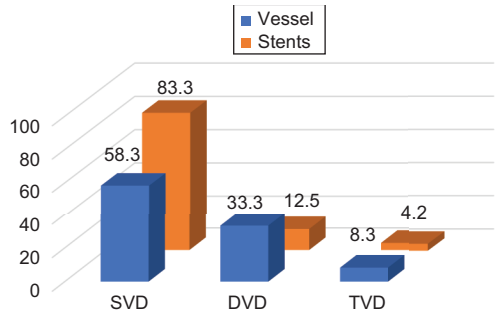


Fig.-8: *Percentage distribution of Vessel involved and stents*

Discussion:

The worldwide pandemic caused by the novel acute respiratory syndrome coronavirus 2 (SARS-CoV2) has resulted a new and lethal disease termed COVID-19. Patient with cardiovascular diseases who become COVID-19 positive are in higher risk of mortality. Cardiovascular manifestations in the COVID-19 patient are complex; may present with Acute STEMI, myocarditis simulating STEMI, cardiomyopathy, non-ischemic cardiomyopathy, coronary spasm, or myocardial injury with documented Type I or Type II AMI.[6-9] Furthermore, patient testing positive for COVID-19 can be asymptomatic despite significant abnormalities noted on Chest CT Scan and there

appears to be significant risk of asymptomatic transmission of the disease.[10-11]

Acute STEMI is one of the major life-threatening clinical condition and leading cause of death in our country. It is well known, that ACC/AHA/ESC guideline for managing ST segment elevated myocardial infarction (STEMI), primary PCI is a class-I indication for revascularization of clogged artery, and thus to provides better myocardial salvage and avoidance of associated life threatening complications.[12-13]

Bangladesh, a densely populated country over 170 million population. Death from Acute Cardiovascular illness including STEMI is one of the major causes among all. Since, the outbreak of global pandemic COVID-19, our center, a tertiary care hospital with availability of round the clock primary PCI facilities, we noticed dramatic fall of STEMI primary PCI. As to restrict the possible exposure of non-Covid patient and health care professionals to COVID-19, we have some set protocol at our center. All STEMI patients until and unless need a lifesaving emergency of intervention and thus, to restore the blood flow, all STEMI patient were admitted in grey zone of CCU, where Pharmacoinvasive strategy of revascularization carried out, either by STK or TNK. Covid-positive patent were shifted to COVID dedicated ward. Negative, patient after thrombolysis, complete revascularization done by interventional approach in a later date. In our patient population, females were more younger and diabetes poorly controlled as HbA1C is more, compare to male patients, indicating that diabetes play key role in developing acute myocardial infarction in female patient.[14] Greater amount of Troponin-I release and low LVEF in male patients indicating greater LV muscle mass involvement in these group of patients than female patients. .

Recently, ACC/AHA/ESC published guidelines in treating ST-segment Elevated Myocardial Infarction (STEMI) patients along with other life-threatening cardiac conditions. For, acute ST elevated myocardial infarction, they recommended initially, Pharmacoinvasive therapy. Where, Patient will be thrombolysed and later, to Rescue or elective PCI. Some recommended for Primary PCI if there is Corvid-19 dedicated Cardiac catheterization lab available.[15-16]

In the era of COVID-19, there is 4-fold increase in the time of symptom to door time for STEMI patients, patients waiting at home until symptoms become unbearable.[17] There is decrease of about 40% reduction in hospital admission with STEMI and subsequent Cath lab activities as compared to pre-COVID time.[18-19] Moreover, careful protocol should be sorted for admitted cardiovascular patients for shorter length of hospital stay and best case scenario, smaller elective procedure to minimize the exposure of uninfected patient risk to COVID-19. Conversely, high demand for clinical resources and hospital bed spaces for COVID-19 patient, may result in premature discharge before clinical optimization achieved.

In Bangladesh, most of the center has only one Cath lab and it is not possible to treat STEMI patient in this global pandemic, where chances of possible infection to non-Covid patient. Since, like west, we do not have separate block or facilities to treat only Covid patient. We have a set protocol of admitting STEMI patient in our CCU, suspected cases were in grey zone, if found positive then were shifted to dedicated Covid ICU. Clean cases with no history of exposure or any sign symptoms of Covid or absence of radiological evidence of ground glass Covid pneumonitis on chest X-ray, were sent directly to Cath lab for Primary PCI. In the current study, only 24 (60%) patient had PCI done and rest 16(40%) are deferred PCI either due to COVID-19 positive results 6 patients or rest are managed medically due to late arrival in ED. Primary PCI were done in done in 7(17.5%) patient, after shifting from ER to Cath lab. COVID-19 test of all primary PCI came Negative. Rest of the all PCI procedure, 17 (82.5%) cases were admitted in CCU, thrombolysis done by Tenecteplase 6(15%) or Streptokinase 11 (27.5%), underwent PCI on a later date after COVID-19 test which was negative.

In the era of COVID-19, ACC/ESC/SCAI both recommend fibrinolytic and Pharmacoinvasive strategy for hospitals if timely primary PCI cannot be performed, specially at hospitals without PCI capability.[15] It is well known that fibrinolytic therapy more frequently aborts myocardial infarction in early presenters compared with primary PCI, requires less personnel, avoids time to treatment delays and almost three Quarters will achieve infarct artery reperfusion. Thus, will allow delayed angiography and unnecessary exposure risk in this unprecedented global pandemic. FDA has recommended rapidly making diagnosis of COVID-19 in STEMI patients and guide appropriate placement within the hospital, including a dedicated

CCL and post procedure unit. In addition, STEMI mimicker as focal myocarditis or stress cardiomyopathy known to associated with COVID-19 and need to be carefully evaluated at presentation in ED.[20]

In a cohort study of 416 patients who tested positive for COVID, Shi et al, described evidence of myocardial injury in 82 (19.7%) patients, as evidenced by elevated high sensitivity Trop-I. The mechanism of myocardial injury during COVID-19 infections has been theorized to be multifactorial. Direct toxicity of virus to cardiac myocytes, systemic inflammatory response, destabilization of pre-existing coronary plaque and aggravated hypoxia are possible mechanism of myocardial injury. Diffuse endothelial injury and impaired fibrinolysis are likely additional factors. Impaired oxygen utilization in the setting of elevated inflammatory cytokines levels may further contribute to cardiac ischemia.[7]

In Wuhan 3.8% of confirmed cases were healthcare workers, of which 5% of cases were classified as severe or critical.[21] Whereas in US, 11% of reported COVID-19 cases were healthcare professionals. [22] Whereas, in Bangladesh, quite a lot of healthcare expert professional died of COVID-19 and many are sufferings, possibly due to lack of available PPE supplies and faulty Donning and especially unmindful mistakes in guided step of Doffing. In a recent study on healthcare professional in Chennai, India found that healthcare workers become positive for COVID-19 while assigned to counsel asymptomatic family contacts of patients who had tested positive for SARS-CoV-2 at their residence.[23]

In the perspective of this global pandemic of COVID-19, a balance must be struck in identifying appropriate patients for invasive approach that is primary PCI for acute STEMI patient regardless of this COVID-19 status and maintaining the safety of health care workers, who might be exposed to the disease as well as maintain the safety or minimizing the contamination of cardiac catheterization laboratory(CCL) facilities. During this COVID-19 pandemic, in the west, primary PCI remain the gold standard of care for STEMI provided the hospital has separate block to treat COVID patient in dedicated CCL and with available proper PPE.

Although, Primary PCI (pPCI) is superior for establishing normal (TIMI grade 3) coronary flow compared with an initial fibrinolysis strategy which has significant bleeding risk. Almost 50% patient requiring rescue PCI after fibrinolysis due to incomplete thrombolysis with residual stenosis.[24] Since, we do not have separate building block and do not have COVID dedicated Cath lab, we made a protocol to treat acute STEMI by Pharmacoinvasive strategy first, until it deems necessitate to save life by pPCI. COVID positive case were shifted to dedicated ward and treated Pharmacoinvasive. We recommend, if primary PCI done, then complete revascularization of non-infarct artery in same sitting, thus, to minimize the risk of CCL staff. and patient's further exposure risk to COVID-19. In our present study, apart from STEMI PCI of infarct related artery, non-infarct double vessel PCI were done in 8 patients and triple vessel in 2 patients. We found better in-hospital survival outcome with screening and limiting the possible contamination of COVID positive cases and preserve the healthcare professionals.

Before reintroduction of any invasive treatment of any cardiovascular emergencies, protection of patients and health care professional's safety must be addressed first. This may include virtual pre-procedural clinics, consenting, thus minimizing exposure the risk of COVID-19 to non-Covid patients, physicians and healthcare professional. Routine pre-procedural testing for all cardiovascular patient before any procedures or interventions. Mandatory uses of PPE for health care professionals for routine as well as invasive procedures. Safe physical distancing of at least 3-6 feet and consider strategies to minimize patient contact including uses of face shield and terminal cleaning after each procedure, so the possibility of COVID-19 infection to non-COVID patient can be avoided.

Conclusion:

Treating STEMI by Percutaneous coronary intervention declined during COVID-19 pandemic, perhaps partly because of patients unwilling to access the emergency medical system or risk of hospital exposure to COVID-19. After presenting to emergency department, primary evaluation and assessment are prolonged due to additional screening for COVID-19. Transfer from ED to Cath lab for primary PCI is complex as risk of additional staff exposure and delays in preparation along with personal protective equipment's. Since, the frequency and duration of PCI-related delays for reperfusion therapy increases. Pharmacoinvasive

strategy by fibrinolytic therapy followed by intervention in later date offer a logical, effective, and safe alternative to primary PCI. Thus, reduce the risk of COVID-19 exposure for patient and healthcare providers.

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Challenging Approach to Rare Case: Radiofrequency Catheter Ablation of WPW Syndrome in a Patient with Interruption of the Inferior Vena Cava

Poppy Bala[1], M. Atahar Ali[2], A. Q. M. Reza[3], Mahmood Hasan Khan[4], Kanu Bala[5]

Abstract

Background: Catheter ablation of accessory pathway is generally performed using a transfemoral venous approach through the inferior vena cava (IVC). We report an alternative approach to ablate the septal pathway in patients with interruption of the IVC with persistent left superior vena cava (PLSVC).

Case summary: A 24 years old male presented with the complaints of recurrent episodes of palpitations since childhood. He was diagnosed as a case of Wolff Parkinson White (WPW) syndrome on ECG. There was history of one failed attempt of radiofrequency ablation 10 years back. Echocardiography revealed atrial septal defect (ASD) secondum with bicuspid aortic valve with PLSVC with Hepatic veins draining into the IVC. He underwent a venogram which showed interrupted IVC with PLSVC connected with azygos vein. After electrophysiology study and 3D mapping, pathway was located in right posteroseptum. Under the guidance of 3D mapping, successful ablation of a right posteroseptal accessory pathway was done via internal jugular vein.

Conclusion: Very few numbers of radiofrequency catheter ablation were done in a patient with an interrupted IVC in Bangladesh. Knowledge of this anatomic variation is vital because it allows invasive electrophysiologists to thoughtfully plan a percutaneous approach.

Keywords: Ablation; Congenital anomaly; Wolff Parkinson White syndrome; interruption of the IVC; Persistent left superior vena cava.

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Introduction:

Catheter ablation is the choice of treatment in WPW syndrome. Catheter positioning typically is achieved through the femoral veins, though there are patients in whom this approach is not possible because of congenital anomaly of the inferior vena cava (IVC). Interruption of the inferior vena cava is a rare congenital anomaly found in 1.3-3.0% of patients with congenital heart disease (1-3). In this condition due to interruption of inferior vena cava, the systemic venous drainage below the interruption is via an enlarged azygos vein usually into the superior vena cava; in contrast, the hepatic veins typically drain through the residual orifice of the inferior vena cava into the right atrium. In these rare situations, access to the heart may still be achieved with a superior approach, that is, with catheters descending from the superior vena cava (SVC) into the right side of the heart.(4–12) Alternatively, left-sided heart arrhythmias may be accessed using a retrograde aortic approach.

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Case Report:

A 24 years old male presented with the complaints of recurrent episodes of palpitations since childhood. He was diagnosed as a case of WPW syndrome on ECG (Fig 1). There was history of one failed attempt of radiofrequency ablation 10 years back. Though patient was on antiarrhythmic drugs, he experienced recurrent episodes of SVT. Echocardiography revealed ASD secondum with bicuspid aortic valve, absence of IVC

and a dilated coronary sinus (CS), which raising the suspicion of a PLSVC (Fig.2). Then venogram was performed in our laboratory after obtaining written informed consent. Findings of the venogram was interrupted IVC which drained into persistent left superior vena cava (PLSVC) via azygos vein and

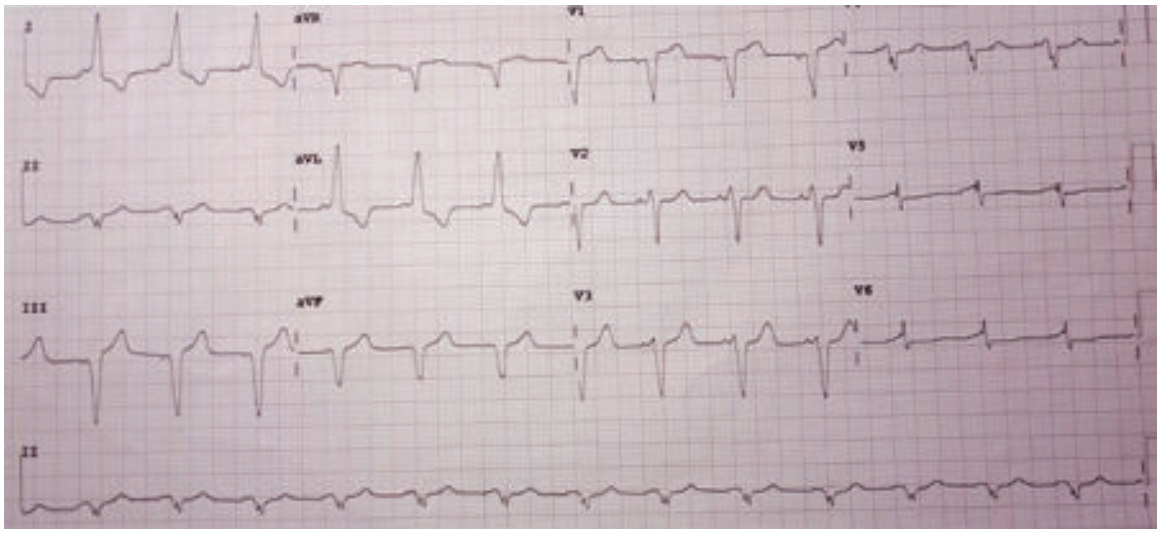


Fig.-1: *12 lead ECG showing WPW type B variety.*

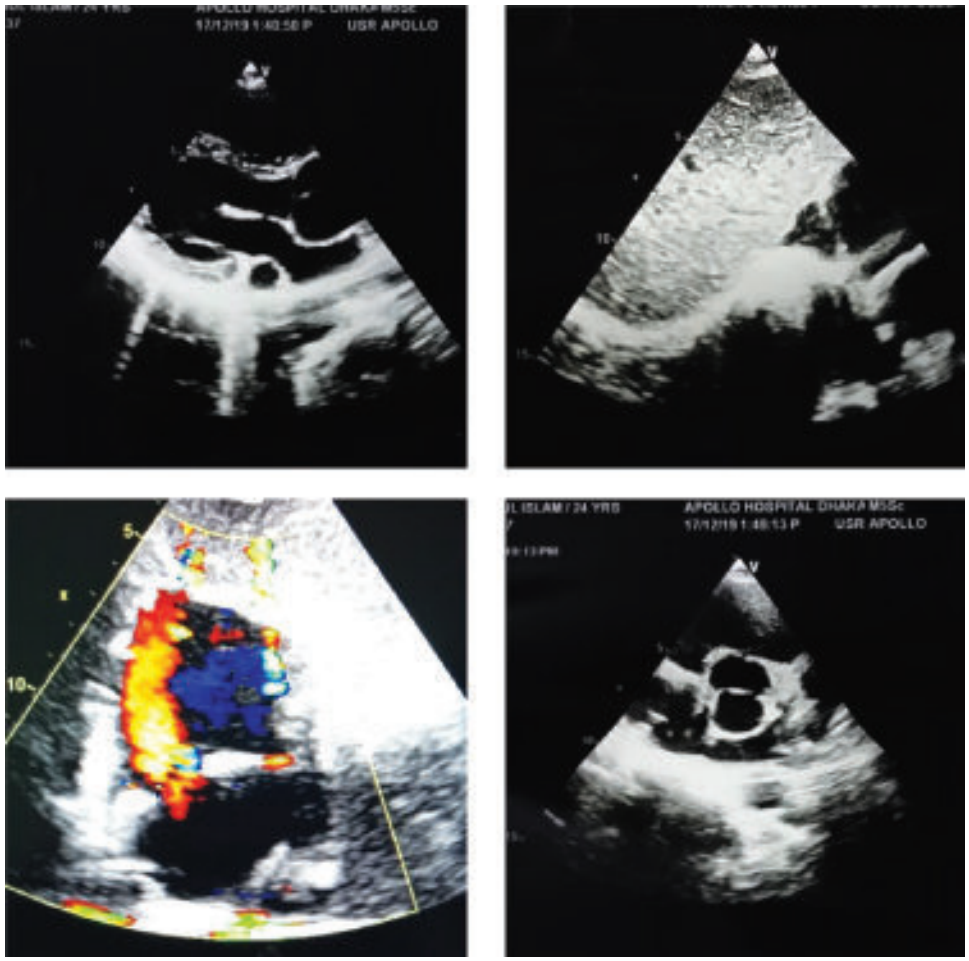


Fig.-2: *2D and color Doppler echocardiography showing dilated coronary sinus, interrupted IVC, ASD and bicuspid aortic valves.*

separate right SVC. After thorough evaluation of cardiovascular anatomy an electrophysiological study was started. Right internal jugular vein was cannulated and two 6F and one 7 F vascular access sheaths were introduced. After placing catheters in right atrium, right ventricle and coronary sinus (Fig.3), electrophysiology (EP) study was done. Accessory pathway was located in right posteroseptum. An orthodromic atrioventricular reciprocating tachycardia was induced during programmed atrial stimulation. Endocardial mapping of the tricuspid annulus in sinus rhythm, showed the area of earliest ventricular activation at the level of the right posteroseptal region near the CS 9, 10 position (Fig. 4 and 5). Radiofrequency current was then applied abolishing the preexcitation in the first second of the application (Fig. 4 and 5). After the ablation, ventricular pacing demonstrated decremental retrograde VA conduction.

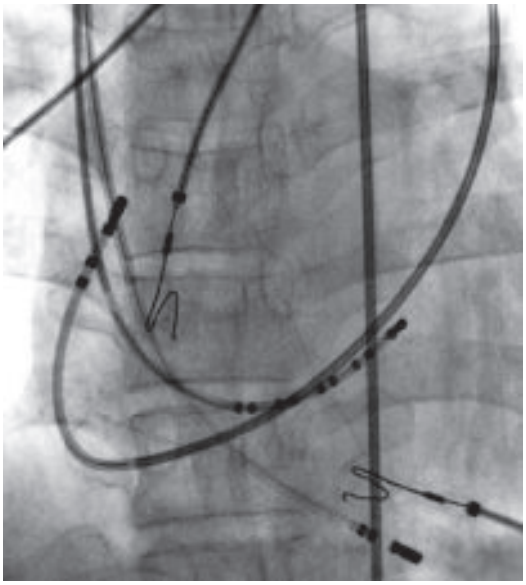


Fig.-3: *Fluoroscopic images of catheter placement in right ventricle, right atrium and bundle of his.*

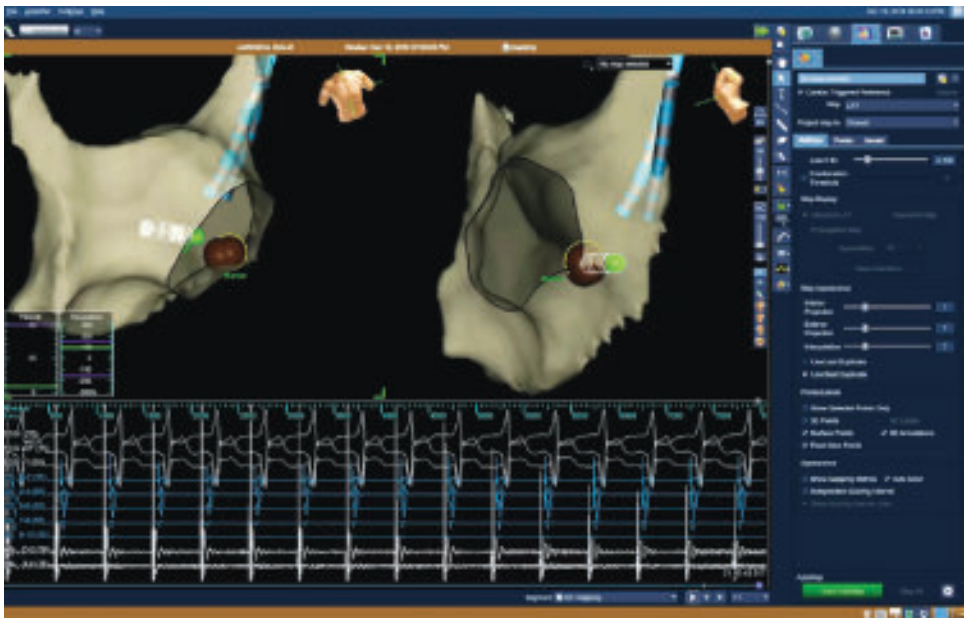


Fig.- 4: *3D mapping and r adiofrequency ablation of posteroseptal accessory pathway.*

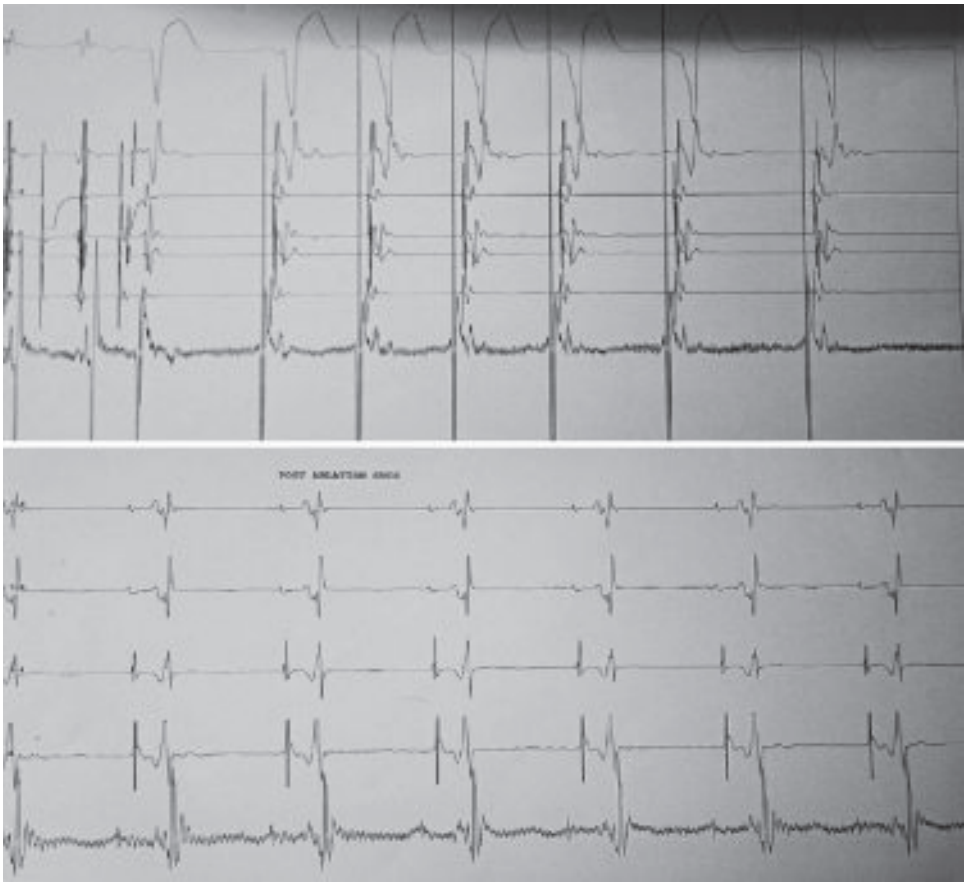


Fig.-5: *Recordings of the RV pacing at the site of coronary sinus and images of the successful post ablation status. (From above to below)*

Discussion:

To our knowledge, radiofrequency catheter ablation in a patient with an interruption of inferior vena cava with azygos continuation and PLSVC has not been previously reported in Bangladesh. In the presence of this anomaly, the access to the right cavities must be made via the superior vena cava. As a result, the positioning and manipulation of the recording and mapping catheters are more difficult entering the superior vena cava.

The anomaly is often associated with other cyanotic or acyanotic congenital cardiac disorders, abnormalities of cardiac position such as dextrocardia and polysplenia or asplenia (1, 3). In normal circumstances, the reported rate of this complication is around 2-5% in most of the series (8). The presence of a distorted anatomy may significantly increase this percentage, as may occur in the setting of congenital heart disease which is around 0.6-3%. In this case patient got ASD secondum with PLSVC with bicuspid aortic valve associated with interrupted IVC. Radiofrequency catheter ablation is the treatment of choice for patients with a history of palpitations and a functional accessory pathway. The most common access to the heart is from the femoral approach. The technique is highly effective and safe. However, when the accessory pathway is located in the right posteroseptal region, close to the His bundle, the possibility of in adverted atrioventricular block has to be taken into account. Some authors (9) have recommended the upper approach (via the jugular or subclavian vein), in order to improve catheter stability.

Conclusion:

Very few numbers of radiofrequency catheter ablation were done in a patient with an interrupted IVC in Bangladesh. Knowledge of this anatomic variation is vital because it allows invasive electrophysiologists to thoughtfully plan a percutaneous approach. When the accessory pathway is located in the right septal region, close to the His bundle, the possibility of AVB (2-5%) has to be taken into account. The presence of a distorted anatomy may significantly increase this

percentage, as may occur in the setting of congenital heart disease. So to avoid any type of complications in altered anatomy of congenital heart disease, 3D mapping is must.

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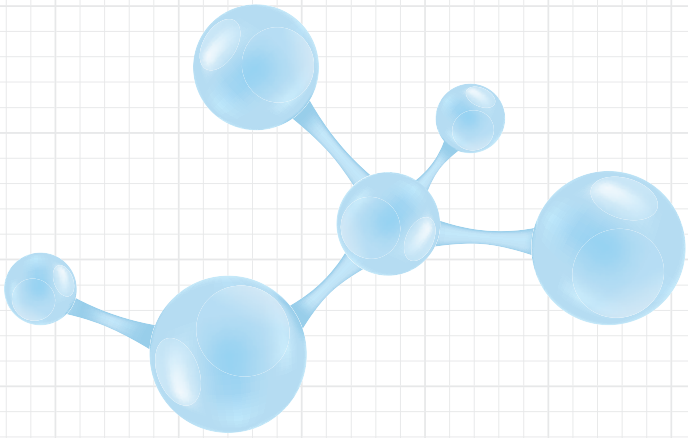


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