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Journal of Invasive and Clinical Cardiology

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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.

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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.

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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.

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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.

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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.

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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.

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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.
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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.

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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.

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- 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.
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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.
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- Abbreviations in each table should be explained in footnotes.
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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.

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- 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).
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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.

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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: PMC 2615549.

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/.

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EDITORIAL

Optimizing Angina Treatment: How Far Have We Come?

Abdullah Al Shafi Majumder

J Inv Clin Cardiol 2023; 5(2): 29-31

Stable angina represents the most prevalent symptom of ischemic heart disease, affecting around 112 million people worldwide.[1] The prevalence varies across regions increasing with age in both sexes.[2,3] More frequent angina results in greater physical limitation, poorer quality of life, and increased risks of disability, depression and job loss.[4,5,6] Angina symptoms also predict worse cardiovascular outcomes, but are commonly under-recognized in clinical practice. In Cadence study performed with 2031 angina patients, Physicians considered patients' angina to be optimally controlled in 80% of cases, despite the prevalence of frequent angina.[7] In a study conducted in the US with 1257 outpatients with coronary artery disease (CAD) managed by 155 cardiologists, only 56% patients with frequent angina symptoms were on optimal antianginal medication.[8]

The current approach to managing myocardial ischemia predominantly emphasizes on "epicardial coronary obstruction-first" strategy. This approach assumes that obstructive atherosclerosis serves as the primary and immediate cause of myocardial ischemia. Consequently, when obstructive atherosclerosis is present, there is often minimal exploration of other potential alternative or coexisting mechanisms contributing to ischemia. Despite guideline recommendations advocating a broader perspective, contemporary clinical practice predominantly revolves around addressing obstructive epicardial coronary artery disease (CAD). The therapeutic objective remains focused on alleviating flow-limiting coronary stenoses. Consequently, revascularization procedures are commonly performed. However, in several clinical studies and meta-analyses, revascularization was not found to be associated with improved survival in ischemic patients.[9-10]

In recent years, our understanding of ischemic heart disease (IHD) has evolved significantly. Recent research has prompted a reconsideration that other mechanisms can also lead to myocardial ischemia, either independently or in combination. This new perspective acknowledges that myocardial ischemia is a multifactorial condition. Scientific evidence has shown that obstructive coronary atherosclerosis is not consistently associated with myocardial ischemia, and conversely, myocardial ischemia can occur even in the absence of obstructive atherosclerosis.[11-16] Several studies and registries have found an inconsistent association between atherosclerosis and myocardial ischemia.[15-19] Non-vascular factors such as abnormalities in cardiac energy metabolism and changes in blood rheology due to platelet activation or inflammation should be considered as contributors to myocardial ischemic syndromes on top of vascular mechanisms.[11]

Chronic stable angina, the most common symptom of ischemic heart disease, necessitates effective management strategies. While revascularization procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) are often performed, drug therapy remains the cornerstone of management. Over the past one and half centuries, numerous pharmacological therapies have been developed and utilized to alleviate the symptoms of angina. The journey of anti-anginal drug development began in 1867 with the introduction of amyl nitrate[20], followed by nitroglycerine in 1879[21]. The landscape of angina treatment was significantly transformed in 1964 with the advent of propranolol, the first beta-blocker for chronic stable angina[22] . Calcium antagonists became available in 1975[23], and long-acting nitrate in the form of isosorbide dinitrate was introduced around the same time[24]. However, the earlier preparations of long-acting nitrate were hampered by the development of drug tolerance[25]. Subsequently, several other classes of drugs, including metabolic modulators (trimetazidine) [26], ATP-

Address of Correspondence: Prof. Dr. Abdullah Al Shafi Majumder, Consultant & Coordinator, Dept. of Cardiology, Bangladesh Specialized Hospital, E-mail: m.abdullaalshafi@yahoo.com

dependent potassium channel openers (nicorandil) [27], I_f channel inhibitors (ivabradine) [28], and late inward sodium channel inhibitors (ranolazine) [29] were developed. Today, these therapies are broadly classified into first-line drugs (beta-blockers, calcium channel blockers, short-acting nitrates) and second-line drugs (long-acting nitrates, ivabradine, nicorandil, ranolazine, and trimetazidine). However, the comparative effectiveness of these drugs remains a topic of debate. Roberto Ferrari and colleagues conducted a comprehensive systematic review to evaluate the evidence supporting the efficacy of these treatments and concluded that There is no evidence to support the use of first and second-line treatments for the management of angina, rather the drug therapy should be tailored to each patient's need.[30]

Optimal medical therapy can be defined as satisfactory symptom control and prevention of events with good adherence and minimal adverse effects. In order to achieve optimal treatment in patients with CCS, drug therapies must be adapted to each patient's characteristics and preferences.[31] More than one antianginal is often needed for relief and early response assessment is important.[31]

The individualized, patient-tailored approach to treating patients from the start with any antianginal, based on the estimated mechanisms of stable angina and taking into consideration the comorbidities and tolerability of the patient, is a key aspect of optimal medical therapy. This approach ensures that patients receive tailored treatment from the stat which is best suited to their specific needs and circumstances.

Traditionally, studies evaluating anti-anginal agents did not consider the underlying pathophysiology of angina symptoms when selecting patients for investigation. However, it has become evident that various mechanisms contribute to myocardial ischemia, and their impact may vary from patient to patient. In individuals with angina, increased myocardial oxygen demand and reduced coronary blood flow (due to factors like epicardial vasospasm or coronary microvascular dysfunction) play a role in the pathophysiology. Recently improved understanding of microvascular angina, including post-angioplasty angina, has added a new dimension to angina treatment.

Different classes of drugs work in distinct ways. For instance, beta blockers effectively reduce myocardial oxygen demand but may increase coronary vascular resistance in some cases. Consequently, patients with microvascular spasm might deteriorate with beta blockers but benefit from vasodilators like calcium antagonists. Additionally, add-on therapy should align with the potential mechanisms of action, such as combination of a hemodynamic agent such as beta blocker along with a metabolic modulator like trimetazidine may be considered to achieve optimal treatment outcome. Furthermore, co-morbidities significantly influence treatment decisions. When choosing an anti-anginal drug, it's essential to consider common comorbidities such as hypertension, diabetes, mitral regurgitation, atrial fibrillation, and autonomic dysfunction, heart failure etc. In cases where specific comorbidities contraindicate certain drug classes, the appropriate treatments become clearer. Anti-anginal drugs without significant hemodynamic effects may be preferable for patients with low heart rate or low blood pressure.

In conclusion, a comprehensive understanding of myocardial ischemia, beyond the traditional "stenosis-centric" view, is essential for providing effective and personalized care to patients with angina. By embracing this multifaceted approach, we can optimize medical therapy and improve outcomes for individuals with ischemic heart disease.

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ORIGINAL ARTICLE

Effect of Intravenous Iron on Functional Capacity in Patients with Ischemic Cardiomyopathy

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Abstract

Background: Iron deficiency is common in heart failure with reduced ejection fraction. Intravenous (IV) iron supplementation has been found to reduce morbidity in heart failure. However, the effect of IV iron on Bangladeshi patients with heart failure are not known.

Objects: The study was done to see the effect of IV iron on functional capacity in Bangladeshi patients with ischaemic cardiomyopathy (ICM) and iron deficiency.

Methodology: In this quasi-experimental study, out of 80 hospitalized patients with ICM and iron deficiency, 40 were given IV ferric carboxymaltose (FCM) in addition to standard therapy of heart failure, while another 40 were randomized to standard therapy alone. Primary outcome measure was changes in six-minute walk test (6MWT) distance, while secondary outcome measures were changes in New York Heart Association (NYHA) functional class, left ventricular ejection fraction (LVEF) and plasma NT-proBNP at Weeks 4 and 12.

Results: 6MWT distance improved significantly in patients receiving IV iron therapy compared to the patients not receiving IV iron. LVEF improved and plasma NT-proBNP decreased significantly in IV iron-treated patients than in patients receiving standard therapy. However, improvement in NYHA functional class was not statistically significant.

Conclusion: In Bangladeshi patients with ICM and iron deficiency, IV FCM on top of standard heart failure therapy was associated with improved functional capacity.

Keywords: Heart Failure, Cardiomyopathy, Ferric Carboxymaltose, Bangladesh.

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Introduction

Ischaemic cardiomyopathy (ICM) is a state of left ventricular systolic dysfunction due to coronary artery disease (CAD).[1] It is one of the end-stage sequalae of CAD, and is an important cause of heart failure. In fact, CAD is considered the most common cause of heart failure which affects 1–2% of the general population and 10% of people e”70 years.[2] On the other hand, despite state-of-the-art treatment including angiotensin-converting enzyme (ACE) inhibitors, beta-blockers, and spironolactone, survival and relief from symptoms still are unacceptably poor in patients with chronic heart failure.[3] In a population-based cohort study in the UK over 2000 to 2017, overall, 1-, 5-, and 10-year survival rates increased by 6.6% (from 74.2% in 2000 to 80.8% in 2016), 7.2% (from 41.0% in 2000 to 48.2% in 2012), and 6.4% (from 19.8% in 2000 to 26.2% in 2007), respectively.[4] To improve the prognosis of heart failure, including those due to ICM, there is a continuous evolution in the management strategy of heart failure. Recently, angiotensin receptor-neprilysin inhibitor (ARNI), and sodium-glucose cotransporter 2 inhibitor (SGLT2) have been added to the existing armamentarium in the battle against heart failure. Side by side, special attention has been paid to explore and deal with other loopholes in relation to heart failure including ICM – presence of concomitant iron deficiency is one of them. Approximately 50% of patients with heart failure have concurrent iron deficiency with or without anaemia.[5-7] Within a heart

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failure population, iron deficiency is associated with a worse prognosis.[8,9]

Given the significance of iron deficiency in heart failure, several randomized controlled trials (RCTs), including FAIR-HF, CONFIRM-HF, EFFECT-HF, and AFFIRM-AHF, have demonstrated significant benefit in terms of functional capacity and heart failure hospitalization.[10-2] Among Southeast Asian patients hospitalized with decompensated heart failure, single-dose Intravenous (IV) ferric carboxymaltose (FCM) administered pre discharge did improve functional capacity in PRACTICE-ASIA-HF study.[13] Despite paucity of statistics, heart failure appears to be common in Bangladesh. Also, ICM as a cause of heart failure may be common as well. In a hospital-based cross-sectional study carried out at the National Institute of Cardiovascular Diseases (NICVD), Dhaka Bangladesh, ICM was the commonest cause of heart failure (n=153, 40.75%).[14] But, the effect of intravenous iron in Bangladeshi heart failure patients, specially those with ICM, has not been studied adequately. Therefore, the present study was done to evaluate the efficacy of intravenous iron in Bangladeshi patients with ICM.

Methods:

Study design

This was a quasi-experimental study conducted in NICVD, Dhaka, Bangladesh. The study protocol was approved by the Ethical Review Committee (ERC) of NICVD, and the study was conducted in accordance with the principles of the World Medical Association Declaration of Helsinki on ethics in medical research and International Conference on Harmonization guidelines for Good Clinical Practice. Written informed consent was obtained from all participants.

Eligibility

All patients of either sex aged >18 years hospitalized for heart failure (diagnosed clinically based on the European Society of Cardiology guidelines) with NYHA functional class II or more and LVEF <40%, and with concurrent iron deficiency (defined as serum ferritin < 100 ìg/L, or serum ferritin 100-299 ìg/L with transferrin saturation < 20%) were eligible for the study. Patients with acute myocardial infarction (MI) within 30 days, valvular or congenital heart disease, pregnancy or postpartum, chronic kidney disease, chronic pulmonary disease, cor pulmonale, stroke, malignancy, haemoglobinopathy, active bacterial infection, and known hypersensitivity to FCM were excluded.

Screening and randomization

Subjects were randomized in a 1:1 ratio to FCM in addition to standard therapy, or standard therapy alone.

Study treatment

Active treatment included two doses of FCM solution (Ferisen, Healthcare Pharmaceuticals Ltd.) 1000 mg/ 20 mL given slow IV bolus injection over 15 min – the first dose during index hospitalization, and the second dose 6 weeks after the 1st dose during the first follow up.

Assessments

The study subjects underwent physical examination, laboratory investigations including serum iron profile (serum ferritin, serum iron, total iron binding capacity, and transferrin saturation), plasma NT-proBNP, complete blood count, random blood sugar, serum creatinine, and routine urinalysis, and electrocardiography (ECG) and echocardiography. Functional capacity was assessed by six-minute walk test (6MWT) done at baseline upon stabilization of heart failure prior to administration of treatment. Plasma NT-proBNP was assayed by chemiluminescence immunoassay using the ALINITY I immunoassay system (Abbott Laboratories, Abbott Park, Illinois, U.S.A.). Echocardiographic examination was carried out by Philips EPIQ 7C Premium Cardiology Ultrasound System (Koninklijke Philips N.V., Amsterdam, Netherlands) following the recommendations of the American Society of Echocardiography (ASE).[15,16] 6MWT was performed as per American Thoracic Society 2002 guidelines[17], and the 6MWT distance was determined during index hospitalization before giving the IV iron.

Follow up was done twice – at 6 weeks, and at 12 weeks. At each follow up, each patient was evaluated by history, physical examination, and investigations with particular attention to NYHA functional class, plasma NT-proBNP, echocardiography, and 6MWT. The findings were recorded in the predesigned form.

Study endpoints

The primary endpoint was change in 6MWT distance over the 12 week period. The secondary endpoints were changes in NYHA functional class, plasma NT-proBNP, and left ventricular ejection fraction (LVEF) at Weeks 4 and 12.

Statistical considerations

The sample size was calculated as follows:

The equation for computing sample size (n) is $n= Z^2pq/e^2$

Here,

n = required sample size

Z = confidence level at 95% (standard value of 1.96)

p = estimated prevalence

q = 1-p
e = margin of error at 5% (standard value of 0.05)
Here, p = 0.050, and q=1-0.050= 0.95
$(1.96)^2$ x 0.050 x 0.95/ $(0.05)^2$

So, n = 72

Considering non-response and unavailability of some study subjects, the targeted sample size for the study was 72+8 = 80.

The sample was divided into two groups – Group I comprised of 40 patients treated with IV iron in addition to standard therapy of heart failure, and Group II comprised of 40 patients treated with standard therapy of heart failure alone.

Statistical analysis was performed in the Statistical Package for the Social Sciences (SPSS) program for Windows, version 10.0. Data was expressed as mean ± SD or percentages for categorical variables. Comparability of both groups at baseline was confirmed using the Student's t test for independent series. The changes in parameters after treatment was compared using repeat measures analysis of variance. A two-tailed p value of 0.05 or less was considered significant.

Results

A total of 80 patients heart failure and ICM were randomized into two groups: Group I comprised of 40 patients who received IV iron, and Group II comprised of 40 patients who did not receive IV iron. Baseline characteristics did not differ significantly between the two groups except for the blood sugar which was higher in Group II. (Table I)

Table-I

Baseline characteristics of the study patients (N=80)

Trait	Group I(n=40)	Group II (n=40)	*p* value
Sex			
Male (n, %)	18 (45.0)	26 (65.0)	0.204
Female (n, %)	22 (55.0)	14 (35.0)	
Age, years (SD)	54.9 (11.53)	56.26 (13.16)	0.165
Cardiovascular risk factors			
Hypertension (n, %)	24 (60.0)	22 (55.0)	0.749
Diabetes (n, %)	18 (45.0)	26 (65.0)	0.204
Dyslipidemia (n, %)	06 (15.0)	04 (10.0)	0.632
Smoking (n, %)	02 (5.0)	04 (10.0)	0.548
History of MI (n, %)	30 (75.0)	28 (70.0)	0.723
Renal impairment (n, %)	08 (20.0)	04 (10.0)	0.376
NYHA functional class			
I (n, %)	00 (0.0)	00 (0.0)	0.815
II (n, %)	12 (35.0)	12(35.3)	
III (n, %)	12 (30.0)	06(17.6)	
IV (n, %)	16 (47.1)	16(47.1)	
Medication			
Beta blocker (n, %)	14 (35.0)	10(25.0)	0.490
ACE inhibitor (n, %)	06 (15.0)	10(25.0)	0.429
Valsartan-sacubitril (n, %)	16 (60.0)	10 (25.0)	0.311
Digoxin (n, %)	24 (60.0)	14(35.0)	0.744
Diuretics (n, %)	30 (75.0)	32(80.0)	0.705
Biochemistry			
Hb, g/dL (SD)	11.32 1.6)	12.25 (1.7)	0.875
Blood sugar, mmol/L (SD)	8.53 (3.0)	10.04 (6.6)	0.005
Serum creatinine, mg/dL (SD)	1.31 (0.5)	1.19 (0.4)	0.267
Plasma NT-proBNP, ng/mL (SD)	6431.48 (9491.1)	5065.07 (5796.2)	0.420
LVEF, % (SD)	29.92 (8.4)	31.66 (12.1)	0.645
6MWT distance, m (SD)	132.50 (123.6)	152.63 (155.9)	0.205

ACE, angiotensin-converting enzyme; MI, myocardial infarction; Hb, haemoglobin; LVEF, left ventricular ejection fraction; m, meter; NYHA, New York Heart Association; SD, standard deviation; 6MWT, 6-minute walk test.

The primary outcome measure, i.e., 6MWT distance improved significantly in Group 1 patients receiving IV iron therapy compared to Group II patients not receiving IV iron. (Table 2, Figure 1) Among the secondary outcome measures, LVEF improved and plasma NT-pro BNP decreased significantly in Group I than in Group II. After intervention with IV iron, compared to the Group II, numerically more patients in Group I shifted from NYHA functional class IV and III to NYHA functional class II and I, indicating improvement of functional class, however, the differences between the groups did not reach statistical significance. (p>0.05) (Table 2)

Table-II

Comparison of outcome parameters of the study patients in follow-up (N=40)

Outcome measure	1st follow up			2nd follow up		
	Group I	Group II	*p* value	Group I	Group II	*p* value
6MWD, m	281.50	197.75		385.50	200.00	0.000
(SD)	(130.6)	(110.5)	0.035	(138.3)	(83.9)	
NYHA class						
‘!, n (%)	00	00		06	00	
	(0.0)	(0.0)		(15.0)	(0.0)	
a!, n (%)	20	10		28	14	
	(50.0)	(25.0)	0.436	(70.0)	(35.0)	0.765
b!, n (%)	18 (45.0)	16		6	14	
		(40.0)		(15.5)	(35.0)	
c!, n (%)	02	14		00	12	
	(5.0)	(35.0)		(0.0)	(30.0)	
LVEF (%)	38.75 (6.9)	32.25 (8.1)	0.010	47.70 (8.4)	36.74(12.3)	0.002
Plasma NT-proBNP,	2286.01	4935.99	0.44	1446.09	4804.23	0.015
ng/mL (SD)	(2705.6)	(6220.2)		(1647.3)	(5558.6)	

LVEF, left ventricular ejection fraction; NYHA, New York Heart Association; SD, standard deviation; 6MWD, 6-minute walk distance.

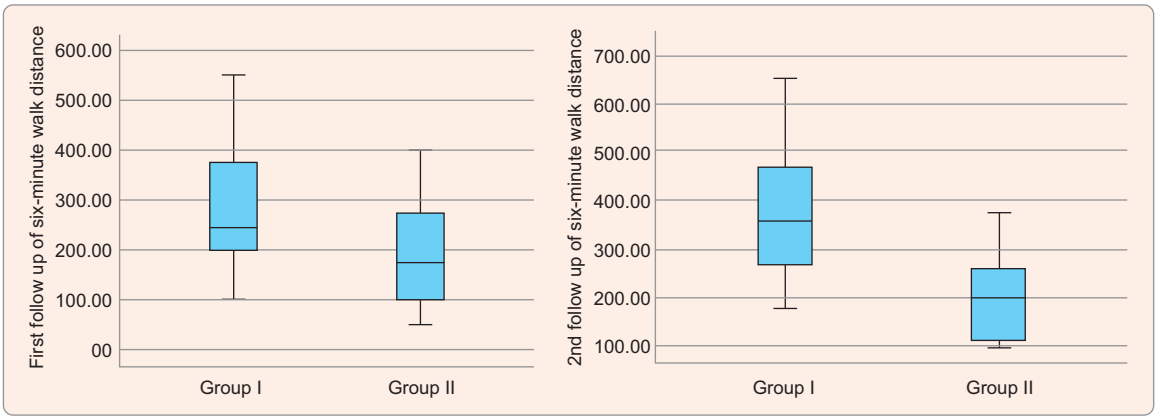


Figure 1: *Six-minute walk test distance of study subjects in follow up.*

Discussion

This open-label study involved 80 patients with ICM divided into two groups: Group I comprised of 40 patients who received IV iron, and Group II comprised of 40 patients who did not receive IV iron. The primary outcome measure was the change in 6MWT distance, whereas the secondary outcome measures were changes in NYHA functional class, LVEF, and plasma NT-proBNP in ICM patients with and without IV iron therapy.

6MWT distance and LVEF improved, and plasma NT-proBNP decreased significantly in IV iron group compared to the standard therapy group. 6MWT distance was used as a primary outcome measure in CONFIRM-HF[11] and PRACTICE-ASIA-HF[13] studies. In both RCTs, significant improvement in 6MWT distance occurred.

Among the secondary outcome measures, LVEF increased significantly in IV iron-treated ICM patients compared to the patients receiving standard therapy. Improvement in LVEF was found in 6-month follow-up in the patients treated with IV iron in the study by Toblli et al.[18] In the present study, plasma NT-pro BNP decreased significantly from baseline in follow ups in both the groups. When compared, the mean plasma NT-pro BNP was significantly lower in iron-treated patients than in non-iron-treated patients. Reduction in plasma NT-pro BNP was found in 6-month follow-up period in the patients treated with IV iron in the study by Toblli et al.[18] In EFFECT-HF trial, FCM had no significant effect on plasma BNP, however, a statistically significant lower increment in NT-pro BNP was observed in FMC-treated group compared to the standard-treatment group at 24 weeks.[12] In the present study, improvement in NYHA functional class was noted in follow up in patients receiving IV iron, as well as, in those receiving standard therapy alone, but for the former, the differences were statistically significant. When the groups were compared, after intervention with IV iron in 1st and 2nd follow-ups, however, the differences between the groups in changes in NYHA functional class did not reach statistical significance. In FERRIC-HF[19], FAIR-HF[10], CONFIRM-HF[11], and EFFECT-HF[12] study, improvement in NYHA functional class was observed often in longer follow up. Our study involved only 12 weeks of follow up; this shorter follow up may be an explanation for failure to reach statistical significance in improvement in NYHA functional class between the groups.

The study has got some limitations. This was an open-label study, so, there was a risk of bias. The sample-size was also relatively small. Because of ongoing COVID-19 pandemic, the timeframe could not be maintained properly. Iron deficiency may or may not accompany anaemia; subgroup analysis involving those with and without anaemia was not done. Fixed doses of FCM were used for all in the present study, but the change in iron status as a result of IV iron administration might be different in the study subjects. Also, effect of IV iron on hospitalization due to heart failure was not addressed.

Conclusion

In patients with ischaemic cardiomyopathy and iron deficiency, administration of IV iron in addition to the standard therapy of heart failure, is associated with improvement of functional capacity. Compared to those not receiving IV iron, 6MWT distance and LVEF increase, NYHA functional class improves, and plasma NT-pro BNP decreases in patients receiving IV iron.

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ORIGINAL ARTICLE

Association of Risk Factors of Acute Myocardial Infarction and Heart Blockage Among non-diabetic Patients in a Tertiary Care Hospital – An Observational Study

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Abstract

Introduction: Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide. Cardiovascular diseases account for more than 17 million deaths globally each year. Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors.

Aim of the study: The aim of this study was to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.

Methods: This was an observational study conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction.

Result: Mean age was 53.03±11.3 years & most of our patients were male. Among all patients, majority (65%) patients had >60% blockage, followed by 30(25%) patients had 40%-60% artery blockage, and <40% blockage was found in 10% patients. Hypertension, dyslipidemia & dyslipidemia with hypertension, age ≥60 years, family history of CHD, smoking, diabetes & obesity were individual risk factors of CHD among non-diabetic patients. The most common risk factors for heart blockage were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life.

Conclusion: In our study, we found hypertension, history of CHD, dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, and obesity were individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients.

Keywords: Myocardial infarction, Non-diabetic, Risk factor

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Introduction

Cardiovascular diseases (CVDs) are a leading cause of death in the world. In 2015, an estimated 442.7 million prevalent cases of CVD were present worldwide.[1] Cardiovascular diseases account for more than 17 million deaths globally each year. This figure is expected to grow to 23.6 million by the year 2030. Ischemic heart disease alone caused 7 million deaths worldwide in 2010, an increase of 35% since 1990.[2] CVD accounted for 27% of all deaths in South Asia in 2013. This has been a substantial rise since 1990 when CVD accounted for only 15% of deaths.[3] The prevalence of coronary artery disease (CAD) in Bangladesh is about 4-6% and CVD is responsible for 17% of total deaths.[4] Coronary artery disease may manifest clinically as either chronic stable angina or

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acute coronary syndrome.[5] ACS encompasses unstable angina (UA), ST-segment elevation MI (STEMI), or acute non-ST-segment elevation MI (NSTEMI). ACS without myocardial necrosis is defined as UA, whereas myocardial necrosis is a necessary component of either STEMI or NSTEMI.[6] STEMI is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with ST elevation in the ECG and release of biomarkers of myocardial necrosis.[7]

At present, STEMI comprises approximately 25% to 40% of all MI presentations. Although subjects with STEMI or NSTEMI share the same cardiovascular risk factors, patients with STEMI have worse short-term mortality compared with patients with NSTEMI.[8] As there is considerable variability in short-term mortality risk, therefore, in patients with STEMI, early risk stratification is crucial for successful initial management.[9] The pathogenesis of coronary artery disease remains incompletely understood. Interplay between environmental and genetic factors likely to the pathophysiology of coronary artery disease. The classic risk factors such as hypertension, dyslipidemia, diabetes mellitus and smoking undoubtedly play a vital role; in addition some emerging risk factors and as-yet-unrecognized factors may be important.[10] However, they do not entirely explain the variation in cardiovascular disease incidence and mortality between individuals and among population.[11] Therefore, additional risk factors have been proposed to better identify patients potentially at risk for CAD.[12] Many individual new biomarkers have been related to cardiovascular risk, including levels of CRP (C-reactive protein), B-type natriuretic peptide (BNP), fibrinogen, D-dimer and homocysteine. Among these new biomarkers is microalbuminuria (MAU), which is gaining recognition as a marker of an atherogenesis, owing to its association with several atherosclerotic risk factors and early systemic vascular (endothelial) damage.[13] Microalbuminuria (MAU) as a biomarker now a day is also considered a risk marker for CHD in diabetics and non-diabetics.[14]

The prevalence of coronary artery disease (CAD), a major contributor to CVD, is related to the increasing prevalence of modifiable risk factors.[15] Previous studies identified diabetes mellitus, hypertension, hypercholesterolemia, smoking, alcohol consumption, obesity and sedentary lifestyle as risk factors.[16,17] Other risk factors identified were waist-to-hip ratio, dietary patterns, physical inactivity, blood apolipoproteins, psychosocial factors, loneliness and social isolation and C-reactive protein, uric acid and homocysteine levels.[18-22] Therefore, in this study we aimed to determine the risk factors for acute myocardial infarction associated with heart blockage among non-diabetic patients.

Methodology & Materials

This was an observational study and conducted in the Department of Cardiology of Jashore Medical College Sadar Hospital, Jashore, Bangladesh during the period from April, 2021 to March, 2022. In this study, we included 120 non-diabetic patients who were diagnosed with myocardial infarction.

These are the following criteria to be eligible for the enrollment as our study participants: a) Patients aged above 20 years old; b)Patients with ST-elevation myocardial infarction; c) Patients with non ST-elevation myocardial infarction; d) Patients with acute myocardial infarction; e) Patients who were willing to participate were included in the study And a) Patients with Diabetes mellitus; b) Patients with Coagulopathy; c) Patients with previous H/O of myocardial infarction ; d) Patients with cardiomyopathy; e) Patients with any history acute illness (e.g., renal or pancreatic diseases etc.) were excluded from our study.

After admission of a patient with chest pain suggestive of acute coronary syndrome, a detailed history and physical examination was performed. Patients were asked about the major modifiable risk factors profile of coronary artery disease such as hypertension, diabetes mellitus, smoking status, dyslipidemia and family history of CVD. Previous medical records were also checked for these risk factors.

A 12-lead resting ECG was done at a paper speed of 25 mm and 10 mm standardization at admission by placing the leads in proper position. Under aseptic precaution blood sample for highly sensitive troponin I was drawn on first assessment (designated as 0 hour). sample was then sent to same standard laboratory for estimation of highly sensitive cardiac troponin-I level. Another sample was sent 3 to 6 hours after first sample.

The diagnosis of acute STEMI was made with electrocardiographic (ECG) changes i.e., ST-segment elevation at the J point in 2 contiguous leads with the cut-point: 21 mm in all leads other than V2-V3 where the following cut-points apply. ≥2 mm in men 240

years: ≥2.5 mm in men <40 years, or ≥1.5 mm in women regardless of age. Plus, clinical evidence of acute myocardial ischemia and detection of a rise and /or fall of Tn I values with at least 1 value above the 99th percentile of upper reference limit.

Statistical Analysis: All data were recorded systematically in preformed data collection form and quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. Statistical analysis was performed by using SPSS (Statistical Package for Social Sciences) for windows version 10. Probability value <0.05 was considered as level of significance. The study was approved by Ethical Review Committee of Jashore Medical College Sadar Hospital , Jashore, Bangladesh.

Results

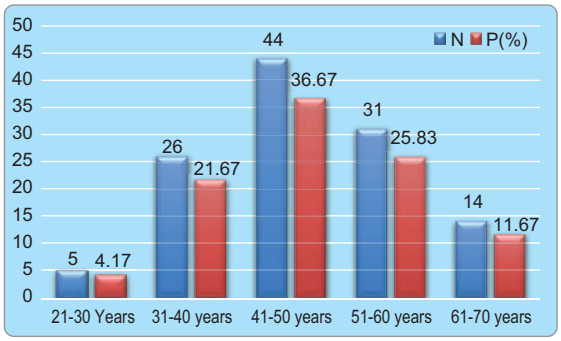


Figure 1: *Age distribution of our study patients*

Figure 1 shows that majority (36.67%) of participants belonged to the age group 41-50 years, followed by 25.83% of participants were 51-60 years and 21.67% belonged to the age group 31-40 years. Only 11.67% & 4.17% patients were found in 61-70 years & 21-30 years age group respectively.

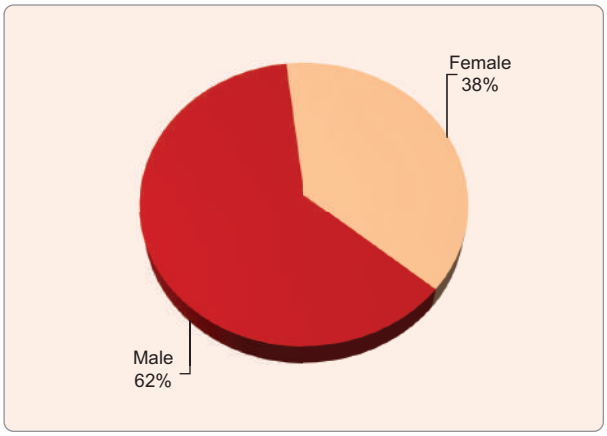


Figure 2: *Gender distribution of our study patients*

Figure 2 shows that most of the participants were male (62%) compared to female (38%).

Table-I

Baseline characteristics of our study subjects

Baseline characteristics	N	P(%)
Mean age (years)	53.03±11.3	
History of hypertension	44	36.67
Family History of CHD	43	35.83
History of dyslipidemia	38	31.67
BMI (kg/m^2)	28.97±4.24	
Heart Rate (per minute)	86 ± 17	
Systolic blood pressure (mm Hg)	135.24 ± 20.78	
Diastolic blood pressure (mm Hg)	83.94 ± 10.69	
Mean FBG (mg/dL)	119.45 ± 63.10	
Triglycerides (mg/dL)	187.85±55.04	
Total cholesterol (mg/dL)	199.83 ± 42.16	
HDL (mg/dL)	40.21 ± 9.05	
LDL (mg/dL)	122.35 ± 35.59	
CAG findings		
<40%	12	10.00
40% - 60%	30	25.00
>60%	78	65.00

CVD= cardiovascular disease, BMI = body mass index, FBS = fasting blood glucose, HDL=high-density lipoprotein, LDL=low-density lipoprotein

Table 1 shows the baseline characteristics of our study participants. We found the mean age was 53.03±11.3 years. Among all patients, 36.67% had family history of hypertension, 35.83% & 31.67% had history of CVD & dyslipidemia respectively. Among all patients, BMI was 28.97±4.24 kg/m^2. Heart rate was 86 ± 17 per mins. Both systolic & diastolic bp were 135.24 ± 20.78 & 83.94 ± 10.69 respectively. Cholesterol was found 199.83 ± 42.16 mg/dL, and HDL & LDL were found 40.21 ± 9.05 & 122.35 ± 35.59 mg/dL respectively. Among all patients, majority (65%) patients had >60% blockage, followed by 30(25%) patients had 40-60% artery blockage , and <40% blockage was found in 10% patients.

Table-II

Risk factors for myocardial infarction among non-diabetic patients

Risk Factors	N	P(%)	P-value
Dyslipidemia	67	55.83	0.02
Hypertension	82	68.33	0.04
Dyslipidemia with hypertension	58	48.33	0.03
Stress	26	23.33	0.01
Age e" 60 years	12	10.00	0.01
Family history of CHD	35	29.17	0.02
History of CHD	43	35.83	0.03
Smoking	49	40.83	0.01
Obesity	38	31.67	0.01

Table 2 shows the risk factors for myocardial infarction. Among 120 cases, majority (68.33%) patients had hypertension. We found dyslipidemia was 55.83%. Dyslipidemia with hypertension was found in 48.33% cases. Stress, age ≥60 years, family history of CHD, history of CHD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients.

Table-III

Association of risk factors for heart blockage in myocardial infarction patients

Risk Factors	N	P(%)	P-value
Age > 45 years	75	62.50	0.01
High blood pressure	82	68.33	0.01
High low-density lipoprotein (LDL) cholesterol	72	60.00	0.01
Overweight or obesity	28	23.33	0.01
Unhealthy diet	94	78.33	0.02
Smoking	43	35.83	0.01
Rheumatoid arthritis	27	22.50	0.04
Stressful life	89	74.17	0.01
Physical inactivity	45	37.50	0.02

Table 3 shows the association of risk factors for heart blockage in myocardial infarction patients. The most common risk factors were age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life. There were some other individual risk factors that were found in our patients like smoking, being overweight, rheumatoid arthritis, and physical inactivity.

Discussion

In our study majority (36.67%) of participants belonged to the age group 41-50 years. A study conducted by Bahall et al found the majority of patients were in 60-69 years age group.[23] In this study we found female were 38% and male were 62%. Bahall et al found male 55% & female 45% in their study similar to our study.[23] We found the mean age was 53.03±11.3 years. In the study by Haffner et al., with 7 years of follow-up, the mean age of the study population at baseline was less than 60 years,[24] whereas in many other studies the mean age of the study population was 60–65 years at baseline.[25-27] Bahall et al found the overall mean age of all patients was 59.9 ± 12.07 years.[23]

In our study, hypertension was the most common risk factor for AMI in non -diabetic patients. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, family history of CHD, CAD, smoking, diabetes & obesity were also individual risk factors of CHD among non-diabetic patients. Traditional risk factors such as hypertension, diabetes mellitus, history of IHD, family history of IHD, smoking and alcohol consumption, but not stress and hypercholesterolemia, were associated with AMI. These risk factors were also identified in the Framingham Heart study and the INTERHEART study.[28,29] Stress and hypercholesterolemia have been identified as risk factors in other studies.[30,31] This may have been related to the patients' unclear understanding and lack of uniformity among patients' understanding of hypercholesterolemia confirmation. The lack of an association, though, has also been noted in other studies.[23] Quintana et al. found that hyperlipidemia was not associated with myocardial infarction-related fatality.[32] In a study conducted by Goldfeld et al., patients with cardiac symptoms without overt CAD showed similar depression and/or stress levels as post-myocardial infarction patients.[33] Hypercholesterolemia is still a cause of concern since it is related to dietary patterns and type of food consumption.[34] Clusters of risk factors for CAD have been identified in numerous studies in Trinidad.[23] Thomas et al. revealed that diabetes mellitus, hypertension, hyperlipidemia and cigarette smoking were prevalent among patients presenting with AMI.[35] Mungrue et al. identified smoking and BMI as predictors of AMI-related death or survival.[36] Smoking was associated with a 1.6-times higher risk for AMI and BMI with a 1.3-times higher risk.[36] Alfred et al. found the most common risks associated with AMI in Tobago to be dyslipidemia, hypertension and diabetes mellitus.[37] Smoking, diabetes, hypertension and history of CAD were found to be the most common

cardiovascular risk factors in Libya,[38] and smoking and a family history of CAD were the common ones in Pakistan.[39] In a study on the epidemiology of myocardial infarction, associated risk factors for AMI mortality included age of > 84 years, female sex, educational level and smoking.[40]

In the Nurses' Health Study the excess risk of CHD mortality associated with prior CHD was higher than that associated with diabetes in all age groups studied (<55 years, 55–64 years and ≥65 years). This was, however, dependent on the duration of diabetes so that in women with a diabetes duration of more than 15 years the risk of CHD death was similar to that in women with prior CHD but no diabetes.[41] It is well-documented that diabetes raises the risk of CHD to a greater extent in women than in men.[42,43] It is as yet unknown what generates this increased risk in diabetic women that already exists in the prediabetic stages as it is only partly explained by an excess of the classic risk factors.[44,45] However, in the study by Mukamal et al. the results were sensitive to the duration of diabetes; when newly detected cases of diabetes were added to the analysis, CHD conferred a higher risk than diabetes.[42] Bahall et al found that diabetes, hypertension, smoking and alcohol consumption were significantly associated with AMI cases. However, stressful life, hypertension, hypercholesterolemia and smoking showed significant associations among controls.[23] This is in contrast to the findings of Kawano et al. who found that hypercholesterolemia is an independent risk factor for AMI in men but not in women.[46]

Limitations of the study

Our study was a single-centre study. We took a small sample size due to our short study period. There are more risk factors of myocardial infarction that needs to be evaluated. After evaluating once those patients we did not follow-up them for a long term and have not known other possible interference that may happen in the long term with these patients.

Conclusion and recommendations

In our study, we found hypertension, history of CHD, family history of CHD, smoking is associated with CHD. Dyslipidemia, dyslipidemia with hypertension, stress, age ≥60 years, and obesity were also individual risk factors for CHD. These elements work as crucial risk factors for myocardial infarction in non-diabetic patients. Risk factors like age >45 years, high blood pressure, high LDL, unhealthy diet, and stressful life were responsible for the highest heart blockage in myocardial infarction patients. Early identification of modifiable risk factors is important to set the strategy for prevention.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to identify more risk factors to prevent mortality among non-diabetic patients.

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ORIGINAL ARTICLE

Lesion Characterization by ^{99m}Tc-MIBI Myocardial Perfusion Imaging (MPI) & ^{18}F-FDG Cardiac PET Following Myocardial Infarction Before Revascularization & Outcome Prediction: Initial Experience in Bangladesh

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Abstract:

99mTc-MIBI SPECT myocardial perfusion imaging (MPI) and ^{18}F-FDG cardiac positron emission tomography (Cardiac PET) can assess the extent and severity of myocardial perfusion and metabolic defect following myocardial infarction (MI) and also able to predict the outcome before revascularization in known coronary artery disease patients. About 135 cases of known coronary artery disease patients were enrolled here for combined nuclear imaging tests, rest only ECG gated MPI and FDG cardiac PET to assess myocardial perfusion and viability status following MI prior to revascularization. In this study we want to figure out the utility of this combined protocol for myocardial lesion characterization and its role for clinical decision-making in-patient selection prior to revascularization and treatment planning. We are also intended to share the initial outcome in available follow up cases.

Key words: Myocardial perfusion imaging, FDG Cardiac PET, Coronary artery disease, Myocardial infarction, Revascularization.

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Introduction:

Assessment of myocardial perfusion & metabolism before revascularization following myocardial infarction in known coronary artery disease is crucial because accurate detection of disease severity is the key factor for guiding management and risk stratification. There are various perfusion and metabolic radiotracer used in SPECT and PET to identify myocardial blood flow and metabolism. After myocardial infarction, perfusion and metabolic defects can be identified by combined non-invasive nuclear imaging technique such as rest only gated MPI and 18F-FDG cardiac PET. In our country for SPECT MPI, we are using 99mTc-sestamibi, a lipophilic cation which, when injected intravenously to a patient, is taken up by the myocardial cell proportional to myocardial blood flow[1]. Although there is expanded use of FDG PET CT for oncology, FDG cardiac PET is an emerging modality to assess the metabolic status of myocardium which may be affected by physiologically significant coronary artery disease. Molecular imaging technique of nuclear cardiology has led to a better understanding of the pathophysiology of ischaemic heart disease[2]. Defining the pattern of match, mismatch or reverse mismatch defect(s) in this combined protocol, it is possible to distinguish between viable from non-viable myocardium, such as hibernating /stunned myocardium from infarcted/ scarred tissue[3]. It can also predict the outcome prior to revascularization. The first FDG Cardiac PET in Bangladesh was performed at INMAS, Dhaka on May 2018. Since then, about 200 cases were done in our center, among them we have selected 135 cases who were referred for combined perfusion and metabolic viability assessment before revascularization following MI. And we are also doing case based follow up of these patients to see the initial and long-term outcome.

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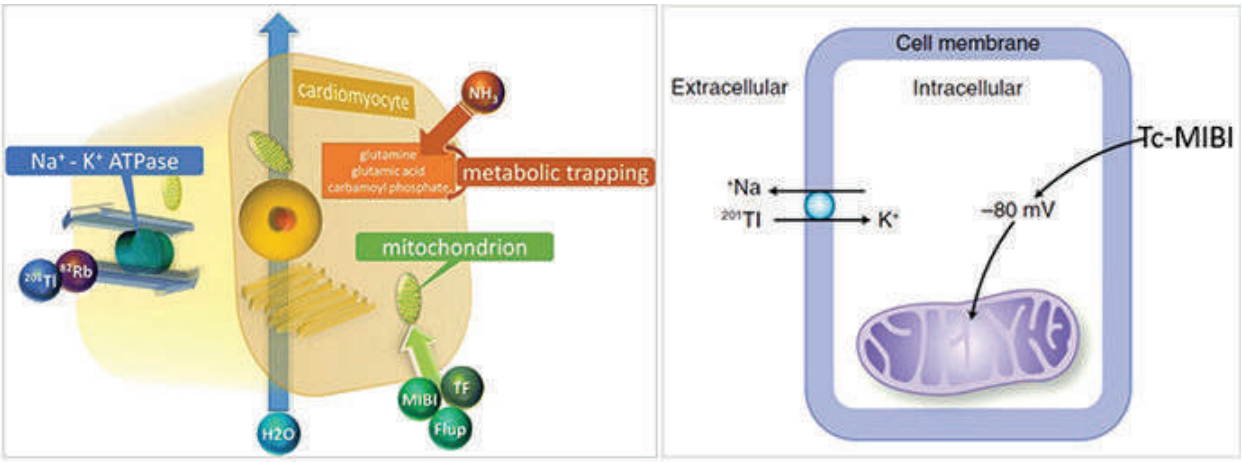


Figure 1: *Schematic representation of various radiotracers for myocardial perfusion imaging. Myocardial uptake of 99mTc-sestamibi is related to the presence of intact mitochondria (Image courtesy by Manabe, O. et al (2018). Radiopharmaceutical tracers for cardiac imaging. Journal of Nuclear Cardiology, 25(4), pp.1204–1236 (5).*

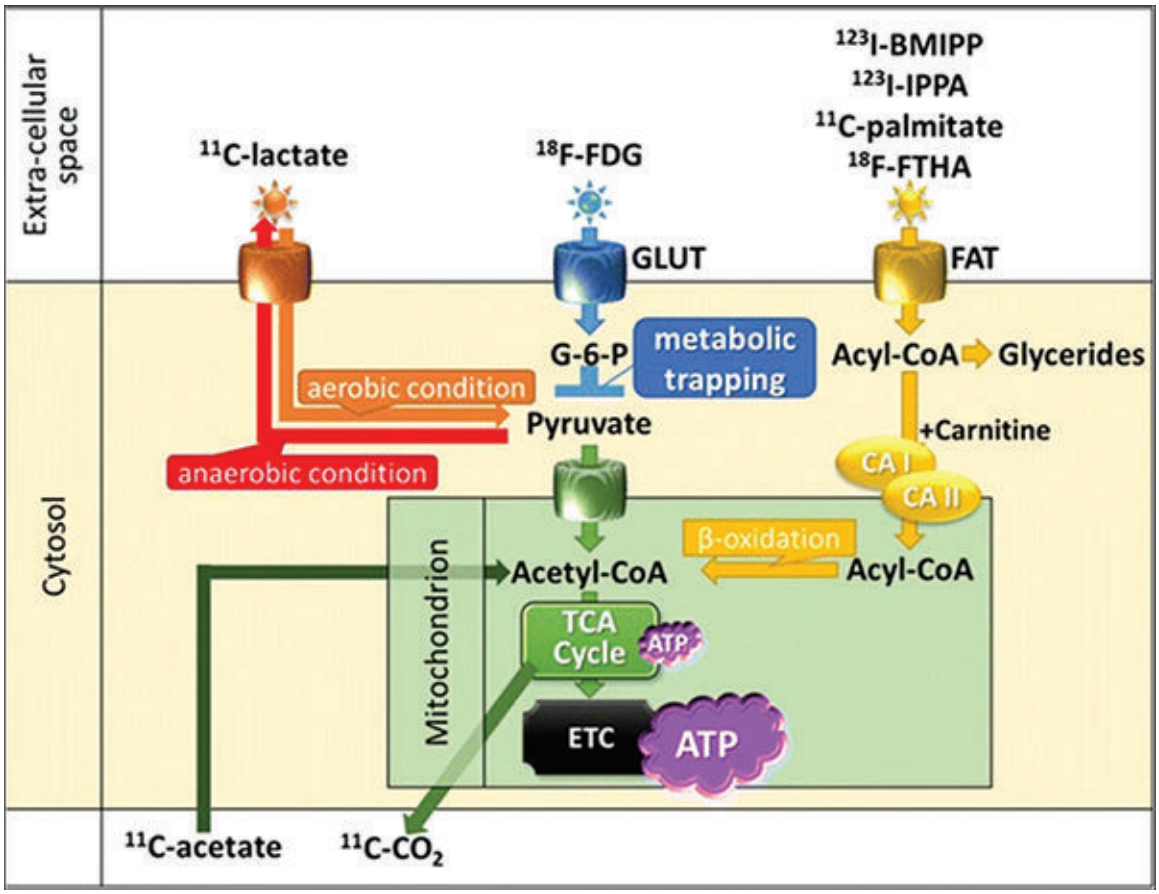


Figure 2: *Schematic representation of various myocardial metabolic tracers. 18F-FDG is a glucose analog actively transported into the cell by GLUT & phosphorylated as 18F-FDG-6-phosphate but it cannot enter glycolysis pathway. Thus, metabolic trapping of 18F-FDG in myocardium can be imaged by cardiac PET to assess myocardial viability. Image courtesy by Manabe, O. et al (2018). Radiopharmaceutical tracers for cardiac imaging. Journal of Nuclear Cardiology, 25(4), pp.1204–1236 (5)*

Materials and Methods:

Study population: In our study we have enrolled 135 patients of known coronary artery disease (M/F: 126/9, age range: 32-75 years). Clinical data from medical documentation: age, gender, weight, height, body mass index, comorbidities, clinical symptoms of heart disease, risk factors of cardiovascular disease, electrocardiography (ECG), echocardiography and coronary angiogram (CAG) findings were collected and analyzed. All patients underwent rest MPI and FDG cardiac PET imaging in combined two days protocol.

Rest MPI protocol: All patients were intravenously injected with a technetium 99m (^{99m}Tc) labeled sestamibi (8-10 mCi, adjusted to body mass index) at overnight fasting state. ECG gated SPECT MPI was performed 45-60 min after ^{99m}Tc -MIBI injection, with a dual-head Siemens Symbia-True point SPECT-CT gamma camera, using a low-energy, high-resolution collimator, a 20% window at 140 keV, 64 X 64 matrix, an orbit with 120 projections, at 3-degree steps and a 20 s per step, patient positioned in a supine position with the arms held above the head.[4]

FDG Cardiac PET Protocol: ECG gated FDG PET myocardial viability imaging was performed for all patients at overnight fasting state with oral glucose loading and intravenous insulin simultaneously. Fasting blood sugar was measured then 50 g oral glucose was administered if blood sugar level ≤150 gm/dl; amount of oral glucose was adjusted < 50 g in diabetic patient. Then blood sugar was monitored every 15 min interval up to 45-60 minutes and 18F-FDG was injected intravenously. ECG gated PET images were obtained 60 to 90 min after 18F-FDG injection using PHILIPS Ingenuity TF PET/CT system. The duration of PET acquisition was 15 min following a low-dose CT scan for attenuation correction.

Myocardial perfusion and metabolic defects were analyzed by MPI and PET derived data using 17 segment model. Finally, MPI and PET fusion imaging was done by Corridor4DM application software.

Results:

In our study most of the patents were in 51-60 years of age group (40%). Coronary angiogram data were available in 119 cases, majority had triple vessel disease (63%), 19% had double vessel disease and 18% had single vessel disease. MPI-PET study characterized the lesions in 5 points scoring system according to severity of myocardial perfusion and metabolic defect in 17 segment model (score 0: normal perfusion-metabolism, score 1-3 as mild, moderate and severe defect and score 4 as absent perfusion-metabolism). MPI-Cardiac PET fusion imaging characterized the

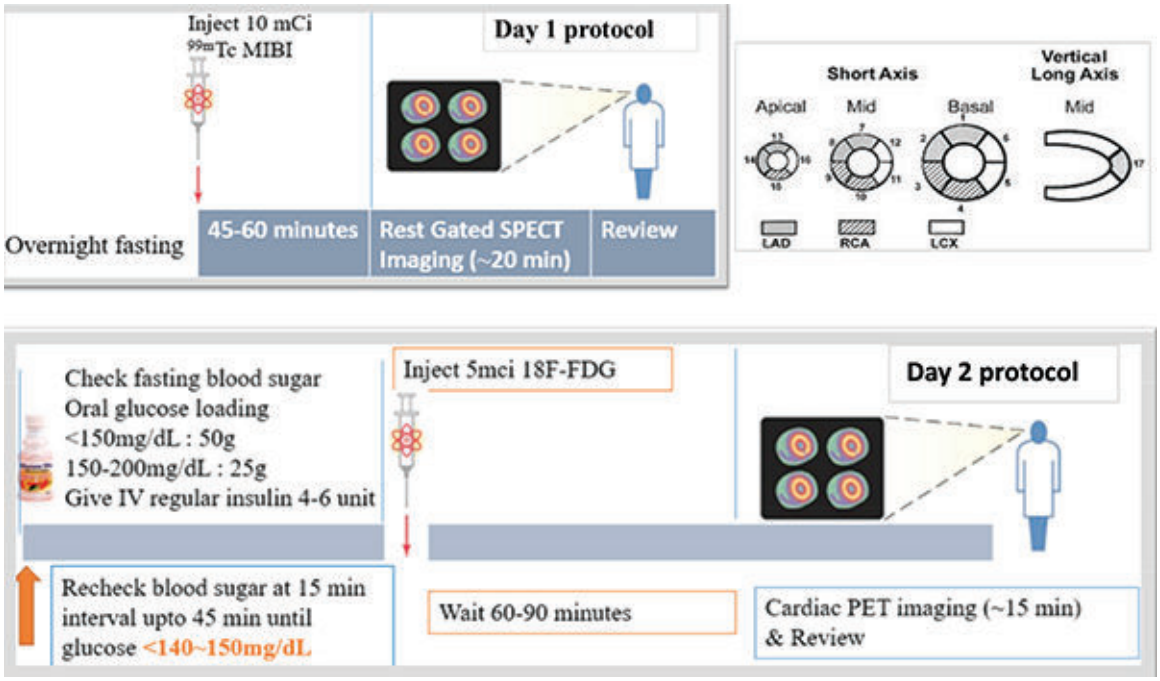


Figure 3: *Rest MPI and FDG Cardiac PET combined protocol and 17 segment model for image interpretation.*

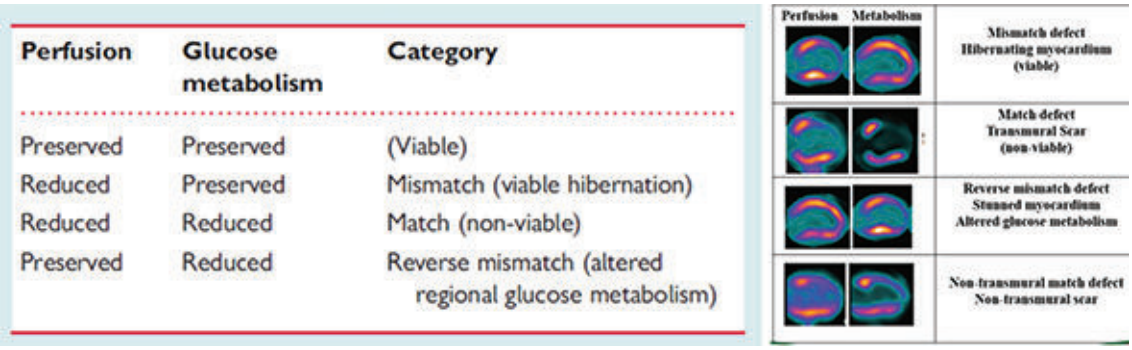


Figure 4: *(a) Simplified classification system for pattern of myocardial perfusion and metabolism (Courtesy by European Heart Journal (2010) 31, 2984–2995 doi:10.1093/eurheartj/ehq361) (6). (b) Radiotracer uptake patterns in myocardial lesion characterization (vertical long axis view).*

lesions in 4 groups along the three major coronary artery territories: severe match defect (absent perfusion-metabolism in infarcted/ scarred myocardium), mismatch defect (reduced/absent perfusion-preserved metabolism in hibernating myocardium), reverse mismatch defect (preserved perfusion-reduced metabolism in stunned myocardium) and mild to moderate match defect (reduced perfusion-reduced metabolism in hibernating myocardium).

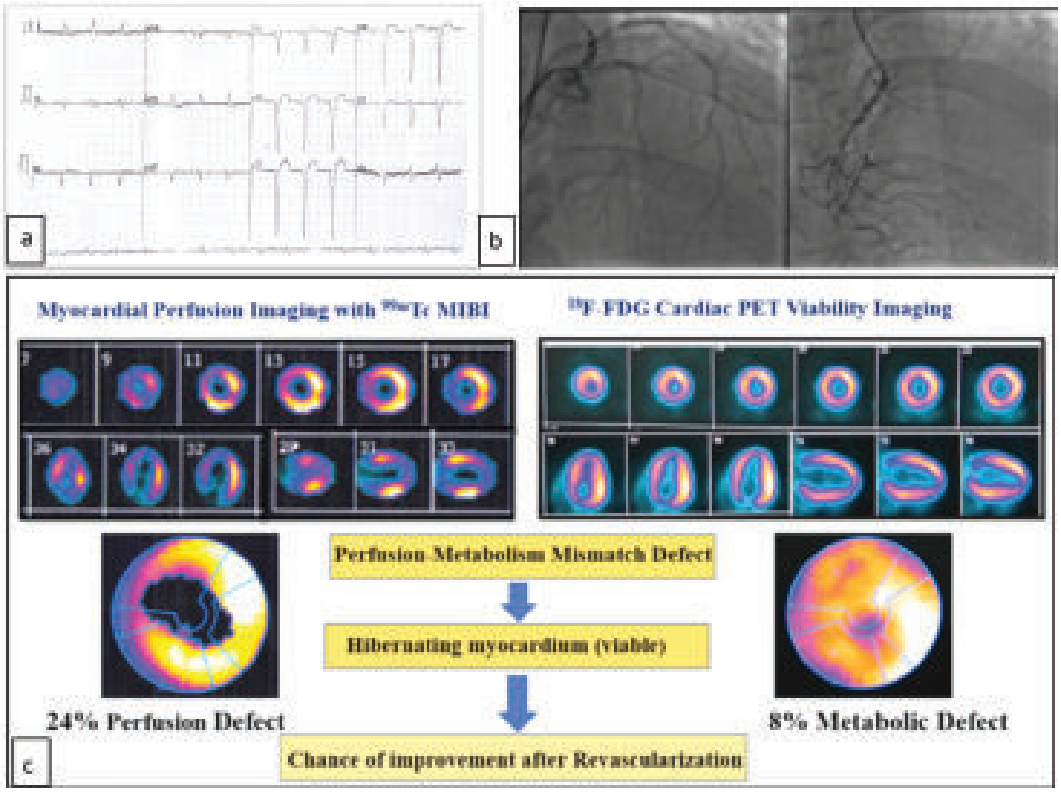


Figure 5 (case 1): *A 56 years old male was presented with acute anterior MI with LVF with HTN, DM and dyslipidemia. On ECG (a) pathological Q wave in lead V1-V4 with ST elevation. (b) CAG revealed triple vessel disease involving left main and LAD, LCX and RCA territory. (c) Combined rest MPI and FDG cardiac PET revealed mismatch defect in the apex, apical to mid anterior & anteroseptal wall, apical lateral wall and basal inferior and inferoseptal wall (24% perfusion and only 8% metabolic defect) with LVEF 30%. This patient underwent CABG with 3 grafts in LIMA to LAD & RSVG to OM & distal RCA. He showed significant clinical improvement (LVEF 45-50% on follow up echocardiogram) on 3 months onward.*

Positive outcome was predicted for mismatch defect having hibernating myocardium and also for stunned myocardium having altered glucose metabolism due to acute/recent coronary event. Negative outcome was predicted for severe match defects in corresponding coronary artery territory. Other parameters like LV global systolic function (ejection fraction%), cavity dilatation, wall thickness and wall motion abnormality derived from 3 D volumetric data of ECG gated MPI and cardiac PET were also account for overall impression to predict the outcome of individual patient. Initially we have collected follow up data in 30 cases, among them 3 patients had died before intervention due to comorbid condition, 10 underwent CABG, 4 had PCI and rest 13 were on medical treatment. Pre and post intervention follow up echocardiogram showed significant functional improvement of LV ejection fraction in mismatch defects group after surgical intervention whereas reverse mismatch group showed slow functional recovery.

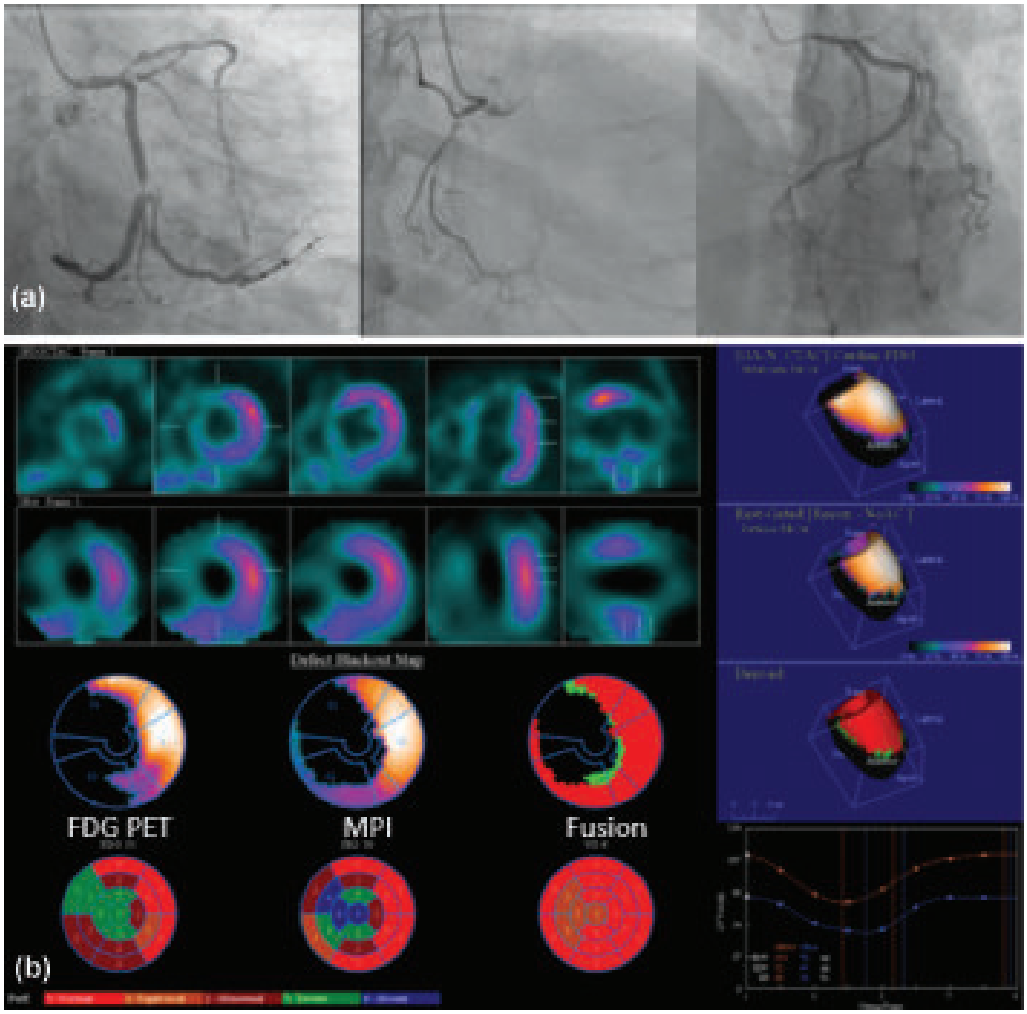


Figure 6 (case 2): *A 53 years old male was presented with post MI angina due to old anterior MI having ICM on echocardiogram with 30% LVEF. CAG (image a) revealed triple vessel disease; LAD: 90% ostio-proximal and 80% distal stenosis, LCX: 95% bifurcating lesion involving principal OM and 95% stenosis in proximal RCA. MPI and Cardiac PET fusion imaging (image b) showed large area of perfusion & metabolism severe match defect in the apex, anterior and anteroseptal wall along the LAD territory and inferior and inferoseptal wall along the RCA territory-signify large infarct with peri-infarct ischemia. Small area of reverse mismatch (stunned myocardium) in basal inferior wall. Approximately 48% perfusion & 52% metabolic abnormality in LV myocardium in fusion image. There was dilated LV cavity, global hypokinesia and severely reduced LV global systolic function (LVEF: 32%). So, this case was not suitable for revascularization and patient underwent medical management.*

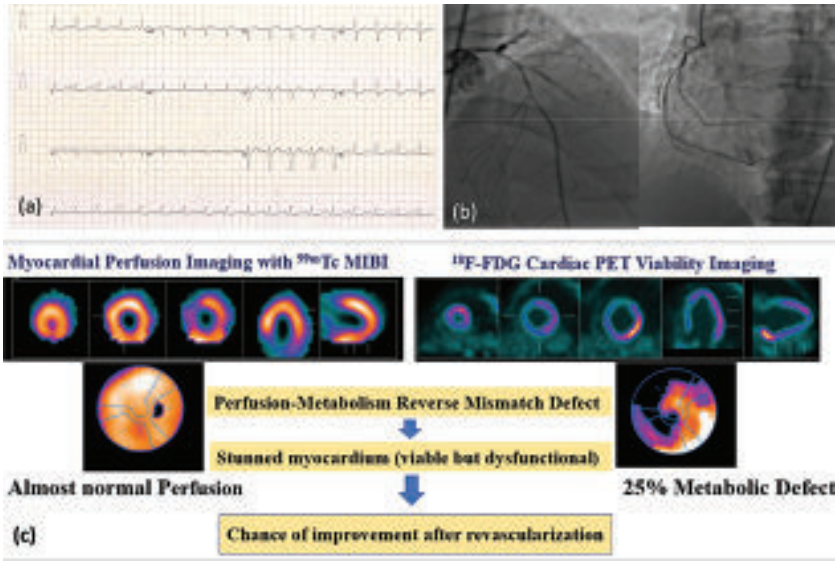


Figure 7 (case 3): *A 55 years old male was presented with ICM with (b) severe left main and TVD with DM and HTN. ECG showed sinus tachycardia with nonspecific ST changes (a). (c) Rest MPI revealed almost normal perfusion might be due to balanced ischemia however FDG PET revealed about 25% metabolic abnormality involving anteroseptal and inferoseptal wall along the LAD and RCA territories. Volumetric data also revealed dilated LV cavity, global hypokinesia& severely reduced LV global systolic function (LVEF 25-30%). This myocardial defect is defined as reverse mismatch defect (stunned myocardium) and might be suitable for revascularization as perfusion is maintained.*

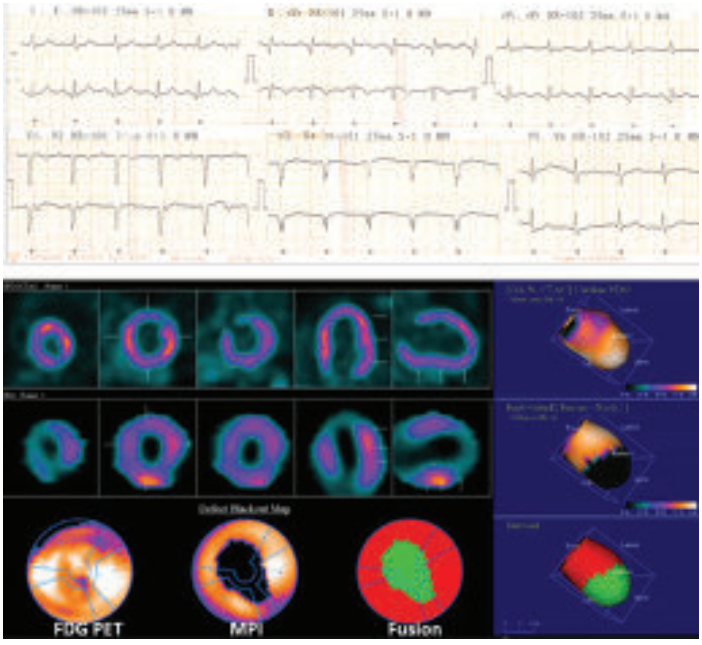


Figure 8 (case 4): *A 52 years male patient having old anteroseptal and inferior MI with critical TVD, DM, dyslipidemia and severe LV systolic dysfunction on echocardiogram (LVEF:33%). MPI and PET fusion imaging revealed large area of perfusion-metabolism mismatch defect in the triple vessel territory involving apex, apical to mid anterior, anteroseptal and inferolateral wall signify hibernating / viable myocardium & good chance of improvement after revascularization. Small area of perfusion-metabolism mild reverse mismatch defect (stunned myocardium) in basal anterior wall- suggesting dysfunctional viable myocardium. Patient underwent CABG and significant clinical improvement was seen in subsequent follow up.*

Discussion:

Dysfunctional but viable myocardium can exist as hibernating state or as stunned myocardium.

Myocardial stunning was firstly described by Braunwald and Kloner as "prolonged, post-ischemic ventricular dysfunction that occurs after brief periods of nonlethal ischemia"[7]. Meanwhile, hibernating myocardium was first described as the result of repetitive and long-lasting ischemia due to significant coronary artery stenosis and severely limited coronary flow reserve[8-10]. If the myocardium is in the hibernation stage, the contractility may recover spontaneously when the blood flow is re-established[11]. Several imaging techniques such as dobutamine stress or myocardial contrast echocardiography, SPECT MPI, 18F-FDG PET, cardiovascular magnetic resonance (CMR) with late gadolinium enhancement (LGE), and computed tomography (CT) can assess viable myocardium. SPECT MPI with 99mTc-labeled sestamibi demonstrates the myocardial uptake and retention of sestamibi, which are dependent on perfusion, cell membrane integrity, and mitochondrial function. SPECT MPI is the frequently used imaging technique for the detection of coronary artery disease (CAD) and demonstrates excellent sensitivity in the diagnosis of hemodynamically significant coronary artery stenosis. As ischemic myocardium shifted to glucose metabolism instead of fatty acid metabolism for their energy production, FGD Cardiac PET estimates the cellular function of the heart.

In our study we have compared myocardial perfusion and 18F-FDG images in corridor4DM software using 17 segment polar map; MPI-PET fusion imaging precisely distinguished viable myocardium from a fibrotic scar by the visual and quantitative analysis of radiotracer uptake pattern in LV segments. Additional ECG gated 3D volumetric data provided the information of LV global systolic function (LVEF%), end systolic and end diastolic volume, LV cavity dilatation, wall motion status and wall thickness abnormality. MPI and PET derived data revealed PET derived LVEF is more comparable with echocardiographic LVEF% than MPI. Here we have discussed 4 different clinical scenarios from our study group.

Management decisions in patients with ischemic cardiomyopathy are complex and require evaluation of other factors such as the anatomic substrate, patient comorbidities, and risk[12]. As post-surgery follow up MPI or cardiac PET was not performed in our study, we have compared our prediction with follow up echocardiogram data and clinical status of individual patient who underwent revascularization.

Conclusion:

Though it's a very initial experience in the field of nuclear cardiology Bangladesh, this combined protocol, rest only gated 99mTc-MIBI SPECT MPI and 18F-FDG Cardiac PET can identify the patients who may be benefited the most from revascularization. It can also help in clinical decision-making in complicated cases where there is minimal or absent viability to avoid unnecessary procedures and risk and thus minimize cardiac event-related mortality and morbidity.

Acknowledgment:

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Conflict of interest: Authors declare no conflict of interest.

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CASE REPORT

Acute Myocardial Infarction in a Amphetamine Abuser with Low ASCVD Risk: A Case Report

Afroza Ahmed, Afzalur Rahman, Shamsun Nahar, Gulam Mostafa, Nusrat Parvin

Abstract:

Wide availability of recreational drugs, like amphetamine, cocaine, cannabis etc has spread out these drugs to all classes and age groups in the society of Bangladesh. Among them association cocaine and cannabis with acute myocardial infarction has been well established. But the popular drug, amphetamine, which is available in tablet form containing the active ingredient named 3,4 methylenedioxymethamphetamine (MDMA), has been reported to have significant cardiac and CNS toxicity. Repeated angina, even myocardial infarction due to active coronary vasospasm and accelerated atherothrombosis in amphetamine abusers has been reported in several case studies worldwide. But, only a few cases has been reported in Bangladesh. Here we present a case of acute myocardial infarction in a amphetamine abuser with low 10 years ASCVD risk.

Keywords: Amphetamine, myocardial infarction, ASCVD risk

J Inv Clin Cardiol 2023; 5(2): 53-55

Introduction:

Amphetamine is a variety of recreational drug which has been popular among the young generation throughout the world. Its easy availability and widespread abuse has been involving people of different age groups and Bangladesh is not an exception. Amphetamine is a sympathetic stimulant and has a variety of adverse effect on cardiovascular system.[1] Cases has been reported from various countries which has demonstrated amphetamine induced hypertensive emergencies, acute coronary vasopspasm, necrotizing vasculitis, spontaneous coronary artery dissection, aggravated coronary atherosclerosis, raised coronary thrombus burden, acute left ventricular failure, cardiomyopathy, arrhythmia, pulmonary hypertension and sudden cardiac death.[2,3,4] The most popular amphetamine found to be abused 3,4 methylenedioxymethamphetamine (MDMA) and several other varieties. Though cocaine has been well established as causing acute coronary syndrome but the role of amphetamine as a cause of ACS is yet to be established.[5,6]

Case description

Our patient a 42 years old a chronic substance abuser, came to ER of a tertiary care hospital with the complaints of central compressive chest pain, which has been radiating to jaw and left arm and associated with sweating and vomiting for few hours. He was a known case of diabetes and hypertension for 1 year with 10 years ASCVD risk 24%. He had been a substance abuser, especially amphetamine for last 3 years. Examination revealed, he was anxious, his pulse was 106/min, regular; BP 140/90 mmHg; S1&S2 normal; lung base clear. Emergency ECG was obtained which revealed acute STEMI inferior. Echocardiography revealed inferior wall hypokinesia. Hs Trop I first sample was negative and 2nd sample wasn't tested as the scenario was clearly indicative of acute myocardial infarction. He was thrombolysed with tenecteplase and prepared for coronary angiography. On next morning CAG was done which revealed long segment ulcerated leasion involving proximal to mid RCA along with thrombus burden. Pharmacoinvasive PCI to RCA along with thrombosuction was done. He had history of hospital admission with similar episodes of chest pain at least twice before but during those time his ECG showed sinus tachycardia with hyperacute T wave from V1 to V4, hsTropI was normal, echocardiography showed no wall motion abnormality and CAG revealed normal coronaries. His urine for amphetamine level were negative during his previous admissions. This time he denied any form of substance abuse but his

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characteristic coronary lesion triggered high level of suspicion and despite of his denial, urine for drug abuse test was positive for amphetamine and negative for benzodiazepine and cocaine Table 1. His blood sugar was uncontrolled during the period of admission and also had raised HbA1c which means uncontrolled blood sugar for long. Subsequently the patient was stabilized. DAPT (aspirin & clopidogrel), atorvastatine, beta blocker, amlodipine, enoxaparine, empagliflozine, insulin was administered. Psychological counseling and lifestyle modifications were advised and he was discharged at home after 5 days.

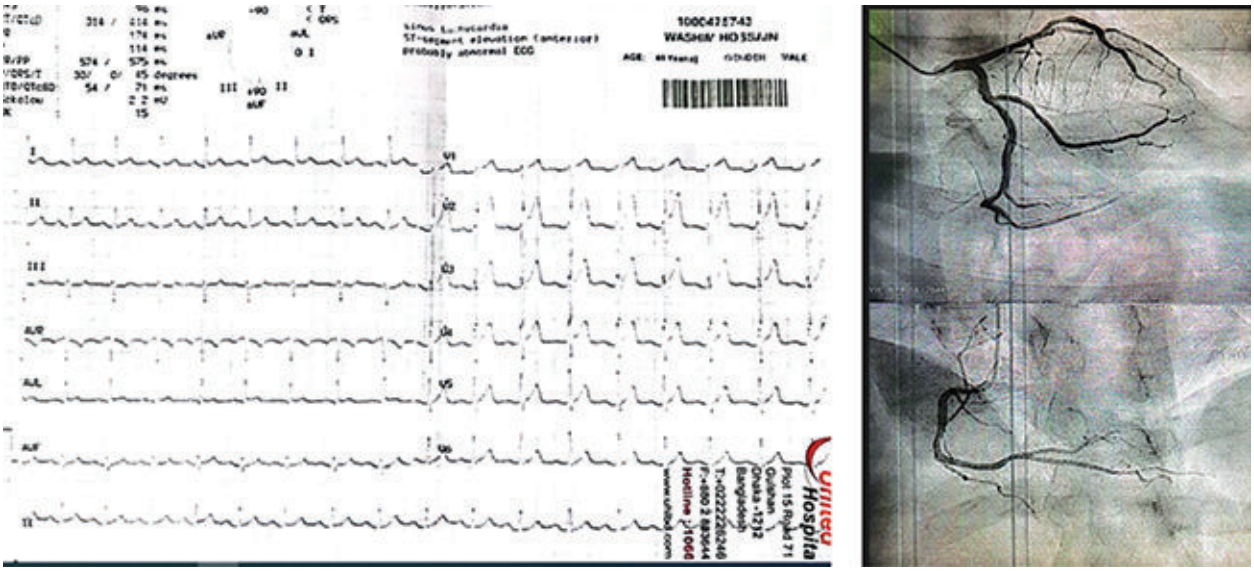


Figure1&2: *ECG and angiography*

Table-I

Comparing clinical and laboratory parameters in two separate admissions

Patient parameters	Oct 2021	Feb 2023
Hs TropI	7.5pg/ml	11.3pg/ml
Echo	no RWMA	Inf wall hypokinesia
Angiography	Normal	SVD
RBS	24 mmol/L	20 mmol/L
HbA1c	10g/L	7 g/L
Creatinine	1.2mg/dl	1 mg/dl
Na	133mmol/L	138mmol/L
K	5.5mmol/L	4.8mmol/L
Ca	2.4 mmol/l	2.8 mmol/L
Mg	0.97mmol/L	0.92mmol/L
Hb	17.5 gm/dl	15.8
WBC	7×10^3	9.4×10^3
Platelet	$252\times10^3/\mu L$	$281*10^3/\mu L$
NTproBNP	15pg/ml	229pg/ml
Ferritin	199µg/L	not done
Urine amphetamine	negative	positive
Urine benzodiazepines	not done	negative
Urine cocaine metabolites	not done	negative

Discussion:

Characteristic chest pain , in a patient with low ASCVD risk, who has a history of recreational amphetamine abuse must raise the suspicion of acute myocardial infarction. Amphetamine stimulates norepinephrine release from sympathetic nerve ending. Norepinephrine stimulates alpha 1 adrenoceptor and eventually promotes coronary vasospasm.[1] Amphetamine also enhances reactive oxygen species production and eventually myocardial damage. It also enhances structural and electric remodeling of cardiac muscle and leads to arrhythmia. Patients who used to take amphetamine, may have repeated anginal attack due to coronary vasospasm and angiography may be normal in those cases. Amphetamine promotes endothelial release of endothelin 1, reduce NO sensitivity and coronary smooth muscle dysfunction.

Amphetamine also enhances pro-inflammatory process by increasing IL1, IL6 release and aggravates platelet aggregation and thrombus formation.[7] Thus aggravated atherosclerotic process has been reported in young amphetamine abusers compared to age matched group in different studies.[10] Atherosclerotic plaque in laboratory mouse treated with methamphetamine has been found to have smooth muscle apoptosis and reduced extracellular matrix deposition, for which the plaques are more unstable and vulnerable to rupture.[8]

Our patient had known cardiovascular risk factors like uncontrolled diabetes and hypertension. But from his last medical records, it was known that, when he came to ER with typical angina for the fisrt time 1 year back, he was newly diagnosed as diabetic and hypertensive. During that admission his angiography was also normal. So, the chest pain occurred that time is guessed to be due to coronary vasospasm. Moreover conventional coronary artery disease risk factors like diabetes and hypertension promotes lipid rich atherosclerotic plaque formation but amphetamine aggravates the atherosclerotic process.[9] Our patient who had normal coronaries 1 year back, was now found to have severe narrowing of RCA with ulcerated lesion with thrombus burden which raises the possibility of amphetamine induced aggravated atherosclerosis, coronary dissection and thrombus formation.[10]

Our patient had urine for Apmhetamine level positive this time which was negative during earlier admissions. Amphetamine persists in urine for 2 to 3 days, and after that the assay may be negative.[11]

Finally, this rare case of amphetamine induced coronary artery lesion and acute MI, indicated a newer emerging epidemic of heart attack in young patient. So , toxicology analysis is a mandatory in young patient with angina. Coronary angiogram is also an utmost necessity in those cases. Reporting these type of cases in medical journals will help to build awareness among general people and medical practitioners.

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CASE REPORT

Alcohol Septal Ablation in Hypertrophic Obstructive Cardiomyopathy: A Patient with a High LVOT Gradient

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Abstract:

Background: Hypertrophic obstructive cardiomyopathy is a type of cardiomyopathy. The presence of a pressure gradient between the mid ventricle and LVOT on the hemodynamic evaluation revealed by echocardiography serves as the basis for the diagnosis.

Objective: To Perform Alcohol Septal Ablation in patient with Hypertrophic Cardiomyopathy

Method: Under both Echocardiography and Fluoroscopy first septal branch of LAD is identified and alcohol is injected to cause necrosis of the selected myocardial tissue to reduce the outflow gradient,

Result: A reduction of the outflow gradient measured after the procedure indicates that it was successful.

Key Words: Hypertrophic Obstructive Cardiomyopathy, Echocardiography, Alcohol Ablation

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A hereditary condition of the cardiac muscle known as hypertrophic cardiomyopathy (HCM) causes left ventricular hypertrophy, myofibrillar disarray, and myocardial stiffness. The most common cause of sudden death in young athletes, this condition affects around 1 in 500 people[1]According to estimates, HCM affects one in 500 people globally in the general population. Still, when all gene-positive people are considered, the prevalence rises to one instance in every 200 people.[2]

Chest pain, dyspnea, palpitations, exhaustion, or syncope are among the clinical signs, particularly after exercising. The majority of hypertrophic obstructive cardiomyopathy (HOCM) patients are detected incidentally; dyspnea is the frequent symptom in 90% of the cases, followed by chest pain in 70-80% and less frequently syncope in 20%[3]

The severity and extent of the hypertrophy will determine the symptoms.HCM patients may experience myocardial ischemia, mitral regurgitation, diastolic dysfunction, or obstruction of the left ventricular outflow tract (LVOT)[4]Exercise testing, cardiac magnetic resonance imaging (MRI), and echocardiography are among the diagnostic tools. LVOT pressure gradient, septal, anterior motion of the mitral leaflet with eccentric MR, and LV wall thickness can all be assessed by echocardiography.[5]

Currently, septal reduction therapy for patients with HCM can be done either by surgical myectomy or by alcohol septal ablation (ASA). Surgical myectomy is

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the most commonly performed surgical procedure in patients with a resting or maximum provoked left ventricular outflow tract (LVOT) gradient of ≥50 mm Hg, who are in NYHA functional Class III-IV, despite maximum tolerated medical therapy.[5]

Alcohol septal ablation, initially documented by Sigwart in 1995, is a catheter-based minimally invasive approach utilized to attain septal reduction.[6]By using angiographic imaging technique and echocardiographic imaging, contrast media is injected into septal perforating arteries, it is possible to determine the arterial supply to the SAM-septal contact area of the basal septum. A small quantity of alcohol injected via an inflated balloon catheter induces an iatrogenic myocardial infarction, induces paradoxical septal motion, promptly eliminates LVOT obstruction, and induces an immediate cessation of SAM. Subsequently, as septal thinning progresses, the obstruction further diminishes. Reductions in mitral regurgitation and end-diastolic pressure of the left ventricle, size and pressure of the left atrium, regression of left ventricular hypertrophy, and alleviation of pulmonary hypertension are among the long-term advantages. Septal ablation improves exercise capacity and symptoms of heart failure, as measured by increased peak oxygen consumption.[7] Similar to the long-term survival of individuals in the general population of the same age and gender, patients who have septal ablation exhibit comparable prognoses over time as those who get surgical myectomy. In contrast to surgical myectomy, alcohol septal ablation is a minimally invasive procedure that necessitates a shorter recovery period and hospital stay.

Few individuals necessitated in-hospital permanent pacemaker placement, and adverse cardiovascular changes happen infrequently throughout the hospitalization process.

Case Presentation

The present case represents successful percutaneous treatment with septal ablation for a patient with hypertrophic obstructive cardiomyopathy associated with systolic anterior motion of the mitral valve and obstruction.

A 24-year-old man with Hypertrophic Cardiomyopathy who has been treated with 100 mg of metoprolol daily was sent to our clinic with complains of chest pain and dyspnea when he exerted himself. His primary diagnosis of Hypertrophic Cardiomyopathy was three years prior. He had a class III New York Heart Association (NYHA) functional capacity. A respiratory system evaluation was performed, and respiratory causes were excluded.

He had no known relatives who have Hypertrophic Cardiomyopathy. During cardiac auscultation, the fourth heart sound and a systolic murmur in the mitral area that radiates to the mid-clavicular line were audible. The patient had repolarization anomalies (negative T waves), left axis deviation, and sinus rhythm on the ECG. Neither cardiomegaly nor pulmonary congestion could be seen on a chest X-ray. The LV anatomy was evaluated by echocardiography, and the measurements of the LV at end-diastole (45 mm) and end-systole were found to be normal (29 mm), SAM of the mitral valve with mild mitral regurgitation, left atrial enlargement (43-mm), and hypertrophy interventricular septum (basal:14 mm, mid:18 mm, distal:13mm). LV ejection fraction was 65%. Continuous-wave Doppler measurements (Figure 1) showed a peak systolic dynamic LVOT obstruction of 96 mmHg at the LV outflow

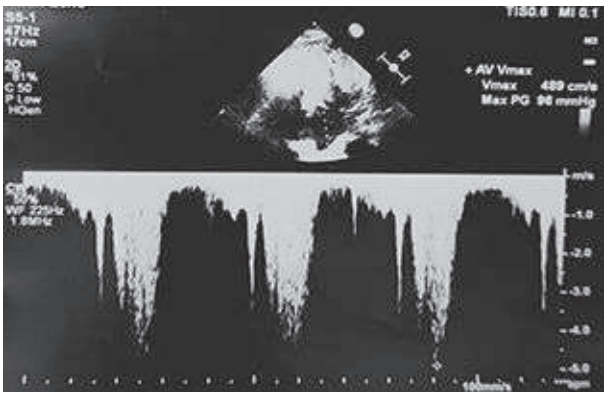


Figure 1: *Preprocedural Echo*

A temporary pacemaker (Figure 2) was inserted as a precautionary measure, and Coronary angiography and an invasive hemodynamic evaluation were carried out. Coronary angiograms revealed that the main epicardial coronary arteries were non-critical. The left ventriculography showed a hyperkinetic contraction pattern at the mid-ventricle with a narrow muscular tunnel between the LV apical and basal cavities

Upon hemodynamic evaluation, a significant intraventricular pressure gradient of 75 mmHg (LV apex

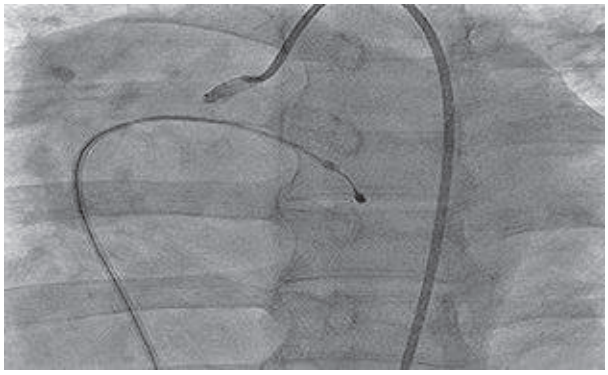


Figure 2: *TPM lead placed*

178/10 mmHg, LV outflow 122/12 mmHg) with mild LV outflow tract pressure gradient of 40 mmHg (aorta 92/64)

We finally diagnosed Hypertrophic Obstructive Cardiomyopathy associated with SAM of the mitral valve.

After being informed of his treatment choices, the patient provided written approval for percutaneous septal myocardial ablation (Figure 3). The first septal branch was dominant (diameter: 2.1 mm) and showed prominent septal myocardial distribution.

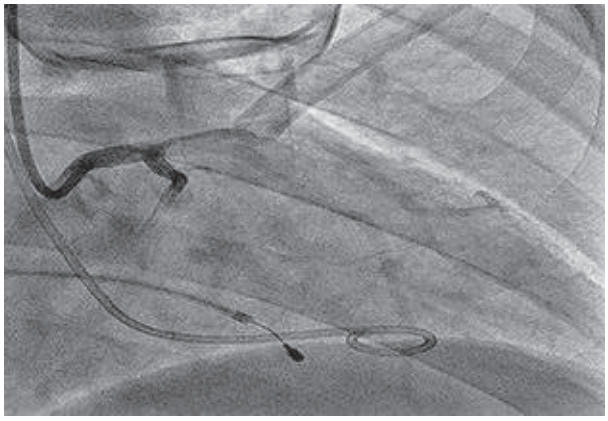


Figure 3: *Angiogram of the left system done and first septal branch identified.*

The floppy wire (Choice scimed guide wire, 0.014", 300 cm, Boston Scientific, Miami, USA) was passed to the first septal branch. A 2.5 × 20 mm over the wire balloon (Maverick OTW PTCA dilatation catheter, Boston Scientific, Maple Grove, USA) was placed in the proximal part of the vessel. Before injecting alcohol, the balloon location was checked using a dye injection. Hemodynamic measurements (Figure 4) were repeated after the balloon had inflated and a transient occlusion of the separate branch. 2 ccs absolute alcohol (Figure 5) in portions of 1 cc/min was injected slowly.

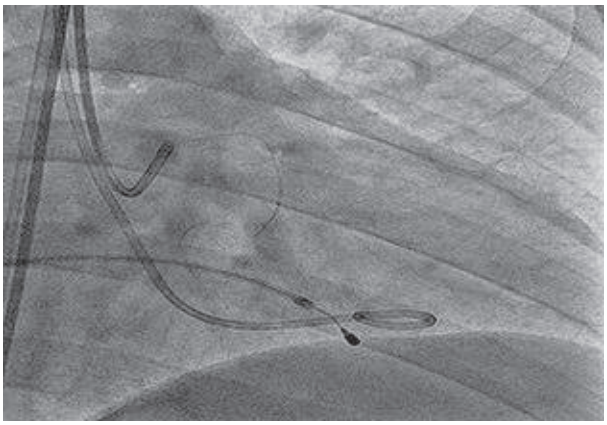


Figure 4: *Invasive hemodynamic measurement*

Repeated hemodynamic measurements revealed that the post-extrasystolic gradient at the midventricular level decreased to 30 mmHg and that there was no resting gradient at the LV outflow level.

The procedure caused the patient to have mild chest pain. There were no complications, such as pericardial effusion. A 1mm ST elevation in V1-2 and a 1mm ST segment depression in II, III, and aVF were visible on the post-procedure ECG as well as RBBB.

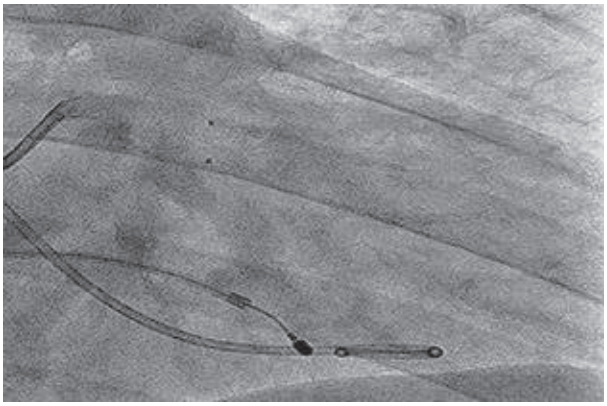


Figure 5: *During alcohol septal ablation*

After 48 hours, temporary pacemaker leads were removed as the patient maintained a sinus rhythm.

Before discharge, a post-procedural echocardiogram was performed, and the results showed that the left atrial dimension had decreased to 42 mm, the

interventricular septum thickness had decreased to 13 mm, there was septal hypokinesia, there was no mitral regurgitation without SAM of the mitral valve. The end-systolic and end-diastolic diameters of the LV were 46 mm and 28 mm, respectively. A peak systolic gradient of 44 mmHg was observed using continuous-wave Doppler measurements.

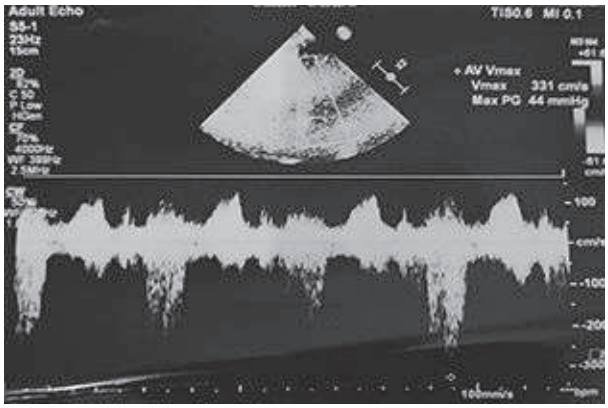


Figure 6: *Post procedural echo before discharge*

After a seven-day, unremarkable hospital stay, the patient was released. Medication with 100 mg metoprolol was continued at discharge. The patient was asymptomatic, and his functional capacity improved during the one-month follow-up to NYHA class I. Physical examination showed a mild systolic murmur in the mitral area. On the ECG, there was no Q wave in V1-2; there was RBBB and sinus rhythm.

Conclusion:

The purpose of septal ablation is to deliver alcohol to the area of the basal septum that contacts the anterior mitral leaflet during systole by using echocardiography guidance to locate the septal artery that supplies it (approximately 1 cc per 1 cm septal thickness). Alcohol septal ablation is a reliable therapy method for specific patients with symptoms associated with HOCM that are drug-refractory[8]. Morbidity is significantly decreased, procedure-related mortality is equal to or lower than with surgical myectomy, and long-term symptom alleviation and survival are comparable. Only a small percentage of individuals need permanent pacing and second ablation treatments[3].

Over the past five to ten years, the course of treatment for hypertrophic cardiomyopathy has seen a significant transformation, moving from surgical myectomy to percutaneous cardiac intervention. The results of alcohol ablation are comparable to those of surgical myectomy and are safe and effective[9].

However, research tends to show that septal myectomy offers patients better long-term symptom alleviation, a decreased risk of complications, and immediate results over ASA with a swift decline in LVOT gradient. Finally, individuals are considered poor candidates for ASA if they have extremely high LVOT gradients[10].

Competing interests

The author(s) declare that they have no competing interests.

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