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

BMDC RECOGNIZED

BANGLADESH HEART JOURNAL

VOL. 35 NO. 1 JANUARY 2020

CONTENTS

Official Journal of
Bangladesh Cardiac Society

BANGLADESH HEART JOURNAL

VOL. 35, NO. 1, JANUARY 2020

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

Printed by :
Asian Colour Printing
130, DIT Extension Road
Fakirerpool, Dhaka-1000
Phone : 49357726, 58313186
E-mail: asianclr@gmail.com

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

VOL. 35, NO. 1, JANUARY 2020

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INSTRUCTION TO AUTHORS

A. Introduction

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

B. Categories of Articles

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

Original Research:

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

Review Articles:

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

Case Reports:

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

Cardiovascular Images:

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

Letter to the Editor:

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

C. Criteria for Acceptance

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

D. Editorial Process

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

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

E. Cover Letter

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

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

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

F. Manuscript Preparation

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

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

a. Title page information

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

b. Abstract

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

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

c. Keywords

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

d. Abbreviations

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

e. Acknowledgements

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

f. Units

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

g. Figures and graphics

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

h. Tables

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

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

i. References

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

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

Examples of correct forms of references are given below:

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

1. *Standard journal article*

List the first six authors followed by et al.

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

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

2. *Organization as author*

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

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

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

4. *Volume with supplement*

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

5. *Issue with supplement*

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

6. *Type of article indicated as needed*

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

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

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

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

Books and Other Monographs

1. *Personal author(s)*

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

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

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

3. *Organization(s) as author*

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

4. *Chapter in a book*

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

5. *Conference proceedings*

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

6. *Dissertation or thesis*

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

Other Published Material

Newspaper article

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

Unpublished Material

In press or Forthcoming

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

Electronic Material

1. *Journal article on the Internet*

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

Article published electronically ahead of the print version:

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

Article with document number in place of traditional pagination:

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

Article with a Digital Object Identifier (DOI):

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

2. *Monograph on the Internet*

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

3. *Homepage/Web site*

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

G. Submission Preparation Checklist

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

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

H. Submission

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

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

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Original Article

Stenting of Right Ventricular Out Flow Tract: Analysis of 32 Cases from Catheterization Laboratory of a Paediatric Cardiac Centre

Nurun Nahar Fatema Begum[1], Nazmul Islam Bhuiyan[2], Ashfaque Ahemmed Khan[2]

Abstract:

Introduction:**The objectives of the present study are to describe the institutional experience, technical aspects and outcome of right ventricular outflow tract (RVOT) stenting in Tetralogy of Fallot type lesions as the initial palliation in a Bangladeshi centre.**

Methods: **This is a retrospective, single-center study of nonrandomized, consecutive 32 patients over a 12-year period. Selected patients underwent cardiac catheterization for implanting a stent into an obstructed RVOT to improve pulmonary blood flow.Statistical data analysis was performed using SPSS 20.**

Results: **Thirty cases had stenting in RVOT and two cases were postponed. Median age was 8.1 (3-40) months, median weight was 4.8 (3.3-11.4)kg, median procedure time was 65 (26-210) minutes and fluoroscopy time was 16 (10-75) minutes.Stents were implanted through 5F Judkins coronary guide catheter and 5F or 6F delivery sheath of ADOII device. Median stent diameter was 6 (4-7) mm. Stent length varies from 12-22 mm with median 14 mm. Oxygen saturation of the patients increased from median 60 (30 - 75)% to 91 (85-98)%. In one patient stent was embolized to aorta and was fixed to descending aorta. Two cases were postponed for short infundibular length. One patient died from non cardiac cause two months after palliation. No procedure related mortality recorded.**

Conclusion: **Right ventricular outflow tract stenting is a good option of palliation for small babies with reduced pulmonary blood flow. In our setting we did most of the palliation to offer better quality of life who could not afford surgery or who was detected late.**

Keywords: Right ventricular out flow tract; stenting; Tetralogy of Fallot.

(Bangladesh Heart Journal 2020; 35(1): 1-5)

Introduction:

Primary repair of Tetralogy of Fallot (TOF) or ToF like lesion with confluent pulmonary arteries is the standard treatment protocol in many institutions. Right ventricular out flow stenting are used to palliate a wide variety of congenital heart lesions with Tetralogy of Fallot physiology[1].This kind of palliation in patient with small pulmonary arteries with or without association of comorbidities, low body weight relieves cyanosis and defers surgery for sometime. This in turn allows somatic growth and growth of pulmonary arteries with good opportunities for future surgery and its outcome[2]. RVOT stenting is an effective bridging procedure from palliation to definitive surgery thus avoids mortalities from early surgeries like total repair or Blalock Taussig shunt (BT shunt) [3-5].

Methodology:

Retrospective review of the patients clinical records, Echo report, Angiography report, OPD follow up notes were performed from Jan 2007 to September 2019. All patients with TOF physiology who had RVOT stenting attempt were enrolled in the study group from catheterization laboratory

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DOI: https://doi.org/10.3329/bhj.v35i1.49136

data base. Total thirty two cases were isolated from records. Two of them were postponed after trial in catheterization laboratory.

All RVOT stenting procedures were performed under general anesthesia and mechanical ventilation. All patients received 50 IU Heparin/

kg and standard antibiotic prophylaxis. After getting the venous access, theprocedure of stenting in RVOT includes(1) Right ventriculography in antero posterior (AP) and lateral view and measurement of length of RVOT and diameter in systole and diastole to decide stent length and diameter(2) To look for any supravalvular stenosis. If present, then stenting across pulmonary annulus and beyond stenotic arAeawas considered. (3) Aortogram to look for close proximity of RVOT to coronary arteries (4) Placement of exchange wire to branch pulmonary artery. (5) Placement of long sheath or guide catheter over the wire (6) Placement of stent with side arms injection for checking position of stent. The pre-mounted stent over a balloon was inflated manually with indeflator up to the prescribed nominal pressure i.e. 8 atm for GENESIS™ ,Express® LD and NEFRO peripheral stent; 9 atm for Gazelle® and Liberte´® coronary stent. In one case three coronary stents were used. In another case two Express® LD vascular stents were used to cover the whole infundibulum. In one case first stent was embolized to right pulmonary artery and inflated there with balloon. Another RVOT stent was deployed again. Patients were routinely extubated on the table and transferred back to the ward. Patients who experienced an increase of oxygen saturations in excess of 20% were commenced on twice daily diuretics. Aspirin (3–5 mg/kg) was commenced once the patient started feeding. This was maintained until complete repair with explantation of the stent.

Informed consent was obtained from the parents of each patents. Permission of the institutional ethical committee was obtained. After collection, data were compiled and analyzed in MS excel spread sheet. As this study was carried out on single variants, comparative analysis were not performed.

Results:

Thirty two patients underwent RVOT stenting. Two cases were postponed; one due to very short infundibulum and another due to embolization of stent to Aorta for short infundibulum. Age of most of the patients was from 3 months to 12 months (65.65%). Some children of >36 month to 40 month (6.25%) were in the series. They were untreated cases due to monetary constraint or late reporting.Median age was 8.1months (Table I).

Table-I

Age distribution of patients (N= 32)

Age	Number	Percentage
03 Mo to 12 Month	21	65.63%
>12 Mo to 36 Month	9	28.12%
>36 Mo to 40 Month	2	6.25%

Median age 8.1 months

Among 32 cases, 62.5% were female (fig-1) Tetralogy of Fallot was the main lesion in study cases (56.25%), DORV, VSD, PS was present in 40.62% cases and complete AV canal defect, DORV, PS in 3.12% cases (Table-II). Weight of the patient ranged for 3-11 kg with median of 4.8 kg (Table-III). Most common type of stent used were GENESIS™ peripheral stent (32.4%) followed by Boston scientific Express® LD stent (24.3%) and NEFRO® peripheral stent (21.6%) (Fig-II).

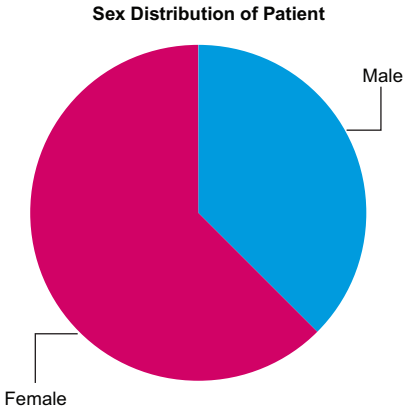


Fig.-1: *Sex distribution of patients(N= 32)*

Out of 32 cases, 12 (37.50%) were male and 20 (62.5%) were female

Table-II

Disease type with TOF or ToF physiology cases (N= 32)

Disease type	Number	Percentage
ToF	18	56.25%
DORV, VSD, PS	13	40.62%
AV Canal, DORV, PS	01	3.12%

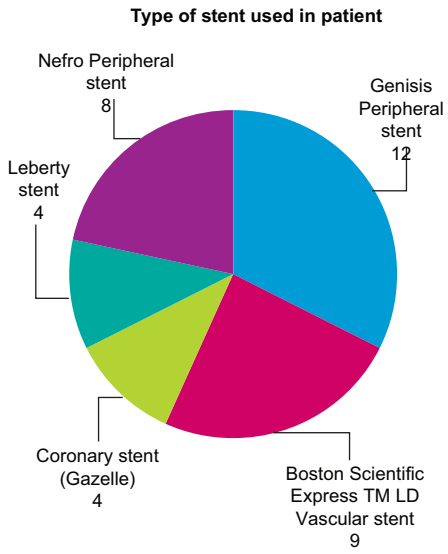
Note: TOF- Tetralogy of Fallot, DORV- Double outlet right ventricle, VSD-Ventricular septal defects, PS-Pulmonary stenosis, AV canal–Atrioventricular canal

Table-III

Weight distribution of patient at the time of stent implantation (N= 32)

Weight in Kg	Number	Percentage
3-5 Kg	17	53.12%
>5-11.4 Kg	15	46.85%

Median weight was 4.8 Kg



Multiple stents were used in 3 cases

Fig.-2: *Type of stent used in patient (N= 32)*

Stent diameter varied for 4-7 mm and median was 6 mm. stent length varied for 12-22 mm and median was 14mm. Stent diameter was decided from in fundibular Diameter at diastole (Table-IV). Procedure time varied from 26-210 munities. With experience of the cath lab team, procedure time was reduced. Fluoroscopy median time was 15 munities. Oxygen saturation varied for 30%-70% with median 66%. Oxygen saturation after stenting varied from 85-98% with median 91% (Table- V).

Table-IV

Range and median of stent size, oxygen saturation and procedure time of Patients (N= 32)

Variables	Range	Median
Stent diameter	4-7 mm	6 mm
Stent Length	12-22 mm	14 mm
Procedure time	26-210 min	63 min
Fluoroscopy time	10-75 min	15 min
Oxygen saturation (Before stenting)	30%-70%	66%
Oxygen saturation (After stenting)	85%-98%	91%

Table V showed outcome of the patient. Stepping up of oxygen level above 85% was considered as good outcome and achieved in 93.75% cases. One case was postponed for very short infundibular length. Another postponed after embolization to Descending Aorta due to short infundibulum and embolized stent was positioned to abdominal aorta later. In another case first stent was embolized to RPA which was stationed there (Fig-III). There was no procedure related mortality.

Table-V

Outcome of patients(N= 32)

Variables	Number	Percentage
Good (SPO2 > 85%)	30	93.75%
Postponed for short RVOT	01	3.12%
Embolized to Aorta	01	3.12%
Embolized to RPA	01	3.12%
Procedure Related Death	00	00%

Discussion:

Some infants with Tetralogy of Fallot like physiology are premature, low body weight, and have poor pulmonary artery anatomy, having non cardiacabnormalities etc and outcome of surgery is guarded. In our institution lack of money for costly cardiac surgery and lack of surgical facilities on young infant are additional factors. So right ventricular outflow tract stenting sparing pulmonary valve is a good option of bridging to aorto pulmoary shunt, or complete repair[6-7]. This procedure not only allowed somatic and pulmonary growth but also help to get rid from comorbidities[8-9]. In our institution, RVOT stenting is offered to get benefit for interim period with good quality of life and positive growth curve until they can manage cost of definitive surgery. It may be mentioned here that there is no health insurance policy for this kind of patient in our country. Cardiac surgery counterpart in our institution is still in their learning curve and they prefer to do surgery on a patient of TOF when they achieve 10 kilogram body weight. In most of the institute, elective TOF repair is performed at 6 month of age if pulmonary artery size is adequate by McGoon ratio or Nakata Index or by Z scoring. Important risk factor for early total repair is low body weight (<2.5 kg) prematurity (<37 weeks), pulmonary artery hypoplasia (Z score <-2) and important non cardiac comorbidities.[5]Although RVOT stenting is an accepted palliation for patients with TOF, consideration should be given to the anatomy for a safe placement of the stent especially when there is a deficient infundibular septum as in a doubly committed sub arterial VSD.[10]RVOT stenting is contraindicated in situation

where RVOT patency could not be established e.g. RVOT muscular atresia or nonconfluent central pulmonary arteries. Aortopulmonary shunt or ductal stent are ideal for such cases.[11]. There is no hard and fast rule for early repair versus bridge to complete repair by aortopulmonary shunt, arterial duct stenting or RVOT stenting or RVOT accentuation.[12]Centers with good experience and outcome of early repair have identified low body weight, severe cyanosis, pulmonary atresiarather than stenosis, hypoplastic pulmonary arteries and non cardiac comorbidities as risk factor for mortality in these children.[13-14]BT shunt though very effective but it continues to carry a very high mortality and morbility.[15]There is also chance of pulmonary artery distortion, stenosis and need for a separate surgical incision.[16]RVOT stenting in Fallot-type lesions can be accomplished safely, with lower PICU admission rate, a shorter hospital length of stay and shorter duration of palliation until complete repair compared with mBTS palliation.[17]

Transcatheter intervention of congenital heart disease is getting access beyond the limit as outcome in most of the cases are good and mortality is negligible. Modern coronary intervention kits are suitable for use in newborn babies also. As a result, stenting of arterial duct and stenosed BT shunt has become a routine practice in many institutions.[18-19] Stenting of right ventricular outflow tract was first attempted by Hausdorff and Gibbs and result were not good.[20]

Our first case of RVOT stenting was performed in a spelling child of 3 kg when all the available cardiac surgeons refused the case as she was very sick and was ICU bound since birth.[21]

In our series we preferred for surgical options in cases where body weight was reasonable and pulmonary anatomy were acceptable. But then we decided for RVOT stenting when patient failed to manage fund or surgeons refused the case. In 53.12% cases body weight of the patients were less than 5 kg. After achieving significant skill, technique has now become popular in our centre and has become standard approach for patient with Fallot type physiology who is too young or too high risk for complete repair. Surgeons are also becoming comfortable to deal with stented RVOT during complete repair.[22]Stenting across pulmonary valve annulus can be avoided in most of the patient which in turn leaves the opportunity to avoid transannulur patching at the time of repair. In babies less than 3.5 kg we used coronary stent (Liberte´® Boston scientific) and PALMAZ GENESIS™ stent.In older groups, NEFRO® peripheral stent, Boston scientific Express® LD vascular stents were used.

In syndromic case, redilatationof stent may be required and stent should be selected accordingly. RVOT stenting in severe form of TOF physiology cases with late presentation may reduce perioperative death from reperfusion injury by gradual increment of pulmonary blood flow.All transcatheter procedures of RVOT stenting were done utilizing off-label stents and accessories. Surgeons,interventionalists, and engineers will need tocollaborate to establish new purpose-built stent or devicesthat are more effective.[23]

Conclusion:

Right ventricular outflow tract stenting has revolutionized the management approach of Fallot physiology cases especially in country like ours where presentation of patient is late and most of the patientsare not solvent to afford surgery. At the same time surgery for infants and high risk cases are not possible in most of the centers.

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Original Article

Percutaneous Coronary Intervention of Saphenous Vein Graft in Post-CABG Patients- Experience at a Tertiary Cardiac Centre

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Abstract:

Background: Percutaneous Coronary Intervention (PCI) of obstructed & atheromatous venous graft is a real challenge for interventionist to deal with as SVG PCI patients are usually older with significant coronary & non coronary comorbidities. SVG usually presents a degenerated pattern of atherosclerosis with complex friable thrombosis prone lesions, higher risk of distal embolization, poorer long-term outcome with higher ISR rate

Objectives: In the current era, with the advent and availability of different Drug Eluting Stents, PCI of SVG vessel is an alternative to re-do surgery for the occlusion of graft vessel. Although, PCI is associated with higher risk of in-stent restenosis, target vessel repeat revascularization, myocardial infarction or death. Uses of embolic protection devices is class I indication by ACC/AHA for SVG PCI. Therefore, we have carried out this prospective study, to see the outcomes of SVG vessel PCI at our center.

Methods and materials: Patients were enrolled in this observational non-randomized prospective cohort, who underwent routine CAG for the post CABG angina, shortness of breath, dyspnea on minimal exertion or hospital admission with MI, NSTEMI, Angina II-III and planned for PCI of occluded graft vessel. Total 50 patients were enrolled in this study. Distal protection devices were not used in most of the cases as financial costing is an issue.

Results:Total 46 patients were enrolled in this observational study. Average age of the patient population was (62.1±10.8), female 3(6.5%): male 43(93.5%), BMI (24.9±2.9). Among the CAD risk factors; DM 30(60%), HTN 34(68%), Dyslipidemia 31(62%), Smoking 12(6%) And family history of IHD 9(18%). Graft vessel occlusion occurred average (11.5+5.4 Yrs.) after CABG. SVG to OM is the commonest vessel, that developed significant stenosis in 27(56%), followed by LAD 9(16.1%), RCA 6(10.7%), PDA 6(10.7%), PLB 3(5.4%), DG 3(5.4%)m and LIMA-LAD 1(1.8%). Total 63 stents were deployed in 56 vessels of 46 patients. Double or overlapping stents were deployed; two stents in 11 (17.5%) and three stents in 1 (2%) vessel. One patient had recurrent ISR of SVG-OM stents and had PCI at our center and elsewhere. Common DES were, Sirolimus 25(39.7%), Everolimus 22(34.9%), BMS 9(14.3%), Zotarolimus 3 (4.8%). Average stent size was 3.3mm in Diameter. Total 3 (6%) patient died, in 1 month to 2yrs after the procedure. No acute or late complications were noted in this small group of patients and all were doing well at 12-24 months OPD follow-up.

Conclusion: We found that our patients developed graft vessel occlusion on an average 11yrs, after CABG. OM is the commonest territory to develope significant stenosis. PCI of SVG survival outcome was 93.5% (43 patient) in this very primitive observational cohort and all were doing well with OPD follow-up. Thus, we recommend percutaneous coronary intervention of occluded or stenosed graft vessel as an alternative to re-do surgery in this part of the world.

Key Words: SVGs, PCI, CABG

(Bangladesh Heart Journal 2020; 35(1): 6-13)

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DOI: https://doi.org/10.3329/bhj.v35i1.49137

Introduction:

Saphenous vein grafts (SVGs) are commonly used during coronary artery bypass graft surgery (CABG) for severe coronary artery disease. However, SVGs are prone to both degeneration and occlusion, leading to poor long-term patency and thereby graft occlusion. Rates of SVGs failure in the first 12-18 months may be as high as 25%.[1-2]Percutaneous coronary intervention (PCI) of patients with obstructive atherosclerotic disease in coronary saphenous vein bypass graft (SVG) remains a challenge in interventional cardiology. Usually, this groups of patients are older, suffer significant comorbidities. SVG PCI is associated with worse clinical outcomes compared with native coronary artery PCI.[3]Saphenous veins present degenerative pattern of atherosclerotic plaque with complex, friable, thrombotic-prone lesion. Intervention of diseased SVGs carry a higher risk of distal embolization and poorer long-term outcomes.[4-5] The important reason of poorer outcomes in SVGs PCI is the embolization of atherothrombotic debris into native circulation, often resulting in periprocedural MI or reduce antegrade flow.

With the advent of interventional procedures with different drug Eluting stents and distal protection devices, intervention of SVGs in our patient population is an alternative to Re-do CABG as the later carries a risk with different comorbidities. Exact data of PCI in SVGs in our Bangladeshi patient population not yet available. Therefore, we have carried out this observational study to see the procedural success, morbidity and 1-year survival outcome in this subset of patient population with SVGs stenosis.

Material and Methods:

Patients were enrolled in this observational non-randomized prospective cohort, who underwent routine CAG for the post CABG angina, shortness of breath, dyspnea on minimal exertion or hospital admission with Angina II-III and planned for PCI of occluded graft vessel. Total 50 patient were enrolled in this study. Distal protection devices were not used in most of the cases as financial costing is an issue. Most of the studied patient had their PCI or CABG done here or somewhere else and kept on DAPT with Aspirin and Clopidogrel. For those in our center, all Patient were routinely loaded with pre-procedural Clopidogrel 300mg and Aspirin 300mg with post procedural maintenance doses Clopidogrel 150mg and Aspirin 150mg. Average age of the patient population was (62.1±10.8), Female 3(6.5%): Male 43(93.5%), BMI (24.9±2.9). Among the CAD risk factors; DM 30(60%), HTN 34(68%), Dyslipidemia 31(62%), Smoking 12(6%) And FH 9(18%).

Results:

Table1. shows the profile of studied patient. Total 46 patient were enrolled in this observational study. Figure 1. Shows distribution of Female were 3 (6.5%) and male 43 (93.5%). Figure 2. Shows, average LVEF, FBS level, HbA1C and Creatinine level. Figure 3 shows average level of lipid profile. Figure 4. Shows percentage distribution of CAD risk factors, HTN followed by Dyslipidemia, DM, FH and smoking. In this study, we found that Graft vessel occlusion occurred at an average (11.5+5.4 Yrs.) after CABG. As shown in Figure 5,SVG to OM is the commonest vessel, that developed significant stenosis and found in 27(56%), followed by SVG to LAD 9(16.1%), SVG-RCA 6(10.7%), SVG-PDA 6(10.7%), SVG-PLB 3(5.4%), SVG-DG 3(5.4%) and LIMA-LAD 1(.8%). Total 63 stents were deployed in 56 vessels of 46 patients. One patient had multiple stents and several times PCI for recurrence of symptoms and ISR in OM territory. Double or overlapping stents were deployed; two stents in 11 (17.5%) and three stents in 1 (2%) vessel. Figure 6 shows the percentage distribution of different stents used; common DES were, Sirolimus 25(39.7%), Everolimus 22(34.9%), BMS 9(14.3%), Zotarolimus 3 (4.8%). Average stent size was 3.3mm in Diameter. Total 3 (6%) patient died; within 1 month to 2yrs after the procedure. No acute or late complications noted in this small group of patients and doing well at 12-24 months OPD follow-up. Figure 7. Shows the distal protection device and by using it, PCI of SVG graft vessel. Figure 8 shows the distal filter and by using it, PCI of SVG graft vessel. Figure 9. Shows PCI of SVG-RCA and Relook CAG after 2 months.

Table-I

Demographic Profile of the patients

Number	(F3/M43)
Age (yrs)	62.1±10.8
BMI(kg/m^2)	24.9±2.9
SBP(mmHg)	128.0±19.0
DBP(mmHg)	76.2±8.3
No. of CAD Risk Factor	2.8±0.9

Data were presented as Mean ± SD

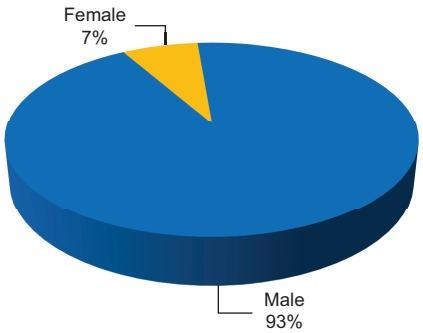


Fig.-1: *Percentage distribution of Male and Female in the studied population*

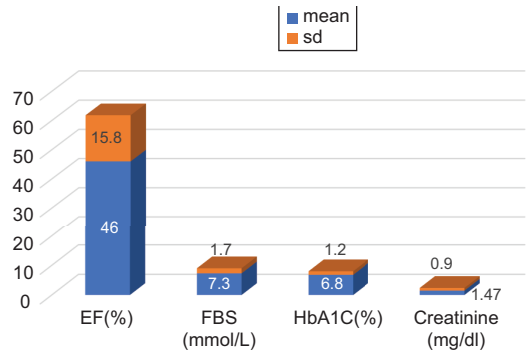


Fig.-2: *Shows LVEF, FBS, HbA1C and Creatinine level*

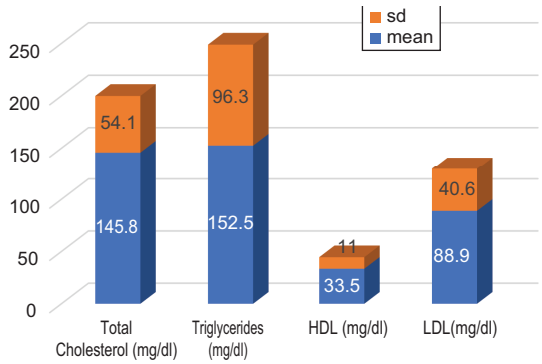


Fig.-3: *average shows Lipid Profile*

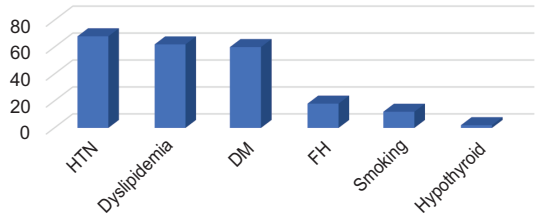


Fig.-4: *Percentage distribution of CAD Risk Factors*

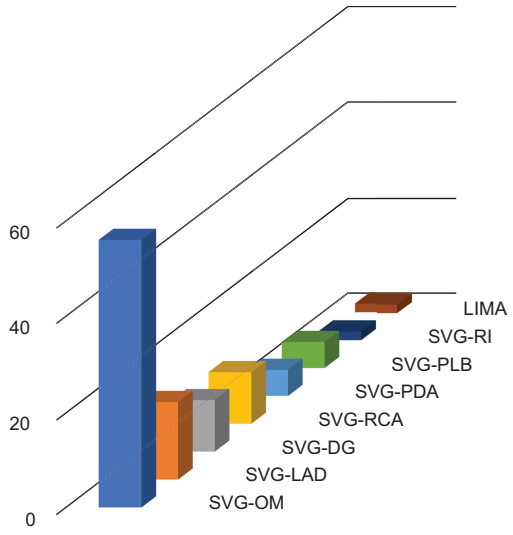


Fig.-5: *Stented territory of SVG to Native Coronaries*

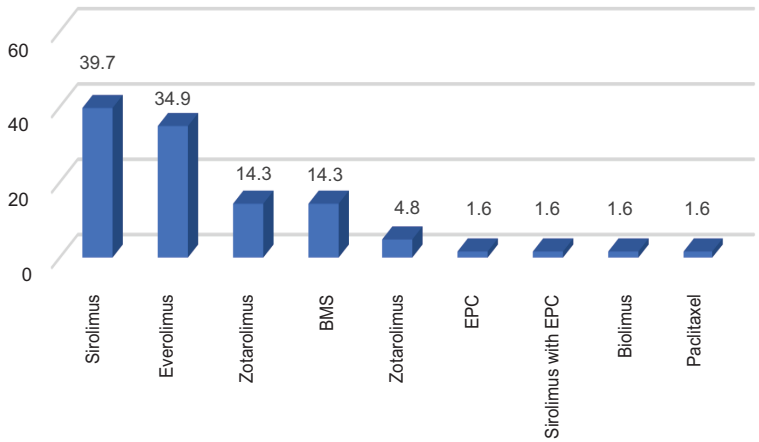
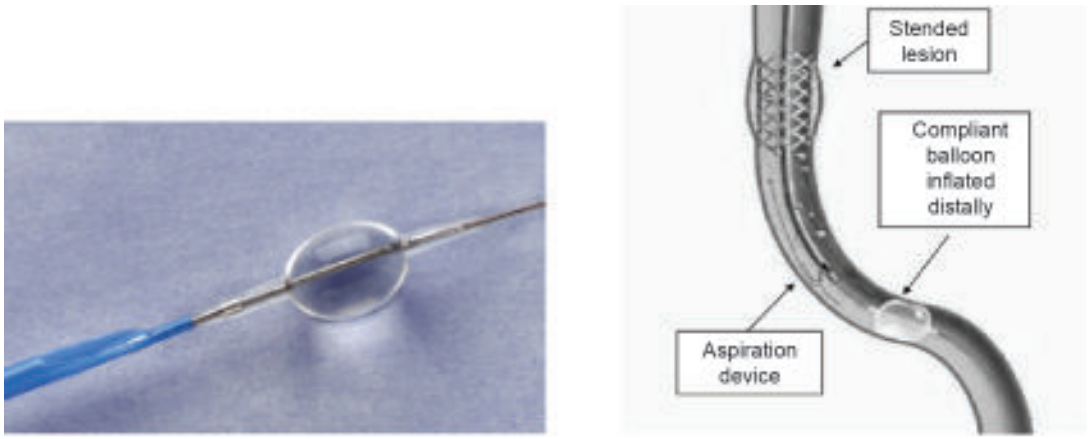
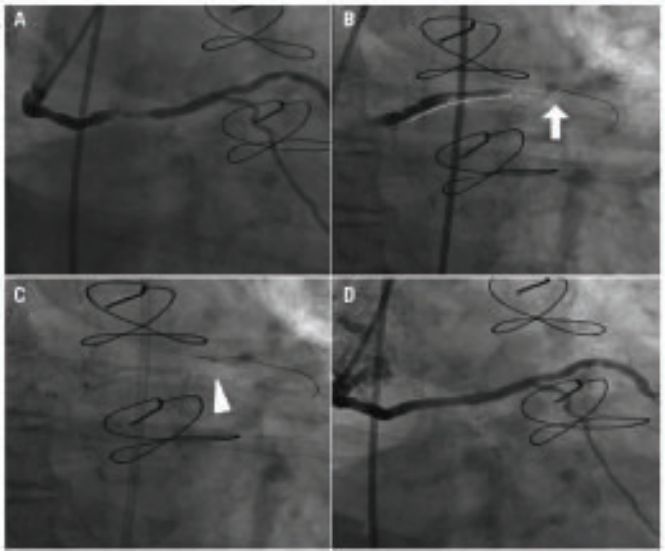


Fig.-6: Distribution of Stents

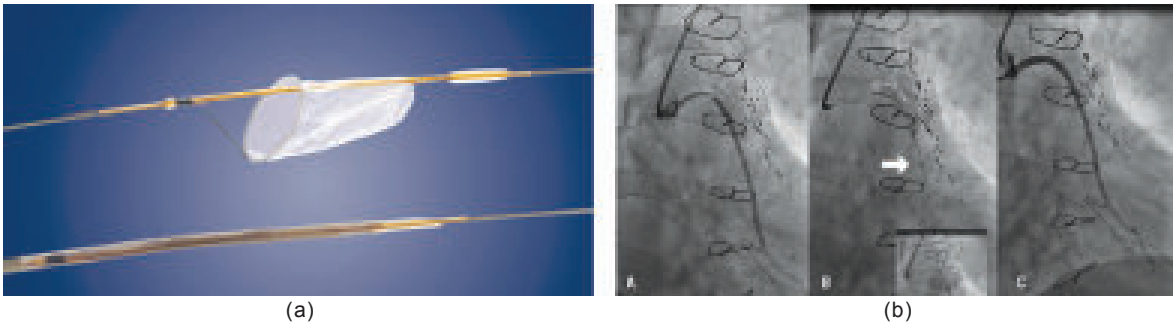


(a) (b)



(C)

Fig.-7 *a). Distal occlusion device (PercuSurgeGuardWire; Medtronic Inc., Minneapolis, MN, USA). b). Distal occlusion device, graphical representation. c). Distal occlusion device mechanism of action: A) Severe stenosis in the mid portion of a saphenous vein graft to the left circumflex coronary artery. B) Distal occlusion non-compliant balloon inflated (arrow) with a stent positioned at the level of the lesion (dotted line). C) Manual debris aspiration (the arrowhead indicates the tip of the aspiration catheter) still with inflated distal occlusion balloon in place. D) Final result.*



(a) (b)

Fig.-8: *a). Distal filter (FilterWire EX®; Boston Scientific, Natick, MA, USA). b). Distal filter mechanism of action: A) long severe proximal stenosis of a saphenous vein graft to the left circumflex coronary artery. B) distal filter (arrow) (Emboshield; Abbott Vascular, Redwood City, CA, USA) and stent in place (dotted line). In the small bottom left quadrant, a second stent is deployed in proximal overlap with the first one, still with the filter in place. C) Final result.*

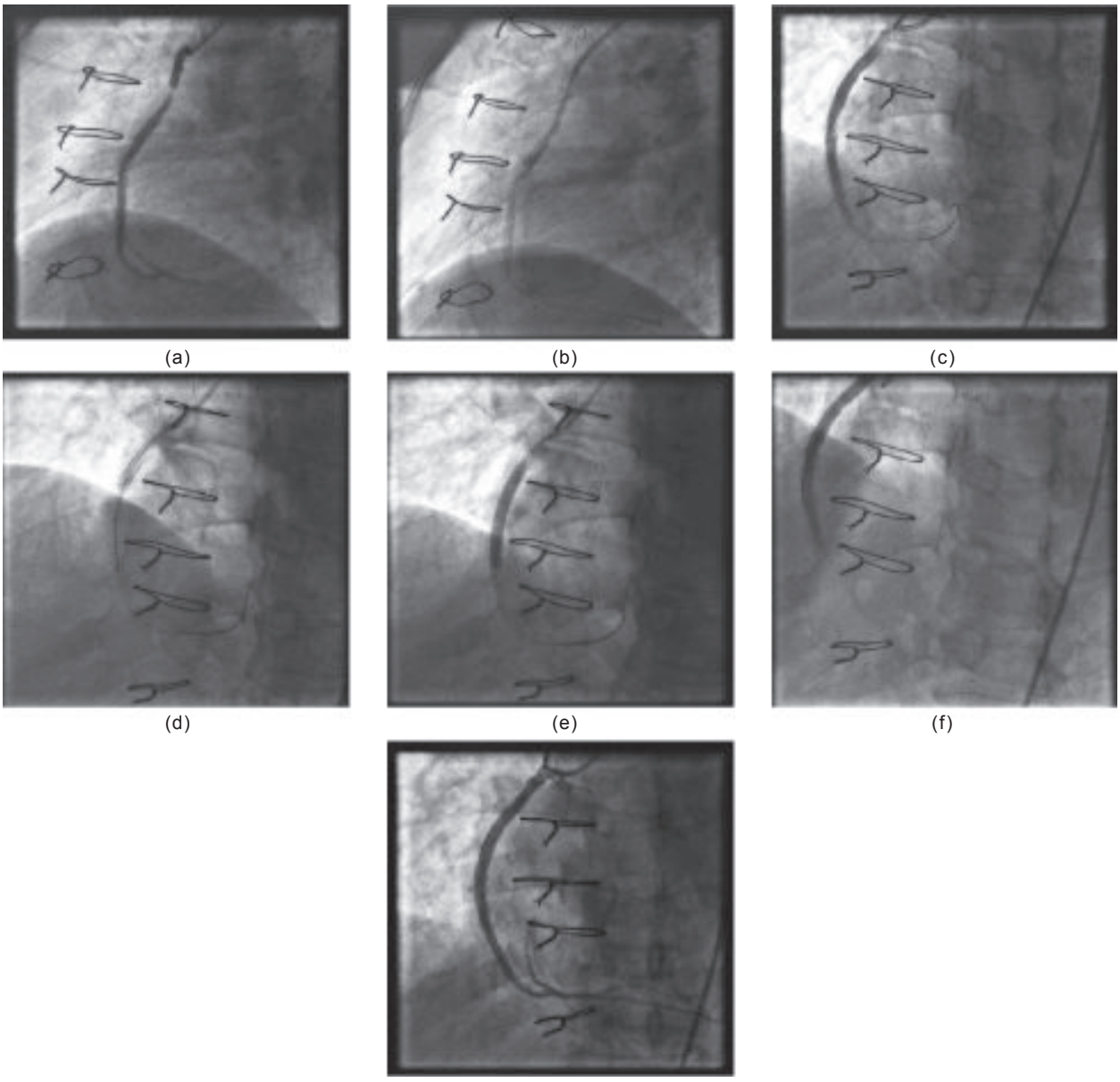


Fig.-9: *a). Acute Inf MI, 16 years after CABG, Thrombolysed, Post MI Angina SVG PCI to RCA. b and c). After directly stenting the plaque, initially looked ok. 2nd injection showing new thrombus/ degenerated materials after the stent. d, e,f) A 2nd stent deployed directly followed by no flow and slow flow. After Adenosine, Nitrates, Integrillin, some flow returned with native artery visualization and improvement of symptoms and hemodynamics g). Relook CAG 2 months later showed patent SVG-RCA stent with no residual stenosis*

Discussion:

Saphenous vein graft (SVGs) are still commonly used for surgical revascularization of coronary artery although are related to poor long-term patency.[6] Full arterial revascularization in coronary artery bypass graft (CABG) procedure, despite related improved clinical outcomes, is still seldom achieved.[7] For this reasons , percutaneous coronary intervention of SVGs is being routinely done in daily practice, accounting approximately 6-10% of total PCI volume with optimal clinical outcome compare to

native coronary PCI with higher rate of in-stent restenosis (ISR), target vessel revascularization(TVR)m, death, MI.[8] In this scenario, DES vs BMS in SVGs have shown favorable outcome in DES than compare to BMS regarding angiographic and clinical short and midterm restenosis at follow-up.[9-10]

Although, advancement of interventional cardiology with newer technology along with the availability of hard wires for SVGs intervention, the optimal satisfactory outcome doing PCI in SVGs remain unsatisfactory. Several study on SVGs PCI either with First Generation DES vs BMS has shown different outcomes. For instances in in SAVED (saphenous vein de NOVO) trial reported that compared with balloon angioplasty, BMS were associated with higher peri-procedural success. DIVA trial,[11-12] where 88% DES stents were of Second-generation DES, at 1-year follow-up the incidence of target vessel failure (Primary endpoint of composite of cardiac death, target vessel MI or TVR) was not different compare to BMS. Moreover, at median 2.7 years follow up no significant difference between the group in terms of all cause death, MI, stent thrombosis, stroke, bleeding or other secondary outcomes were observed. In the ISAR-CABG trial[13] randomly assigned 610 patients to first generation DES or BMS, and reported lower 12-month incidence of target vessel revascularization in the DES group (7% vs 13%, P=0.01)and no significant differences in all-cause mortality, myocardial infarction and definite or probable stent thrombosis as com[pared with BMS. BASKET- SAVAGE trial[14] has lower incidence of target vessel revascularization in the DES group (4.5% vs 19.1% at 3 years p<0.001) and lower rate of MACE in DES group (30% vs 12%, HR 0.33, P=0.001). In RRISC (Reduction of Restenosis in Saphenous vein grafts with Cypher), ISR rate at six months significantly reduced in Cypher, consistently with a drop of TLR and TVR.[6] Similarly, SOS (Stent of saphenous Vein Grafts) trial, paclitaxel eluting stent showed lower rate of ISR in paclitaxel with significant reduction of TLR and TVR in Taxus arm than BMS. Thus, both RRISC and SOS uses first generation DES with significant advantages of drug eluting stents in treating de-novo SVG.

Percutaneous coronary intervention of saphenous vein graft lesion is associated with a uniquely high-risk peri-procedural myocardial infarction. (MI) and mortality-much higher than routine native coronary. Distal embolization manifested as slow-flow and no-reflow (SNFR) in 10-15% of SVG PCIs. SVG plaques are large, soft, friable lipid rich, containing large necrotic debris, cholesterol crystals and foam cell, and are often associated with overlying thrombus. During PCI of SVGs, distal embolization of this particle may lead to platelet and leukocyte activation, release of vasospastic mediators (serotonin, endothelin). And activation of chemotactic mediators (tissue factor, thrombin/anti-thrombin III complex and prothrombin fragments. Thus, lead to triad of microvascular embolization, spasm, and thrombosis manifesting as SFNR.[15]

Uses of Embolic protection devices is a class I indication according to the ACC/AHA/SCAI PCI guideline[16] when feasible, to decrease the risk of distal embolization, no-reflow, and periprocedural myocardial infarction. This recommendation was based on a single randomized controlled trial, the SAFER study, which showed significant reduction in major adverse cardiac events (MACE) with the use of a distal balloon occlusion device.[17]

Bangladesh has emerged as one of the leading countries, in this part of world where most of the big city, cardiac catheterization laboratory is available. For last decades, we set to world class standard in treating all types of coronary intervention, both elective and primary. Doing all normal to complex, including lifesaving intervention with the support of IABP when indicated.

CABG is the choice of revascularization intreating multivessel disease, where PCI is very expensive as we don't have individual medical insurances. Most of our patient are physically not fit enough to proceed for Re-do surgery. Moreover, intervention of SVGs PCI single or multiple, interventionist needs to be expert enough to treat such de-novo SVG. Till now, we don't have exact clinical scenario or data of survival outcome follow-up, in this subset of cardiac patient.

To our knowledge, for the first time, we have carried out this observational non-randomized prospective study in our center. Patient with significant SVGs occlusion with ongoing Angina or dyspnea on effort or at rest, underwent for PCI were studied. We found that SVGs to OM are prone to develop occlusion possibly due to anatomic location of OM is of the predisposing factor. Also, stents in SVG to OM is susceptible to develop recurrent ISR. One of our patients had several times stenting in SVG to OM for recurrent ISR. Thus, PCI to SVG to OM may not be suitable or recommended until it is deemed necessitate to relief ongoing angina or the OM territory is big enough with viable myocardium.

The long-term success of surgical coronary revascularization is limited by accelerated atherosclerosis and intimal fibrosis of saphenous veins after its use as a vascular conduit.

At 1-year incidence in 1 or more total SVG occlusion has been reported to be high as 41% after on-pump by-pass surgery.[18-19] Because of increased morbidity and mortality with repeat coronary artery bypass graft surgery, SVG intervention is considered by many to be the preferred revascularization in patients with diseased SVGs and accounts for approximately 5 to 10% of all percutaneous coronary intervention.[20-21]

Conclusion:

Saphenous vein grafts (SVGs) are commonly used conduits for surgical revascularization of coronary arteries but are associated with poor mid and long-term patency rates. We know that PCI of SVGs is associated with worse clinical outcomes including higher rates of in-stent restenosis, target vessel revascularization, myocardial infarction and death compared to PCI of native coronaries. The higher rate of MI with SVG PCI compared with non-SVG PCI supports the role of thrombosis in the pathogenesis of SVG failure. However, reduced flow rate, altered shear stress, pronounced neointimal proliferation and differential plaque and vessel (absence of media) structure and composition are also likely to contribute SVG failure.[22-23] Although, longer term DAPT might improve the better survival outcome, the chances of bleeding risk among this group of patients who are mostly older ages. Rather, intensified DAPT may be beneficial in this group of patients.[24]Re-do CABG is always complex, carries a higher risk of morbidity and mortality. Thus, we may conclude that in our context, PCI to SVGs may be the choice of revascularization.

Future perspectives:

This is very primitive observational study of SVG PCI of post CABG patient admitted for coronary angiogram for ongoing chest pain or exertional dyspnea. One of the major drawbacks of our Bangladeshi patient population are not follow-up with the same physician or hospital. Noncompliance to medication and lifestyle modification along with control of CAD risk factors harmful effects are also reason to recurrence of symptoms with hospitalization and revascularization. We know that, SVGs are prone to degeneration and occlusion, leading to poor long-term patency and thereby graft occlusion. We found recurrence of ISR in graft vessel is not an uncommon phenomenon. Thereby, needs multicenter involvement to develop common consensus in treating this group of Graft occlusion patient. Thus, to treat early and reduce repeat re-hospitalization and target vessel revascularization.

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Original Article

Impact of Raised Blood Glucose Level on In-Hospital Outcome of Thrombolysed Patients with Acute Myocardial Infarction

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Abstract:

Background: Diabetes mellitus (DM) is an established major cardiovascular risk factor associated with increased prevalence of coronary artery disease (CAD). Patients with diabetes often have numerous concomitant cardiac risk factors with a higher incidence of acute myocardial infarction (AMI) and congestive heart failure (CHF). Patients either with or without a prior history of DM may present with hyperglycemia during AMI. We analysed our population to determine whether admission hyperglycemia was a strong risk factor for in-hospital mortality and morbidity in patients with AMI and may be even stronger than a previous history of diabetes.In-hospital death risk of AMI patients without DM was about 2 to 4 times higher in patients with hyperglycemia than in those without hyperglycemia.

Methods:This Prospective observational study was carried out at the National Institute of Cardiovascular Diseases (NICVD), Dhaka. A total number of 200 ST-segment elevation AMI patients were enrolled in this study as per inclusion and exclusion criteria. They were subdivided on the basis of admission blood glucose into two groups. Group-1A and 2A were 50 patients with blood glucose <200mg/dl (<11.1mmol/l) and Group-1B and 2B were 50 patients with blood glucose ≥200mg/dl (11.1 ≥mmol/l). The numerical data obtained from the study were analyzed and significance of differences were estimated by using statistical methods. Computer based SPSS (Statistical Package for Social Science) were used.

Results:In the present study mean age of the male and female were 56.10±11.86 and 57.83±13.74 years, p>0.05%. There was no significant difference regarding risk factors and smoking was higher in both group. Regarding in-hospital adverse outcome, death was significantly higher in hyperglycemic non diabetic group (p<0.0001). It was two times (56%) higher than diabetic hyperglycemic (28%) group.Cardiogenic shock (66%) and CHF (56%) were also more common in hyperglycemic non diabetic group. Lowest patients (8%) died of AMI without DM with random blood glucose <11.1 mmol/l (controlled). On the other hand highest improvement was in the controlled group (p<0.0001).Multivariate analysis showed Diabetic status with normal blood sugar was a predictor of adverse outcome; but patients with hyperglycemia and no history of diabetes had a worse outcome and were independently associated with significant risk of in-hospital mortality. Age group >65 years and Male sex were also associated with significant in-hospital mortality.

Conclusion: Independent of diabetic status, the occurrence of hyperglycemia during AMI is associated with a sub-population of patients at particularly high risk for an adverse clinical outcome. Even with the highly efficacious treatment strategies currently available, persons presenting with AMI and hyperglycemia are at increased risk for cardiogenic shock and CHF or death in hospital.

Key Wards: Diabetes mellitus, In-hospital outcome, Acute myocardial infarction.

(Bangladesh Heart Journal 2020; 35(1): 14-19)

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DOI: https://doi.org/10.3329/bhj.v35i1.49138

Introduction

Diabetes mellitus (DM) is an established major cardiovascular risk factor associated with increased prevalence of coronary artery disease (CAD).[1] Patients with diabetes often have numerous concomitant cardiac risk factors with a higher incidence of acute myocardial infarction (AMI) and congestive heart failure (CHF). Patients either with or without a prior history of DM may present with hyperglycemia during AMI. Several studies have reported an association between elevated blood glucose upon admission and subsequent increased adverse events including CHF, cardiogenic shock and death.[2]

In-hospital death risk of AMI patients without DM was about 2 to 4 times higher in patients with hyperglycemia than in those without hyperglycemia.[3]Higher myocardial necrotic markers and lower left ventricular ejection fraction (LVEF) in patients of AMI without DM with hyperglycemia.[4]Hyperglycemia itself is arrhythmogenic , due to prolongation of QT interval that may favour the occurrence of arrhythmias like ventricular tachycardia/ ventricular fibrillation, with potential fatal outcome more in patients of AMI without DM.[4]

Hyperglycemia activates thrombosis. Namely acute blood sugar level increase induces alteration in coagulation by shortening of fibrinogen half –life increases of pro-thrombin fragments and factor VII, together with enhanced platelet aggregation resulting in thromboembolic manifestation.[5]An estimated 170 million people are affected by diabetes- the majority by type 2 diabetes. The top ten countries, in terms of absolute numbers of individuals with the condition, are India, China, United States, Indonesia, Japan, Russia, Brazil, Italy, and Bangladesh.[6]A higher percentage of the hyperglycemic non-diabetic suffered cardiac arrest before admission compared with hyperglycemic DM (15% and 2% respectively).[7]

The high prevalence of undiscovered abnormal glucose metabolism among patients with AMI, compatible with the pre-diabetic state as well as frank diabetes, may in part explain the association between admission glucose levels and mortality, especially in subjects who are not diagnosed as having diabetes at the time of the AMI.[8]Another recent report showed that in patients without a history of DM, there was a linear relation between admission glucose and in hospital mortality. Impaired glucose tolerance and DM are common after an attack of AMI.These patients developed more adverse cardiovascular events like CHF,angina as compared to patients with normal glucose tolerance.[9]

Diabetic women with coronary heart disease had more severe atherosclerotic lesion in comparison to diabetic men. CAD in diabetic women was also more diffuse than that of diabetic men.[10]Another recent study showed that cardiogenic shock as well as death was significantly higher in patients with AMI with impaired fasting glucose (IFG).[11]There was no such study carried out in our country to see the association between admission blood glucose level and the short term mortality risk in patients with ST-Segment elevation AMI who received thrombolytic , with the emphasis on whether the patients had a previous history of diabetes or not. So the proposed study might be quite justified and time worthy.

Materials and methods

This prospective observational study was conducted in National Institute of Cardiovascular Disease (NICVD), Dhaka. A total of 200 ST-segment elevation AMI patients with or without a history of DM admitted in coronary care unit (CCU) of NICVD who received thrombolytic were studied. Plasma Glucose was measured on admission. On the basis of history of DM, patients were divided into two groups one is (Group-1) where there were 100 AMI patients without undiagnosed DM; another is (Group-2) where there were 100 AMI patients with diagnosed DM.

The patients were again subdivided on the basis of admission blood glucose into two groups. Out of 100 patients in Group-1,subdivided into Group-1A: (50) were AMI without undiagnosed DM with admission blood glucose <200mg/dl (<11.1mmol/l) and other Group-1B: 50 were AMI without undiagnosed DM with admission blood glucose e”200mg/dl(11.1e”mmol/l) .On the other hand ,other 100 patients in Group-2,subdivided into Group-2A: (50) were AMI with diagnosed DM with admission blood glucose <200mg/dl (<11.1mmol/l) and other Group-2B: 50 were AMI with diagnosed DM with admission blood glucose e”200mg/dl(11.1mmol/l).

The strength of association of glycemic status will be assessed by comparison of the two groups with a disordered blood glucose profile to the “normal”(control) Group-1 (A) patients not previously diagnosed with diabetes and with a random blood sugar <200 mg/dl (<11.1 mmol/l).All patients were followed up maximum up to 5 to 12 days after admission to see the In-hospital adverse outcome likely mortality & morbidity (CHF, Cardiogenic shock/Hypotension, Arrhythmia, Thromboembolism and in-hospital stay.

The numerical data obtained from the study were analyzed and significance of differences were estimated by using statistical methods. Computer based SPSS

(Statistical Package for Social Science, version 20) were used. Data were expressed in percentage, frequencies and means and standard deviation, as applicable. The chi-square test were used to assess differences in the distribution of categorical variables; t-tests done to compare continuous variables. Multivariate regression analysis were performed in order to identify independent predictors of in-hospital mortality.

Results:

In the present study mean age of the male patients were lower (56.10±11.86 years) than that of the female patients (57.83±13.74 years), but the mean defference was not statistically significant (p>0.05%) (Table-I).There was no significant difference regarding risk factors among the studied patients (p>0.05) and smoking was higher in both groups (Table-II).

Regarding biochemical, hemodynamic and echocardiographic parameter of the study population, it was found that the mean percentage of ejection fraction in hyperglycemic patients of group 1B (Non diabetic with stress hyperglycemia e”11.1) were 40.88+6.86 and in group 2B (DM with hyperglycemia) were 46.00±7.89 (Table -III).The difference between two groups of patients were statistically highly significant (p<0.001).

In this study it was found that LV dysfunction were significantly more common in group 1B in terms of mild (p<0.05) and moderate (p<0.001) LV dysfunction than in group 2B.But there was no significant difference in severe LV dysfunction (p>0.05) among both groups. LV dysfunction were significantly more common in group 1B (Hyperglycemic non diabetic in terms of mild (p<0.0001) and moderate (p<0.0001) LV dysfunction than in group 1A (controlled).But there was no significant difference in severe LV dysfunction (p>0.05) among both groups. LV function were significantly normal (p<0.05) in non-diabetic normal glycemic group 1A (Table IV)

In this study also showed that regarding in-hospital adverse outcome, death was significantly higher in hyperglycemic non diabetic group (p<0.0001) than hyperglycemic diabetic group. It was two times (56%) higher than diabetic hyperglycemic (28%) group.In addition in this study we also found that cardiogenic shock (66%) and CHF (56%) were also more common in hyperglycemic non diabetic group than hyperglycemic diabetic group in which cardiogenic shock (44%) and CHF (34%) (Table-V, VI). In this study Out of 200 patients, 50 of them were non diabetic with hyperglycemia among them that the highest 28 patients died of AMI with stress hyperglycemia without DM (p<0.0001) than those of patients of AMI with or without

Table-I

Age and sex distribution of the study patients of both groups (n=200)

Age in Years	Study Subject				P value
	Male		Female		
	No.	%	No.	%	
<45	19	11.1	04	13.8	0.752
45- 54	51	29.8	07	24.1	0.533
55-64	61	35.7	07	24.1	0.225
≥65	40	23.4	11	37.9	0.097
Mean ± SD	56.10±11.86		57.83±13.74		0.48

Table-II

Risk factor distribution of study subject (n=200)

Risk factors	Study subject (n=200)								P value
	Group1A		Group1B		Group2A		Group2B		
	No.	%	No	%	No	%	No	%	
Smoking	38	26.0	40	27.4	35	24.0	33	22.6	0.401
HTN	07	14.9	11	23.4	14	29.8	15	31.9	0.230
Dyslipidaemia	02	11.8	04	23.5	05	29.4	06	35.3	0.522
Family History	02	14.3	04	28.6	03	21.4	05	35.7	0.674^{N}

Group 1A: Non-diabetic with RBS<11.1 mmol/l, Group 1B: Non-diabetic with RBS >11.1 mmol/l
Group 2A: Diabetic with RBS < 11.1 mmol/l , Group 2B: Diabetic with RBS e” 11.1 mmol/

hyperglycemia with DM. Lowest patients (8%) died of AMI without DM with random blood glucose <11.1 mmol/l (controlled). On the other hand highest improvement was in the controlled group (p<0.0001).).So that the result was statistically highly significant.

Multivariate analysis identified several variables that were independently associated with in-hospital mortality. Diabetic status with normal blood sugar was a predictor of adverse outcome; but patients with hyperglycemia and no history of diabetes had a worse outcome and were independently associated with significant risk of in-hospital mortality. Group 1A (Non-diabetic and RBS <11.1mmol/L) was considered as reference category for the 'Groups' as variable. Age group (>65 years) and Male sex were also associated with significant in-hospital mortality. In case of age groups '<45 years' was considered as reference category (OR 0.17; 95% CI 0.05-0.59 in group1B and OR 3.02; 95% CI 1.23-7.41 in group2A) (Table-VII).

Table-III

Biochemical, Hemodynamic, Echocardiography and Other parameters of study subject (n=200)

Parameters	Study subject (n=200)				P value
	Group1A Mean±SD	Group1B Mean±SD	Group2A Mean±SD	Group2B Mean±SD	
S.Creatinine (mmol/L)	0.95±0.23	1.13±0.17	1.10±0.19	1.17±0.53	*0.004*^{S}
Diastolic BP (mm Hg)	68.5±14.53	58.4±32.03	61.5±30.7	67.5±26.23	0.203^{NS}
Systolic BP (mm Hg)	102.6±22.86	89.2±49.89	94.9±48.1	103.5±42.55	0.286^{NS}
Ejection Fraction (%)	48.34±5.05	40.88±6.86	46.4±6.8	46.0±7.9	*0.0001*^{S}
Weight (kg)	63.96±7.88	62.26±6.57	61.06±5.68	64.44±6.65	*0.049*^{S}
Hospital Stay (days)	5.96±1.89	4.0±2.1	4.66±1.63	4.74±1.91	0.0001^{S}

Group 1A: Non-diabetic with RBS<11.1 mmol/l, Group 1B: Non-diabetic with RBS ≥11.1 mmol/l
Group 2A: Diabetic with RBS < 11.1 mmol/l ,Group 2B: Diabetic with RBS ≥11.1 mmol/
P value reached from one way ANOVA

Table-IV

In-hospital outcome of hyperglycemic patients (n=100)

Outcome	Study Subject				p value
	Group 1B (n=50)		Group 2B (n=50)		
	No.	%	No.	%	
Improved	22	44.0	36	72.0	0.005
C.Shock	33	66.0	22	44.0	0.027
CHF	28	56.0	17	34.0	0.027
Tachyarrythmia	03	06.0	05	10.0	0.715
Bradyarrythmia	05	10.0	05	10.0	1.000
Thormboembolism	00	00.0	01	02.0	1.000
Death	28	56.0	14	28.0	0.005

Table-V

In-hospital outcome of non diabetic patients (n=100)

Outcome	Study Subject				p value
	Group 1A (n=50)		Group 1B (n=50)		
	No.	%	No.	%	
Improved	46	92.0	22	44.0	0.0001
C.Shock	13	26.0	33	66.0	0.0001
CHF	13	26.0	28	56.0	0.002
Tachyarrhythmia	03	06.0	03	06.0	1.000
Bradyarrythmia	06	12.0	05	10.0	0.749
Thormboembolism	04	08.0	00	00.0	0.117
Death	04	08.0	28	56.0	0.0001

Group 1B: Non diabetic with RBS ≥11.1 mmol/l, Group 1A: Non diabetic with RBS < 11.1 mmol/l

Table-VI

In-hospital outcome of diabetic patients (n=100)

Outcome	Study Subject				p value
	Group 2A (n=50)		Group 2B (n=50)		
	No.	%	No.	%	
Improved	40	80.0	36	72.0	0.349
C.Shock	15	30.0	22	44.0	0.147
CHF	11	24.0	17	34.0	0.271
Tachyarrhythmi	01	02.0	05	10.0	1.204
Bradyarrythmia	04	08.0	05	10.0	1.000
Thormboembolism	01	02.0	01	02.0	1.000
Death	10	20.0	14	28.0	0.349

Group 2A: Diabetic with RBS < 11.1 mmol/l , Group 2B: Diabetic with RBS ≥11.1 mmol/l

Table-VII

Independent Predictors of In-hospital mortality (N=200)

Variables of interest	Multivariate Analysis		
	Odds ratio	95% CI for OR	P value
Group 1A	1.00	0.14-0.64	0.07
Group 1B	0.17	0.05-0.59	*0.005*
Group 2A	3.02	1.23-7.41	*0.015*
Group 2B	0.48	0.18-1.28	0.143
Age group(>50 yrs)	4.21	1.03-17.11	*0.044*
Sex (Male)	0.17	0.04-0.67	*0.011*
Smoking	3.07	0.90-10.49	0.073
HTN	1.42	0.6-3.36	0.425
Dyslipidaemia	2.76	0.66-11.65	0.165
Family history of IHD	1.96	0.47-8.16	0.354

Group 1A: Non-diabetic with RBS<11.1 mmol/l, Group 1B: Non-diabetic with RBS >11.1 mmol/l

Group 2A: Diabetic with RBS < 11.1 mmol/l, Group 2B: Diabetic with RBS ≥11.1 mmol/

Discussion

The present study was a prospective observational study conducted in the National Institute of Cardiovascular Diseases (NICVD), Dhaka. The aim of the study was to assess the prognostic significance of on admission blood glucose level with ST-segment elevation AMI patients with or without history of DM who received thrombolytic.

In the present study mean age of the male patients were lower (56.10±11.86 years) than that of the female patients (57.83±13.74 years), but the mean defference was not statistically significant (p>0.05%). In this study out of two hundred patients 171 (85%) were male and 29(15%) were female.There was no significant difference regarding risk factors among the studied patients (p>0.05) and smoking was higher in both groups. In this study shows that LV dysfunction were significantly more common in group 1B in terms of mild (p<0.05) and moderate (p<0.001) LV dysfunction than in group 2B. But there was no significant difference in severe LV dysfunction (p>0.05) among both groups.

Another study showed that high admission blood glucose level (ABG) levels could be a marker of high-risk patients with excess stress response mediated by neurohormonal system activation, particularly cortisol and catecholamine's.[12]Furthermore, impaired myocardial performance results in the activation of compensatory neurohormonal systems, including activation of the sympathetic nervous system, with the degree of sympathetic activation being proportional to the severity of ventricular dysfunction and degree of HF.[13]Activation of the sympathetic system not only increases insulin resistance but also

decreases the release of insulin from the pancreatic beta cells and increases hepatic glucose production by stimulating both gluconeogenesis and glycogenolysis.[14,15]However, hyperglycemia may contribute to exacerbation of HF by several independent mechanisms.

Multivariate analysis identified several variables that were independently associated with in-hospital mortality. Diabetic status with normal blood sugar was a predictor of adverse outcome; but patients with hyperglycemia and no history of diabetes had a worse outcome and were independently associated with significant risk of in-hospital mortality. Group 1A (Non-diabetic and RBS <11.1mmol/L) was considered as reference category for the 'Groups' as variable. Age group (>50 yrs) and Male sex were also associated with significant in-hospital mortality.

Conclusion:

From this study it may be concluded that, independent of diabetic status, the occurrence of hyperglycemia during AMI is associated with a sub-population of patients at particularly high risk for an adverse clinical outcome. In this study we found that in-hospital death was significantly higher in hyperglycemic non diabetic group (p<0.0001) than hyperglycemic diabetic group. It was two times (56%) higher than diabetic hyperglycemic (28%) group.This study may be the base of further clinical controlled studies with larger population to validate our findings.

Limitations of the study

Although the results of this study support the hypothesis, yet this has got some limitations.The study was a non-randomized and observation study, Number of study population was limited. We could not determine the true incidence of diabetes mellitus, especially among persons without a prior history of this condition. Finally no attempt was made to analyze sequential glucose levels in the hospital, and thus we have no information on the outcome of patients who may have developed hyperglycemia later in their hospital course.

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Original Article

Comparison of Early Outcome of Off-pump and Conventional Coronary Artery Bypass Graft Surgery in Patients with Multivessel Coronary Artery Disease and Left Ventricular Dysfunction

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Abstract:

Introduction: Left ventricular dysfunction is an important predictor of in-hospital mortality. Due to the theoretical and practical advantages to avoid the harmful effects of cardiopulmonary bypass (CPB), many cardiac surgeons are using Off-pump Coronary Artery Bypass (OPCAB)as an effective alternative to conventional CABG (CCAB) even in patients with reduced left ventricular (LV)ejection fraction.

Objectives: This study performed in the National Institute of Cardiovascular Diseases (NICVD) evaluated the early outcomes of OPCAB in terms of mortality and major post-operative morbidities and compared them with that of CCAB in patients with multivessel coronary artery diseases and reduced left ventricular (LV) function.

Methods: Total 120 patients with multivessel coronary artery disease with reduced left ventricular ejection fraction (d"50%)were allocated into two groups: a) 60 patients who underwent OPCAB and b) another 60 patients who underwent conventional CABG between January 2013 and December 2015. Pre-operative, per-operative and early post-operative variables were recorded, compiled and compared.

Results: All risk factors and co-morbidities were homogenously distributed between the two groups. Majority of the patients had triple vessel disease. Nearly three-quarter (73.3%) of patients in OPCAB group and 80% in CCAB group received 3 grafts (p=0.470). The mean total operative time (268.5 ± 33.5vs. 296.3 ± 34.8minutes, p < 0.001), intubation times(8.6±0.3 vs. 12.3±0.5 hours, p<0.001), blood losses (377.8378 ± 45 ml vs. 602 ± 60 ml, p < 0.001); requirements for blood and blood products (689.7±21.1 vs. 1199.3±34.5ml, p < 0.0010),intensive care unit stays (31.7±0.9 hours versus 41.6±1.5 hours; p<0.001) and hospital stays (8.2 ± 0.2days vs.10.3 ± 0.3days, p < 0.001)were all significantly lower in the OPCAB group.

Conclusion: OPCAB is a safe and effective operative revascularization procedure for patients with multivessel coronary artery disease and left ventricular dysfunction and is associated with reduced morbidity. However, a larger and omized trial with long-term follow-up may show the real benefits of OPCAB.

Key Words: OPCAB, CCAB, Multivessel Coronary Artery Disease, Left Ventricular Dysfunction.

(Bangladesh Heart Journal 2020; 35(1): 20-27)

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DOI: https://doi.org/10.3329/bhj.v35i1.49139

Introduction:

Jones et al[1]examined seven large datasets, with more than 172,000 patients undergoing isolated CABG, to assess the predictive power of certain preoperative values on operative mortality. Seven variables were found to be predictive of mortality in all datasets. These seven core variables included urgency of operation, age, prior heart surgery, gender, left ventricular ejection fraction (LVEF), and percentage of stenosis of the left main coronary artery and number of major coronary arteries with 70% stenosis.[1]

CABG with cardioplegia has been considered the gold standard operation for coronary revascularization. The introduction of the heart-lung machine created optimal operative conditions of bloodless, motionless operative field and allowed CABG to be done consistently with generally good results in most patients.[2] However, this technique is linked to several side effects mostly due to use of aortic cross clamp, cardioplegia, and cardiopulmonary bypass. High risk patients are extremely sensitive to cardioplegic arrest and have higher intra-operative and post-operative risk.[3]

Atrial fibrillation occurs in 20-40% of patients who had CABG with cardiopulmonary bypass and is associated with higher risk of cerebrovascular accidents.[4]The higher incidence of post-operative IABP insertion, renal hemodialysis, mechanical ventilation and/or reintubation or tracheostomy could be responsible for the significant higher rate of readmission for CPB patients.[5]

The invention of Off-pump Coronary Artery Bypass (OPCAB) is often attributed to Kolessov in 1967.[6]In the mid-1990s interest in beating-heart techniques experienced resurgence in an attempt to decrease the morbidity associated with CABG without jeopardizing the benefits[6]. Although the initial experience with OPCAB was limited to single or double vessel disease with preserved left ventricular function,[7,8] the availability of modern retractor-stabilizers, heart positioning devices, techniques of exposure of all surfaces of heart, intracoronary shunts, and adequate surgeon experience, similar completeness of revascularization and graft patency can be achieved with OPCAB even in patients with multivessel disease and reduced left ventricular function.[9,10,11]Now OPCAB is widely accepted and considered to be safe for myocardial revascularization specially for high risk patients.[12]

The rapidly increasing incidence of diabetes mellitus, hypertension, and hypercholesterolemia in most communities has given rise to more severe and diffuse coronary artery disease.[13]As a result of improvement in invasive cardiology most patients referred for CABG have diffuse disease and poor ventricles. The global ischemia caused by conventional CABG (CCAB) could be detrimental to them. The OPCAB technique was developed with specific purpose of reducing mortality and morbidity in high risk patients.[6]

The shorter operating time in OPCAB group is probably because of the shorter time required for hemostasis and no time spent on cannulation, managing cardiac arrest and rewarming from hypothermia during CPB. There is also less intra-operative and post-operative blood loss, a lower incidence of re-exploration for bleeding, a smaller transfusion volume and lower incidence of transfusion.[14]

The shorter ICU stay and ventilation time in the OPCAB group may be related to lack of the pulmonary dysfunction that occurs after CPB. Glomerular filtration rate and renal tubular function are better protected by OPCAB group than by conventional CABG.[14]

There are also potential economic benefits including reduced postoperative patient instability and faster recovery rate, reduced use of vasoactive drugs, less need for blood products and cost effective resource utilization.[15]

Materials and Methods:

This was prospective non-randomized clinical study was done in National Institute of Cardiovascular Diseases (NICVD) from January 2013 and December 2015. Among the 120 patients with multivessel coronary artery disease with reduced left ventricular ejection fraction (d”50%) 60 patients underwent OPCAB (Group: A) and the rest 60 underwent conventional CABG (Group: B).

Anesthesia and Monitoring

Patients were premedicated with morphine (0.1 mg/kg) and bromazepam (3mg). Induction and maintenance was done according to local protocol. All patients had a radial artery cannula, a central venous catheter, ECG leads and nasopharyngeal temperature probe for monitoring. Femoral artery cannulation was performed in patients with poor ventricular function (left ventricular ejection fraction <35%) in the event that urgent institution of an intra-aortic balloon pump was required. Arterial blood gases and activated clotting time (ACT) were monitored every 30 minutes. The patient’s temperature was maintained close to 36°C for OPCAB and 32-34°C for CCAB.

Technique of OPCAB

All patients were operated through a median sternotomy. The internal thoracic artery, the radial artery, and the saphenous vein were harvested as appropriate with

standard techniques. Then intravenous heparin (100IU/kg) was given to maintain an ACT of 300 second before starting distal anastomoses. Regional myocardial immobilization was achieved with a suction stabilizer (Octopus) and apical suction device (Star Fish). Intracoronary shunts were used in most patients to maintain coronary flow, thereby reducing myocardial ischemia and at the sametime minimizing bleeding from the coronary arteriotomy. The left anterior descending (LAD) artery was revascularized first using left internal mammary/ thoracic artery (LIMA/ LITA). Proximal anastomoses were performed on the partially clamped ascending aorta using 6-0 continuous Prolene suture. Distal anastomoses were performed with continuous 7-0 or 8-0 polypropylene (Prolene)monofilament suture. After the procedure, heparin therapy was reversed with protamine sulfate in a 1:1 ratio. The leg, forearm, and chest wounds were closed and the patients were shifted to ICU. Total operation time and number of grafts were recorded.

Technique of Conventional CABG

After median sternotomy conduits were harvested and prepared and the patients were heparinized with an initial dose of 300 IU/kg heparin to achieve a target activated clotting time greater than 450 second. CPB was established with ascending aortic and two-stage venous cannulation. The blood pressure was maintained within 50 to 70 mm Hg. The aorta was cross-clumped, and myocardial protection was achieved with intermittent antegrade cold blood cardioplegia according to a standard protocol. On completion of all the distal anastomoses aortic clamp was released and the proximal anastomoses were performed with partial clamping of the ascending aorta during rewarming. Then the patients were gradually weaned from cardiopulmonary bypass (CPB).Heparin neutralization was done by protamine in 1:1 ratio at the end of the procedure. The leg, forearm, and chest wounds were closed and the patients were shifted to ICU. Total operation time and number of grafts were recorded.

Postoperative Management

After surgery, all patients were transferred to the intensive care unit (ICU). Cardiac, respiratory, renal function and hourly blood loss were monitored meticulously. Extubation was done as early as possible while the patients fulfill the extubation criteria. Arterial blood gas, serum electrolytes and hematocrit estimation were done as per standard protocol. Haemodynamic and other parameters were managed according to standard protocol. Pre-operative medications continued as per protocol. Patients were encouraged to intensive spirometry and early mobilization. Then the patients were shifted to general wards and subsequently discharged according to unit protocol. Antibiotic administration was continued until the patient hadcentrallines or chest drains (normally 24-48 hours).

Data collection:

All data were collected from each patient using pre-designed questionnaire and collection form. Data were analyzed and verified with statistical program for social sciences (SPSS) using student's t test, fisher's exact test, chi-square test, where appropriate. The descriptive statistics used here were frequency, mean and standard deviation (SD) and compared using student's t test. Categorical data were expressed as percentages and evaluated using Chi-square or Fischer's exact probability test. The level of significant was 0.05. Any p-value <0.05 was considered as significant.

Results:

Patient characteristics are shown in the Table-1. The mean ages of the study sample were61.4±9.56years for the OPCAB group and 59.2±5.87 years for CCAB group with no significant difference (p=0.4090; >0.05) in age distribution. In the study both sexes were homogenously distributed between the two groups but with clear male predominance (90% in OPCAB vs. 86.7%). Overweight and obese patients were higher among CCAB group than that in OPCAB group (43.3% vs. 33.3%). However, the mean BMI were almost similar (28.1±2.38vs. 27.7±3.4kg/m^2, p = 0.955; >0.05).In our study, the commonest co-morbid factor was smoking in both groups (66.7% in OPCAB vs. 63.3% in CCAB group). It was followed by dyslipidemia (63.3% vs. 53.3%), hypertension (53.3% vs. 50%) and diabetes mellitus (33.3% in both groups). Other co-morbid factors were family history of CAD (10% vs. 13.3%), past history of CVA (6.7% vs. 10%), COPD (10% vs. 10%), history of MI (20% vs. 23.3%), PVD (10% vs. 10%) and renal dysfunction (6.7% vs. 3.3%). All were almost identically distributed between the groups (p > 0.05). In the study the mean left ventricular ejection fraction (LVEF) was almost similar in both groups (39.5 ± 3.6% vs. 38.65± 2.7, p = 0.1461).Pre-operative angiographic study demonstrated that majority of the patients had triple vessel disease (TVD) in each group (70%and 83.3% respectively). The rest had double vessel disease (DVD).The operating time was significantly higher in CCAB group (296.3 ± 34.8vs. 268.5 ± 33.5minutes, p < 0.001). The mean cardiopulmonary bypass (CPB) time was 110.3 ± 23.9minutes in conventional CABG group. Most of the patients of both groups (73.3% and 80%respectively, p = 0.470) required 3 grafts. 2(6.7%) CCAB and 1(3.3%) OPCAB patients had 4 distal anastomoses. Among the post-operative variables the mean ventilation time was significantly higher in the CCAB group than those in OPCAB group (12.3±0.5 vs. 8.6±0.3 hours, p<0.001). In NICVD there is a trend to use inotropic support to almost all post-CABG patients unless otherwise specified. So, we used

prolonged post-operative inotropic support (>24 hours) or use of IABP as post-operative outcome variables. In our study 4(6.7%) CCAB patient required prolonged inotropic support. Among them 2 (3.3%) required IABP support. On the other hand, one (1.67%) of the OPCAB patients received prolonged inotropic support and one (1.67%) required IABP.

Total post-operative bleeding was significantly lower in OPCAB (378 ± 45 ml vs. 602 ± 60 ml, p < 0.001) group. Blood product requirement was also significantly lower in OPCAB group(690 ± 30 vs.1085 ± 45 ml, p < 0.0010).In this study, the average ICU-stay (34.7 ± 0.9hours vs. 43.6 ± 1.5hours, p<0.001) and total postoperative hospital stay was also shorter in OPCAB group (8.2 ± 0.2days vs.10.3 ± 0.3days, p < 0.001).

One patient (1.67%) of OPCAB group and two (3.3%) of CCAB group (p=1.000) died within 30days of operation. In the immediate postoperative period, 2(3.3%) of the CCAB patients and 1(1.67 %) of the OPCAB patients developed new Q-wave myocardial infarction (MI). Other patients with post-operative myocardial infarction recovered with conservative management.One patient of CCAB group having LVEF of 30% required IABP during weaning from CPB. The only death of OPCAB group was due to cardiac temponade from mediastinal bleeding. Re-exploration was done and bleeding was secured. But he died later due to multi-organ dysfunction from prolonged low output syndrome. The other patient of CCAB group died of pulmonary complication (pneumonia) requiring re-intubation.The mean period of mechanical ventilation, amount of blood products needed, length of ICU stay and hospital stay during the early post-operative period- all were significantly greater in CCAB group. Three (6.7%) patients of CCAB group and one (1.67%) of OPCAB group required re-exploration for bleeding (p=0.6186). Two (3.3%) of CCAB patients and one 1(1.67%) of OPCAB group developed stroke (p=1.000). New postoperative arrhythmias were developed in 12 (20%) CCAB and6 (10%) OPCAB patients (p=0.236). In most (14 patients) of them there were atrial arrhythmia and the remaining (4 patients) had ventricular tachycardia.

LOS (6.7% vs. 1.67%), pulmonary complications (10 vs. 6.7%), infective complications (10 % vs. 4%), and renal dysfunction(10 % vs. 4%), were also more common in CCAB group. Thus, postoperative complications were relatively less common in OPCAB group although statistically not significant. But this might be significant if larger sample would have been taken.

Table-I

Patient characteristics of multivessel coronary artery disease

Variables	OPCAB group(n=60)	CCAB group(n=60)	p Value
Age, years#	61.4±9.56*	59.2±5.87*	0.4090ns
Male, n (%)¥	54(90)	52(86.7)	0.500ns
Female, n (%)¥	6 (10)	8(13.3)	0.500ns
BMI(kg/m²)#	28.1±2.38*	27.7±3.4*	0.4568ns
Hypertension, n (%)¥	32(53.3)	30(50.0)	0.796ns
Diabetes mellitus, n (%)¥	20(33.3)	20(33.3)	0.608ns
Smoking, n (%)¥	40(66.7)	38(63.3)	0.787ns
Dyslipidemia, n (%)¥	38(63.3)	32(53.3)	0.432ns
Family H/O CAD, n (%)¥	6(10.0)	8(13.3)	0.500ns
Past H/O CVA, n (%)¶	4(6.7)	6(10.0)	0.500ns
COPD, n (%)¥	6(10.0)	6(10.0)	0.665ns
History of MI, n (%)¥	12(20.0)	14(23.3)	0.754ns
PVD, n (%)¥	6(10.0)	6(10.0)	0.665ns
Renal dysfunction, n (%)¶	4(6.7)	2(3.3)	0.500ns
Arrhythmia, n (%)¶	4(6.7)	4(6.7)	0.694ns
LVEF (%)#	39.5 ± 3.6*	38.65± 2.7*	0.1461ns
NYHA class III or IV, n (%)¥	10(16.67%)	8(13.33%)	0.952ns
CCS angina class III or IV, n (%)¥	26(43.33%)	32(53.33)	0.757ns
DVD¥	18(30.0)	10(16.7)	0.222ns
TVD¥	42(70.0)	50(83.3)	0.222ns

*Data are presented as the mean ± SD for continuous variable.

Student's t-Test, ¥ Chi-square ($Ç^2$) Test, ¶ Fisher's Exact Test, ns= Non-significant

OPCAB: Off-Pump Coronary Artery Bypass; CCAB: Conventional Coronary Artery Bypass; COPD: Chronic Obstructive Pulmonary Disease; CVA:Cerebrovascular Accident; MI: Myocardial Infarction; NYHA: New York Heart Association; CCS: Canadian Cardiovascular Society Angina Class; PVD: Peripheral Vascular Disease.

Table-II

Intraoperative Variables

Variables	OPCAB group (n=60)	CCAB group (n=60)	p Value
Conversion to CPB, n (%)	2(3.33%)		
CPB time, minutes		110.3 ± 23.9	
Total operating time, minutes#	268.5 ± 33.5*	296.3 ± 34.8*	<0.0001s
Conduit used¥			
LIMA, n (%)	60(100%)	60(100%)	0.694 ns
Radial artery, n (%)	8(13.33%)	6(10%)	0.500 ns
SVG, n (%)	60(100%)	60(100%)	0.694 ns
Graft distribution¥			
LAD territory, n (%)	60(100%)	60(100%)	0.694 ns
Circumflex territory, n (%)	56(93.33%)	60(100%)	0.246 ns
RCA territory, n (%)	51(85%)	50(83.33%)	0.083 ns
Intraoperative IABP¶	0(0%)	2(3.3%)	0.500 ns

* Data are presented as the mean ± SD for continuous variable.
# Student's t-Test, ¥ Chi-square (χ^2) Test, ¶ Fisher's Exact Test
ns=Non-significant; s = Significant
OPCAB: Off-Pump Coronary Artery Bypass; CCAB: Conventional Coronary Artery Bypass; CPB: Cardiopulmonary Bypass; IABP: Intra-AorticBalloon Pump; LAD: Left Anterior Descending Artery; RCA: Right Coronary Artery; LIMA: Left Internal Mammary Artery; RIMA: Right Internal Mammary Artery; SVG: Saphenous Vein Graft.

Table-III

Comparison of post-operative outcome between groups

Variables	OPCAB group (n=60)	CCAB group (n=60)	p Value
30 days mortality, n (%)¶	1(1.67)	2(3.3)	1.000 ns
Ventilation time, hours#	8.6±0.3*	12.3±0.5*	<0.0001s
LOS or Prolonged inotropic support¶	1(1.67)	4(6.7)	0.3644 ns
Postoperative IABP¶	0(00)	2(3.3)	0.4958 ns
Total bleeding (ml) #	378 ± 45*	602 ± 60*	<0.0001 s
Amount of blood products needed (ml) #	690 ± 30*	1085 ± 45*	<0.0001 s
Length of ICU stay(hours) #	34.7 ± 0.9*	43.6 ± 1.5*	<0.0001 s
Length of post-operative hospital stay(days) #	8.2 ± 0.2*	10.3 ± 0.3*	<0.0001 s
Re-exploration for bleeding¶	1(1.67)	3(5)	0.6186 ns
Stroke¶	1(1.67)	2(3.3)	1.000 ns
Pulmonary complication	4(6.7)	6(10.0)	0.500 ns
Perioperative MI¶	1(1.67)	2(3.3)	1.000 ns
Arrhythmia¥	6(10.0)	12(20)	0.236 ns
Surgical site infection¶	4(6.7)	6(10.0)	0.500 ns
Renal dysfunction¶	4(6.7)	6(10.0)	0.500 ns

* Data are presented as the mean ± SD for continuous variable.
# Student's t-Test, ¥ Chi-square (Ç^2) Test, ¶ Fisher's Exact Test
ns=Non-significant; s = Significant
LOS= Low Output Syndrome

Discussion:

In the present study, we analyzed our experience with OPCAB in patients having multivessel disease with reduced left ventricular ejection fraction (d"50%). Although OPCAB approach has fewer short-term complications than conventional CABG, incomplete revascularization is more common with off-pump approach, which led to more complications and repeat revascularization.[16] Complete revascularization is believed to be important in producing a re-intervention-free result following

OPCAB.[17]Meharwal et al. showed the average numbers of grafts were 3.0±0.7 for OPCAB group and 3.2±0.8 for on-pump group.[18]Shroyer et al. showed the average numbers of grafts were 2.9±0.9 for OPCAB group and 3.0±1.0 for on-pump group.[19]Youn et al. demonstrated in their study that patients with conventional CABG tended to have more grafts, but there was no significant difference in number of distal anastomoses and complete revascularization between the groups.[20]Technical improvement and experience have led some surgeons to perform off-pump total arterial grafting using two internal thoracic arteries (ITA) or one ITA and radial artery for multivessel coronary artery disease in regular basis.[21]We have used intracoronary shunts in all patients during distal coronary anastomoses. Positioning and stabilization of the heart in OPCAB, specially during circumflex and posterior descending artery anastomosis, are associated with significant haemodynamic changes.[22] These changes may be further exacerbated by the snaring of the coronary arteries. Several studies have shown the effectiveness of intracoronary shunts for maintaining myocardial perfusion to avoid ischemia of target vessels during OPCAB, although the use of shunts is not widespread and remains controversial.[23]We have found intracoronary shunts useful.

The mean period of mechanical ventilation, amount of blood products needed, length of ICU stay and hospitalstay during the early post-operative period- all were significantly lower in OPCAB group. All these reflect definite clinical advantage as well as favorable economic outcome associated with OPCAB group of patients. Transmission of viral infections, induction of immunologic transfusion reactions, and suppression of the immune system remain important risks related to the transfusion of blood and blood products despite improvements in donor-screening methods.[24]

OPCAB has been shown to be associated with decreased morbidity and mortality in high- risk patients, including the elderly, patients with poor left ventricular function, renal dysfunction, left main stenosis, or chronic obstructive pulmonary disease, and patients with prior neurologic dysfunction.[25]As in many studies, our hospital mortalities for OPCAB and CCAB done on patients with multivessel disease with reduced left ventricular ejection fraction (d”50%)were comparable. Meharwal et al. reported that the operative mortality was higher in CCAB group (1.86% vs. 0.97%, p<.001).[18] Ruzzeh et al. in amulti-centre comparative analysis showed similar result (1.4% vs. 2.9%)[5]. But, Sajja et al. (2.8% vs.3.9%, p=0.746) showed a bit different results.[26]

Study Limitations:

The present study has several limitations and those are as follows:

1. Sample size was small and patients were selected purposefully.
2. They were not randomly assigned to either group.
3. The surgical procedure either OPCAB or CCAB was determined by the surgeon. Therefore selection bias may affect our findings.
4. The duration of follow up of this study was limited. Clinical outcomes were restricted to 30-days mortality. No data beyond three months follow-up were available. Nothing was mentioned about the quality of life after CABG.
5. As a single institutional study the conclusions may not be applicable in general because of differences in practice patterns of other centres.
6. Other factors such as variations in surgical skill, patient difference in extent or distribution of coronary artery disease and echocardiography reports although unavoidable should also are considered.

Recommendations:

OPCAB surgery can yield better outcome in terms of shorter recovery time and less adverse effects than CCAB. We recommend OPCAB as a safe and effective surgical strategy for the patients with multivessel coronary artery disease with reduced left ventricular ejection fraction (d”50%). A prospective large scale multi-institutional randomized trial along with long term follow up and evaluation of graftpatency are necessary to confirm our findings and to define the long term clinical and functional results of both on-pump and off-pump CABG.

Development of well-trained cardiac surgical and anesthetic team, establishment of cardiac surgical centres equipped with modern devices, adequate logistic support and research of ischemic heart disease are needed to ensure up to date service and to widen the future prospects of revascularization procedures.

Acknowledgements:

I owe my heartfelt gratitude and indebtedness to Professor Dr. Md. Kamrul Hasan, Professor, Department of Cardiac Surgery, NICVD for his active help, guidance and valuable suggestions.

Disclosure of Interests:

I have no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

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Original Article

Trans-radial Angioplasty of Anomalous Origin of Right Coronary Artery from Left Sinus of Valsalva - A Single-centre Experience

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Abstract:

Background: Percutaneous coronary intervention (PCI) to anomalous coronary arteries remain a challenge in current practice, but can be overcome with appropriate techniques and devices. The objective of this study is to explore the challenges and techniques for success in PCI of anomalous origin of right coronary artery from left sinus of Valsalva (RCA-LSV) through the trans-radial route.

Methods: This study consisted of 13 patients who underwent PCI for an angiographically significant stenosis in RCA-LSV between November 2017 to March 2020. The procedural details including numbers of catheters used, access, hardware, techniques, duration of procedure, volume of contrast and complications were recorded and statistically analysed.

Results: The most frequent site for RCA-LSV is at the level of left main stem (LMS) (53.8%), with 30.8% being just above the LMS level and 5.4% being just below the LMS level. Male to female ratio was 5.5:1. Mean age was 53.7±6.7 (range;42-64) years. 76.9% of our patients were diabetic, 92.3% hypertensive, 84.6% dyslipidaemic, smoker & CKD were 23.1% each. PCI was done successfully in 100% cases. Our default route was trans-radial for coronary angiography. Angioplasty was performed through trans-radial route in 92.3% and trans-femoral in 7.7%, with a single case requiring switch over from radial to femoral route. The average number of guide catheters used was (2±1.0), (range:1-4). We used 4 guide catheters in 2 cases, while the rest of the cases were done by single guide catheter. The guide catheter hooked the coronary ostium selectively and off ostium in 46.2% cases each, while in 7.6% cases it was deeply engaged. Anchoring wire to enhance the guide support was used in 7.7% of cases. The mean duration of the procedure was 33.8 minutes (range: 15-65 minutes), the mean volume of contrast used was 61.5 (range:30-150) ml. We used single stent in 61 % cases and two stents in 39 % cases. Average stent diameter was 2.9 (range;2.5-3.50) mm, length was 28.6 (range;12-43) mm. From among a range of guides used for angioplasty, Judkin's left (JL) and Judkin's Right (JR) successfully cannulated the RCA-LSV in 76.9% & 23.1% respectively. We used Ikari Left (IL) guide catheter in RCA-LSV associated with subclavian tortuosity to enhance guide support. Majority of the lesions stented were of ACC/AHA classification of Type A & B lesions (38.5% each), followed by Type C (23%) lesion.

Conclusion: To the best of our knowledge, this is the first report of transradial PCI to RCA-LSV in Bangladesh, describing our experiences and techniques, with locally available hardware. PCI of RCA-LSV through radial route is technically challenging but feasible with reasonable amount of contrast and radiation. Proper localization of ostium and selection of suitable guide catheter like JL or IL is the key to success.

Keywords: anomalous RCA from left sinus of Valsalva (RCA-LSV), Percutaneous coronary intervention (PCI), transradial

(Bangladesh Heart Journal 2020; 35(1): 28-38)

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DOI: https://doi.org/10.3329/bhj.v35i1.49140

Introduction:

Successful percutaneous coronary intervention (PCI) of congenitally anomalous coronary arteries is technically challenging. There is general belief that femoral approach is associated with better chances of coronary artery engagement and better guide support during PCI of anomalous coronary arteries. This assumption is based on the challenges that we have to face during transradial intervention (TRI). It is the angle between the subclavian and brachiocephalic artery that prevents the guide catheter from sitting snugly on the opposite wall of the aorta.[1].

Coronary arteries arising from an anomalous origin are uncommon and encountered in only 0.2-1.2% of patients undergoing diagnostic coronary angiography.[2] Anomalous origin of right coronary artery (AORCA) is a rare congenital anomaly that was first described in 1948 by White & Edwards.[3] The angiographic incidence of AORCA is 0.09% to 0.25%.[4,5] The prevalence of this anomaly is significantly higher in non-white populations. A study by Kaku and colleagues including 17,731 patients undergoing coronary angiography from 1968-1994 in Japan indicated a prevalence of 0.25%. [6] An anomalous origin of right coronary artery from left sinus of Valsalva (RCA-LSV) has been reported in 6–27% of patients with coronary anomalies.[7] The common location of RCA-LSV is either at the level of left main stem (LMS) or above the ostium of LMS.[8]

Performing percutaneous coronary intervention (PCI) to an anomalous RCA can sometimes be a challenging procedure for interventional cardiologists. This often involves adopting newer techniques, changing of multiple guide catheters or using other tools in the armamentarium of intervention, such as guide extension catheters for proper support of the guide catheter. Selective cannulation of anomalous coronary arteries is often difficult due to an unfavourable angle of the origin of the RCA-LSV. In such a case PCI can be done by off ostium catheter engagement rather than a selective cannulation. Cannulation of a RCA-LSV depends on several factors, like the size of the aortic root, the exact location of the origin, finally the orientation & course of the proximal segment of RCA.[9] Learning curve may be long as it is an incidental and rare finding, especially when it is done through radial route due to poor back-up support. PCI may be frequently needed in anomalous RCA that arise from the Left Sinus of Valsalva (LSOV), which is known to be associated with an increased predisposition to developing significant epicardial atherosclerotic disease.[10] Our study supports the feasibility of radial access as an effective route for PCI of an aberrant right coronary artery from the left sinus of Valsalva (RCA-LSV) .

Materials & Methods:

This prospective study presents the challenges encountered in intervening RCA-LSV at a tertiary care center in Bangladesh between November 2017 to March 2020. A total of 13 patients were of RCA-LSV out of 28 patients who were underwent for PCI of AORCA. We analyzed the angiographic and interventional details of these cases. Our initial view was Left anterior oblique (LAO) cranial 30 degree, as usual. If it was not visualized in that case we reviewed the previous images those were taken for left system for clues. If there was still no yield, we took a sinus shot or aortic root angiogram (hand injection aortogram) in 30-35^0 LAO projection to visualize the RCA. The aortogram was helpful in defining the shape and size of the aorta, showing the position and orientation of the right coronary ostium. This facilitated the selection of appropriate coronary catheters for engagement of the anomalous RCA. As our default route was radial, we took all the shots by 5F Tiger (TIG) catheter mostly. Diagnostic angiogram with TIG catheter is generally more comfortable for negotiation of anomalous RCA than Judkin's Right (JR). For RCA-LSV, our initial guide catheter was Judkin's Left (JL). The right coronary artery normally arises from the right anterior facing sinus, its ostium located in the middle of the sinus just above the free leaflet margin of the aortic leaflet and below the sinotubular junction. When selective cannulation failed, catheter changes were done according to preference of the performer.

Data were processed and analyzed using SPSS (Statistical Package for Social Sciences), version 25.0 for Windows (SPSS Inc., Chicago, Illinois, USA). The test statistics used to analyze the data were descriptive statistics like continuous variables will be expressed as mean and standard deviations from the mean (means ± SD) and categorical variables will be expressed as frequency with corresponding percentage.

Result:

Mean age of the study population was 53.7±6.7 (range: 42-64) years. Male to female ratio was 5.5:1. Other demographic and baseline characteristics are detailed in Table I.

Table-I

Baseline characteristics(n=13)

Demographic parameters	Frequency	Percentage (%)	Mean ± SD (Range)
Age (year)	-	-	53.7 ± 6.7(42-64)
Sex			
Male	11	84.6	-
Female	2	15.4	-
Risk factors			
DM	10	76.9	-
HTN	12	92.3	-
DL	11	84.6	-
Smoker	3	23.1	-
CKD	3	23.1	-
Diagnosis on admission			
STEMI	4	30.8	-
NSTEMI	3	23.1	-
UA	6	46.2	-
Left Ventricular (LV) ejection fraction			
Normal LV function	4	30.8	-
Mild LV systolic dysfunction	8	61.5	-
Moderate LV systolic dysfunctionPrior	131	7.723.17.7	-
myocardial infarction (MI)Prior PCI			

The frequent site for RCA-LSV is at the level of LMS (53.8%), followed by just above the LMS (30.8%) level. Only 15.4% RCA-LSV had ostia just below the LMS level.(Figure 1)

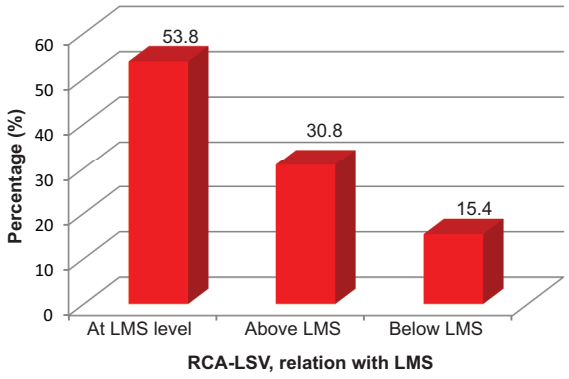

Fig.-1: *RCA-LSV, relation with LMS*

RCA-LSV was most frequently cannulated successfully by means of Judkins left (JL) guide in 76.9% of cases, and alternately by Ikari left (IL) guide (23.1% of cases). (Figure 2)

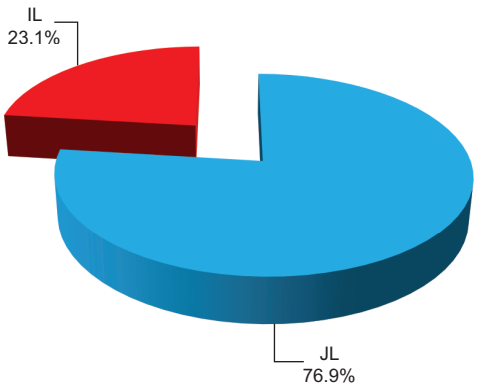

Fig.-2: *Successful Guiding catheters used*

Regarding the engagement of guide catheter, it hooked the coronary ostium selectively in 46.2% cases, while it had to be kept off ostium co-axial with the coronary in same percentage of cases and deep intubation with monitoring of the pressure was done in 7.6% case. (Figure 3)

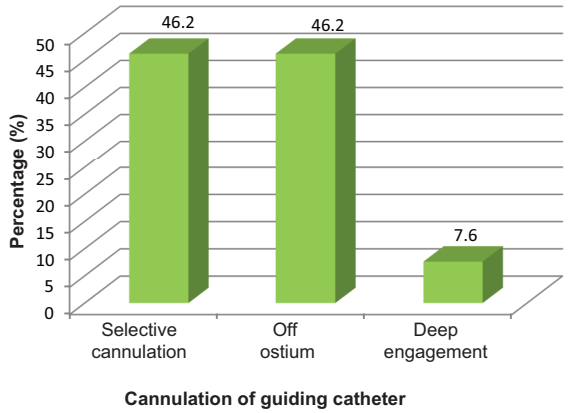

Fig.-3: *Cannulation of guiding catheter*

Angioplasty was performed through trans-radial route in 12 patients (92.3%) and trans-femoral in 1 patient (7.7%). Switch over from radial to femoral access was required in 1 patient (7.7%).

The average number of guide catheters used was (2±1.0), (range; 1-4). A single catheter was used in 84.6% cases. . The mean duration of procedure was 33.8 minutes & range was (15-65) minutes. Other procedural characteristics including types of lesions stented, stent diameters and lengths, contrast volume and other procedural details such use of anchoring wires for support etc are stated in table II.

Table-II
Procedural characteristics (n=13)

Parameters	Frequency	Percentage	Mean ± SD(Range)
Type of vessel(ACC/AHA classification)			
TypeA	5	38.5	—
Type B	5	38.5	—
Type C	3	23.0	—
Vascular access			
Radial	12	92.3	—
Femoral	1	7.7	—
Number of guide catheters used			
1 Cath	11	84.6	—
4 Cath	2	15.4	—
Number of stents used			
Single stent	8	61.5	—
Double stent	5	38.5	—
Segment			
proximal	1	7.7	—
mid	12	92.3	—
distal	4	30.8	—
Average Stent Diameter	—	—	2.9 ± 0.3 (2.5-3.5)
Average Stent Length	—	—	28.6 ± 9.6 (12-43)
Stent			
single	8	61.5	—
double	5	38.5	—
Predilatation	9	69.2	—
Postdilatation	8	61.5	—
Creatinine			
Normal	12	92.3	—
AKI	1	7.7	—
Average Cath used			1.8 ± 1.1 (1-4)
Duration Procedure(minute)	—	—	33.8 ± 14.3 (15-65)
Dye Amount(ml)	—	—	61.5 ± 41.4 (30-150)
No of Guidewires			
1	11	84.6	—
2	2	15.4	—
Anchoring Wire	1	7.7	

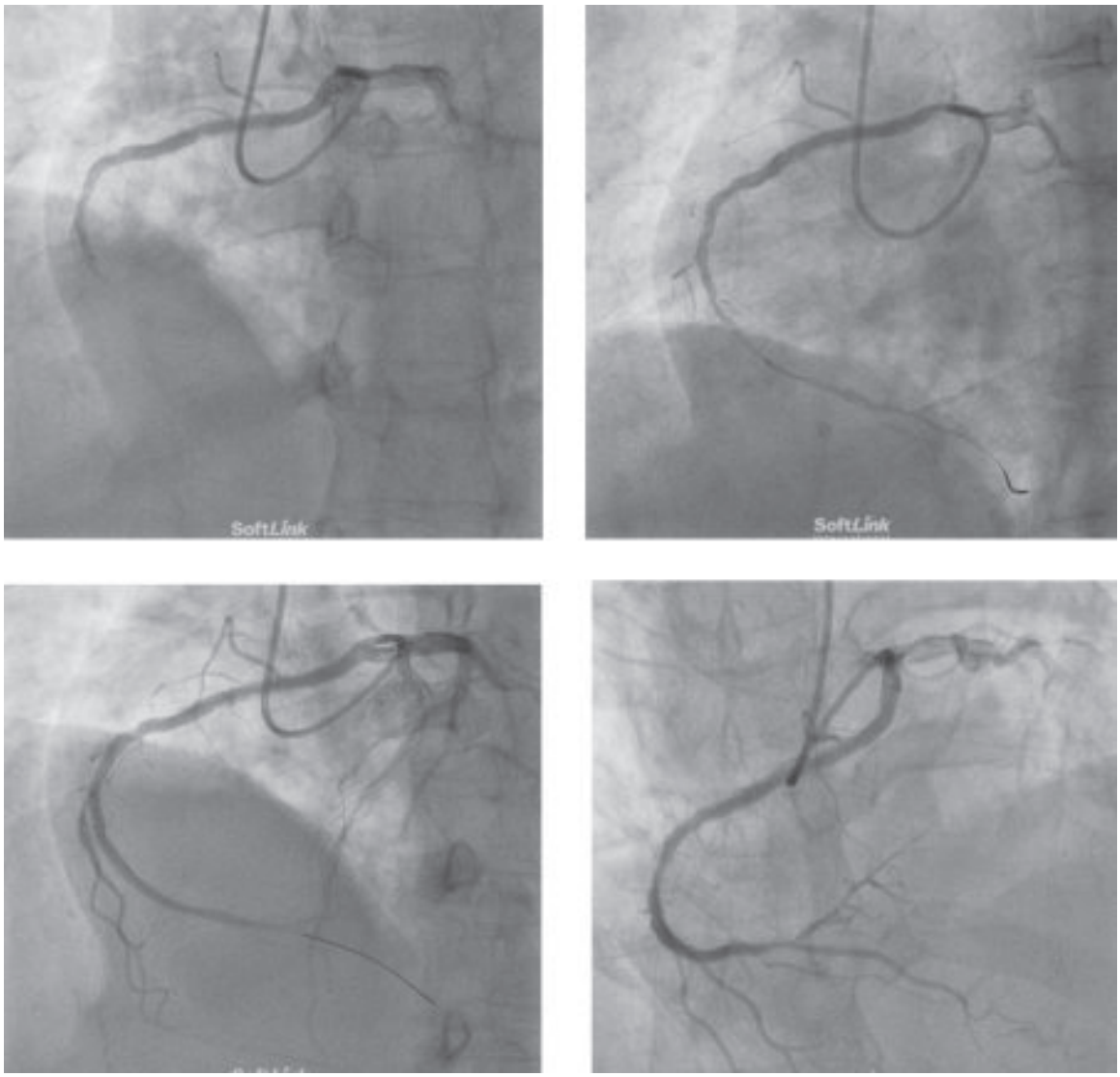

Fig.-4: *PCI to totally occluded RCA-LSV. Guide catheter JL 3.5 5 Fr*

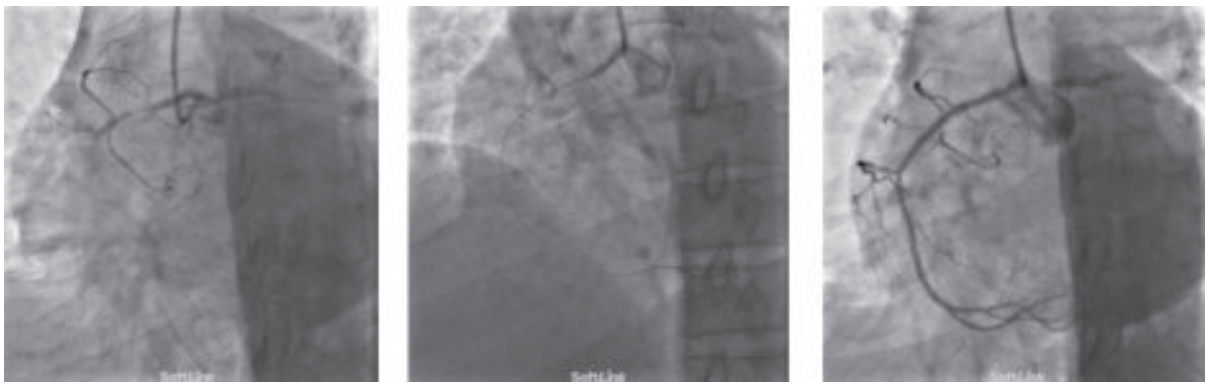

Fig.-5: *PCI to totally occluded RCA-LSV, successful guide catheter 5F JL, off ostial engagement*

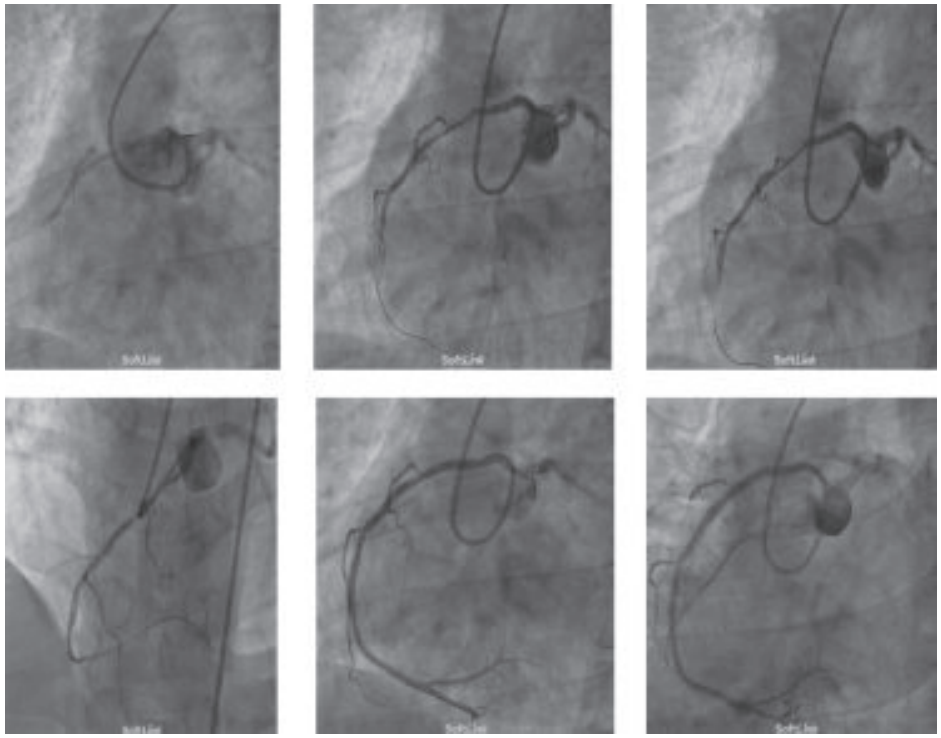

Fig.-6: *PCI to totally occluded RCA-LSV, selective engagement by 6F JL 3.5 guide catheter was done, requiring greater support and switch-over to femoral access.*

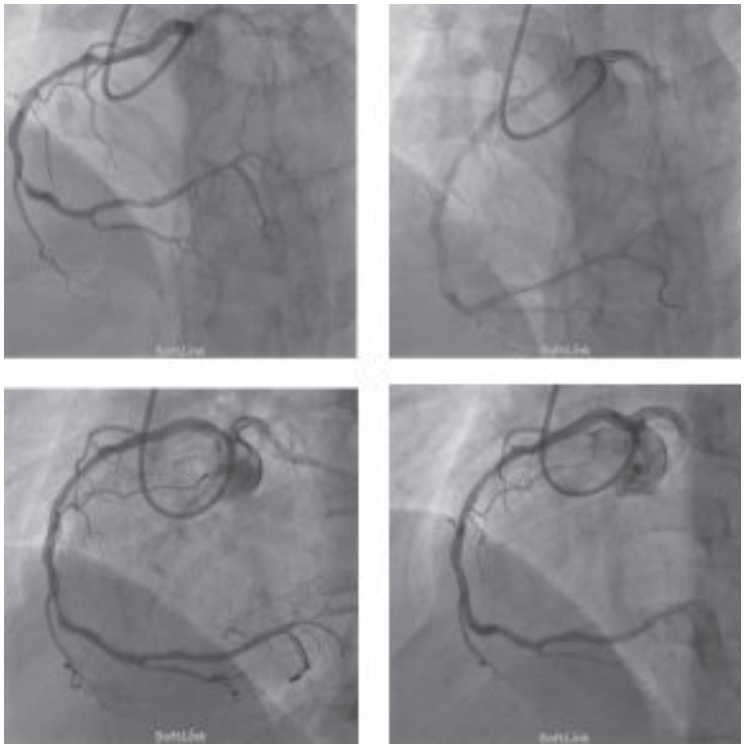

Fig.-7: *Stenting of RCA-LSV, Type B lesion, coaxial engagement, 2 stents deployed, one in PLV including distal RCA, another in mid RCA, guidecatheter- JL 3.5 6 F*

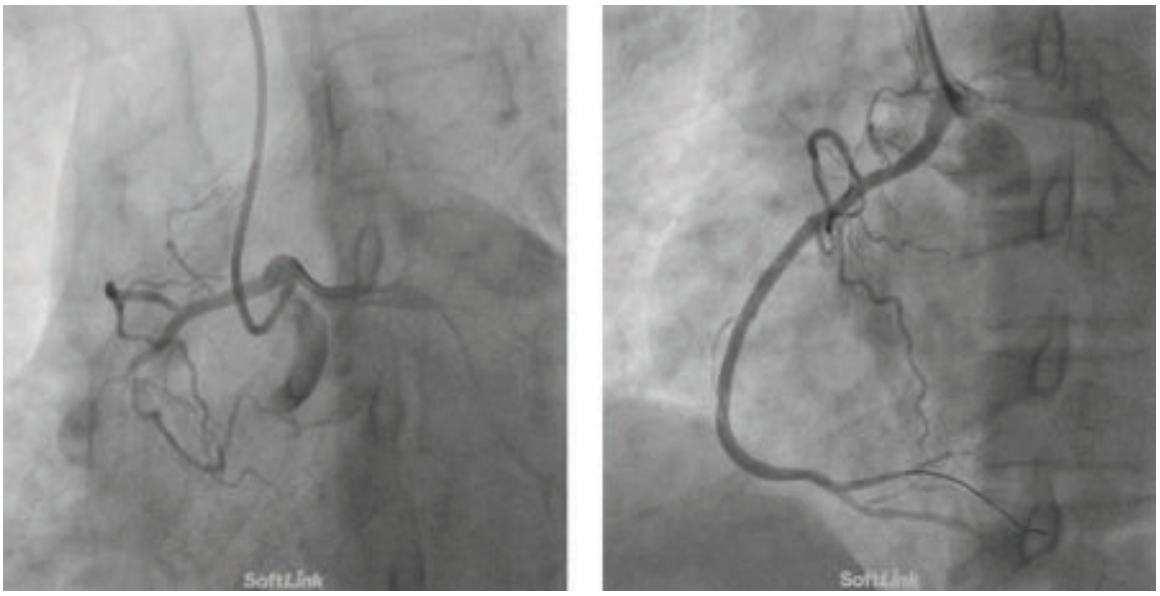

Fig.-8: *RCA arises from left coronary sinus & after successful PPCI with IL guide catheter, off ostium catheter engagement*

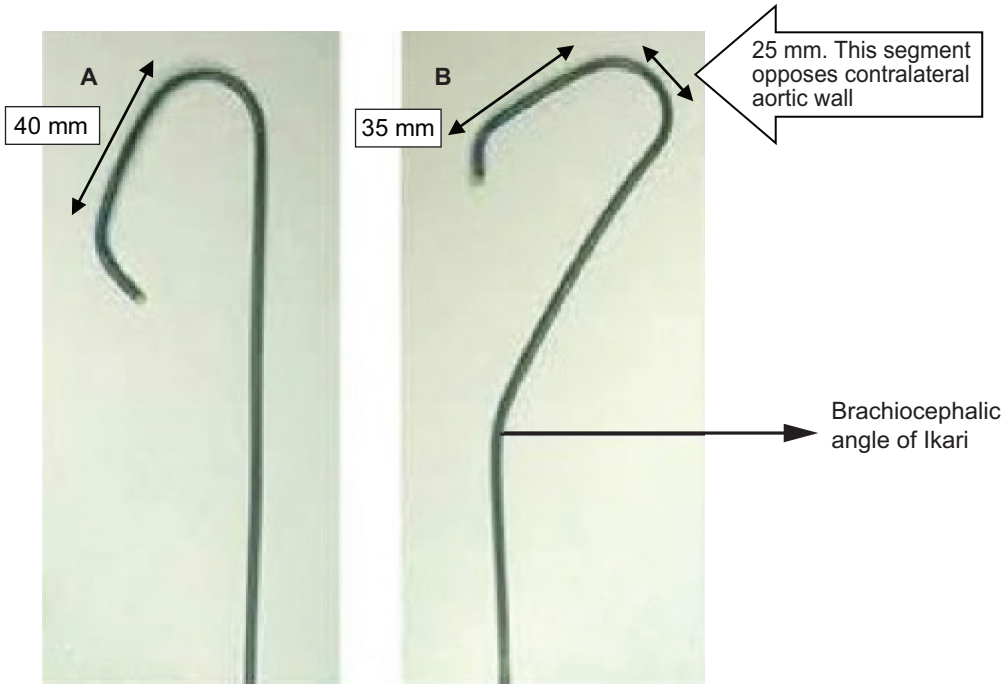

Fig.-9: *Panel A-JL, 3.5 guide catheter, panel B-The Ikari Left 3.5 guide catheter*

Discussion:

The exact location of AORCA was well delineated on routine coronary angiographic views, supplemented by modified views, non-selective sinus and aortic root angiogram. A similar procedure was adopted by Jim et al.[11] Occasionally, an AORCA may be associated with an inter-arterial or intramural course, which can be well documented by 3D-CT angiogram.[12,13] This was however, not required in our cases.

The commonest site of RCA-LSV was at the level of LMS (53.8%), followed by superior to LMS (30.8%). (Figure 4). The commonest site found by Uthayakumaran, et al[8]

was above the LMS (8 out of 17 patients), followed by midline, i.e. at the level of LMS (6 out of 17 patients). They only reported 3 cases below the level of LMS, which is consistent with our study (2/13-15.4%).

Commonest diseased segment found by Nemani, et al[14] & Chun-Chung, et al[15] was the mid segment of RCA (65% & 83.3% respectively), similar to our results (92.3%) (figure:4). The juxta commissural location of the ostia of AORCA and initial tangential course of the anomalous artery in relation to the aortic wall make it difficult to engage the anomalous RCA with routine guiding catheter.[16] So intervention in AORCA depends on proper selection with skillful manoeuvres of the guide, i.e. technique, with adjunction of some extra support of catheter by anchoring wire or buddy wire.

Some challenges for the operator are the anatomy of AORCA (location and configuration of the ostium, immediate take off angle, lesion location and tortuosity of the vessel) and the diameter of the aortic root.[17-19] A retrospective study of elective cases by Uthayakumaran, et al,[8] showed that the average number of guide catheters used for a single PCI of AORCA was three or more, which indicates the challenges involved in the intervention of AORCA. In our study, four guides were consecutively attempted to cannulate the AORCA in a case at the beginning of a study, and in another case with subclavian tortuosity; subsequently the number of guides required gradually diminished with increasing experience in such cases of RCA-LSV. The average number of guides used by Nemani, et al[14] was two, which is consistent with our study.

Guide selection depends on the immediate take off angle of the RCA rather than the anterior or posterior displacement of the ostium. 5 of 6 French guides were used in our cases owing to the transradial access route. Besides this, due to smaller body build and relatively smaller diameter of the radial artery (2.2±0.03 mm)[20] in our population, we could not use guides larger than 6 French, due to potential radial artery spasm. In their study, Nemani, et al[14] reported that the guide hooked the coronary selectively in 40% patients, while it had to be kept off ostium co-axial with the coronary in 55% patients, deep intubation with monitoring of the pressure in 5% of cases, all of which were strikingly similar to our approach.

PCI for RCA-LSV presents additional technical challenges. When the RCA arises below the left sino-tubular ridge, it usually has a slit-like ostium and takes an acute rightward course that precludes the coaxial engagement of most of the currently available guiding catheters. Furthermore, it is usually difficult to perform successful PCI to a totally occluded RCA due to the lack of adequate backup support from the guide. [16, 21-25] We did 3 totally occluded RCA-LSV, one by IL guide catheter and 2 cases by JL guide catheter, all of which were approached transradially (Figures 4 and 5).

The ostium of RCA arising from the LSOV is usually located anteriorly next to the ostium of the left main (LM) artery. The ostium of the LM artery can therefore be used as a useful landmark. The operator advances the JL or IL catheter to the level close to LM ostium and then rotates clockwise or anticlockwise and further advances it. This simple maneuver will engage the anomalous RCA orifice coaxially. The Leya catheter, a modified Amplatz left (AL) guiding catheter with a right-angled tip, was designed specifically for PCI of a RCA-LSV.[25] In absence of this guide catheter in our shelf, JL 5 F (76.9%) remained the most successful guide catheter in our cases. This corelates with that of Uthayakumaran et al.. who used JL guides in 10 out of 17 cases.[8] Two cases of RCA-LSV in the study by Cohen et al., were stented by 6F JL guide.[22] Some cases of Uthayakumaran and Topaz, et al, were done by AL guide.[26] In the study of Chun-Chung, et al the diameter of the guiding catheter was 6 French in five patients, and 5 French in one patient.[15] In our study we used 5F guide catheter in 69.2% cases (9 patients).

In the study done by Nemani, et al,[14] switch over from radial to femoral access was required in 4 patients (20%). In our study it was only in 1 patient (Figure 6). Uthayakumaran et al.[8] who performed 17 cases of PCI to RCA-LSV used a predominantly femoral route, with a single case being switched over from femoral to radial in one case.

The mean amount of contrast we used was 61.5 ml. The mean duration of procedure was 33.8 minutes. The average volume of contrast used by Nemani, et al[14] was 124 ml (range 60-200 ml) and the mean flouroscopy time was 22 minutes (range of 9-38 mins). The duration of intervention was ranged from 18 to 103 minutes (median 44 minutes) in the study done by Chun-Chung, et al for RCA-LSV.[15] The mean fluoroscopy time was 20.7 min (range: 12.2–63.3 min) and the mean amount of contrast used was 210 ml (range: 120–320 ml) in the study done by Uthayakumaran, et al.[8] We experienced no procedure-related complications, similar to Chun-Chung, et al.[15]

Despite the low incidence of RCA-LSV, any experienced interventional cardiologist who performs many PCI procedures may well expect to encounter at least one

case of it. Therefore one should be cognizant of appropriate PCI techniques and guides to be used in such a case, especially in case of Primary PCI (PPCI) where the approach is radial. An adequate knowledge of RCA-LSV obviates the need for switching to femoral access thus saving time in case of PPCI. We encountered a similar case, where PPCI was successfully performed by IL guide catheter transradially. (Figure:8) A Konstantinos[9] also performed a case of PPCI of RCA-LSV radially.

In addition to anatomic factors, catheter selection for PCI is also influenced to a certain degree by operator preference, familiarity, and institutional availability. This explains the difference in catheter selection from our experience, to those by Nemani, et al [14] & Sarkar, et al[16]. Furthermore, the procedures were done through transfemoral route by Sarkar, et al.[16]

Regarding the arterial access, our 12 cases, one case of A Konstantinos[9] and 2 cases of Suryanarayana, et al.[27] indicate that the radial approach is an excellent strategy for PCI of RCA-LSV. It may be considered as an excellent alternative for PCI of RCA-LSV,[28] even when a transfemoral attempt has previously failed.[27,8,29] It seems that the manipulation of the guide catheter is easier and the provided support is more robust with right radial access.

We used Ikari left(IL-23.1% case) guide catheter for RCA-LSV, in case of brachiocephalic/ subclavian artery tortuosity by transradial approach. The primary contact site of IL guide for the RCA is brachiocephalic artery. However, it attaches on the opposite wall of the ascending aorta in power position that provides an extraordinary support for RCA-LSV with subclavian or brachiocephalic tortuosity. It can be done by pushing the guide (IL) along the wire or the balloon shaft; thereby changing the guide shape.[30] By this manipulation we can obtain the power position of IL for the backup support. The IL guide has greater backup force than the Judkins left (JL), based on the mechanics in case of TRI. IL has a wider angle and longer contact on the opposite wall of the aorta, thereby generating greater backup force.[30]

The IL has three modifications from the JL: (1). The length at the final straight position is shorter (length between the third and the fourth angles) 35 mm in Ikari, which is 40 mm in JL. This makes the angle between the guide and the opposite wall of the aorta bigger. (2) The second straight position is longer: 25 mm more than the JL guide. This makes the contact area with the aorta larger, thereby increases the friction force. (3) a new primary curve that was added to fit the brachiocephalic artery-brachiocephalic angle (Figure 9). This does not correlate with the backup force but it makes guide control easier and stabilizes the guide position. This essentially means that the IL is a modified JL catheter designed specifically for TRI. Backup force of the IL is greater than the JL in TRI because the angle between the catheter and the reverse side of the aorta is increased. Furthermore, IL in TRI is shown to be more supportive than a JL in TFI.[30]

From the above discussion it can be concluded that the most effective guide catheter for transradial PCI to RCA-LSV is most likely the JL guide. We can also use IL guide catheter considering the tortuosity of the subclavian artery and also where we need extra backup support.

There are several small case series regarding the successful PCI of RCA-LSV, most of which are through femoral approach,[24,31,22,26] including a relatively larger series of 17 patients by Uthayakumaran et al[8]. With the experience of our 13-patient series, this study provides a simple and effective framework for the busy interventionalist to successfully engage the RCA-LSV with reduced expenditure of contrast agent and radiation exposure, thus increasing the likelihood of technical success transradially.

Limitation:

This study was a single center study with a relatively small sample size, given the lower incidence of RCA-LSV.

Conclusion:

The right radial access can be considered as a reasonable strategy for PCI of RCA-LSV with JL or IL guide catheter. Both these guides offer better manipulation with more robust support, resulting in technical success.

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Original Article

Association of low Serum Magnesium level with occurrence of Ventricular Arrhythmia in patients with Acute Myocardial Infarction

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Abstract:

Background: Acute Myocardial Infarction is the leading cause of morbidity and mortality throughout the world. Its prevalence among developing countries has increased significantly over the past two decades. Acute myocardial infarction is associated with electrolyte imbalance most commonly hypomagnesemia and hypokalaemia. Both are associated with ventricular arrhythmia which can lead to increase hospital mortality and morbidity.

Objectives: To find out association of hypomagnesemia with ventricular arrhythmia in patients with acute myocardial infarction.

Methods: Patients with acute myocardial infarction admitted in the department of Cardiology, DMCH, within the study period and who fulfilled the inclusion and exclusion criteria were taken as study sample. Informed consent was taken from all patients and then the patients were evaluated by detailed history, clinical examination and relevant investigations. Serum magnesium level was measured after admission. The sample population was Grouped into Group A(Acute myocardial infarction with normal serum magnesium) and Group B(Acute myocardial infarction with hypomagnesemia). Patients were followed up regularly till discharge or death for evidence of ventricular arrhythmia. Then the obtained data was analysed with SPSS 22.0.

Results: Among 110 patients of Acute MI, 44 patients were in Group A who had plasma magnesium level e"0.7 mmol/l and 66 patients were in Group B who had plasma magnesium level <0.7 mmol/l. Incidence of hypoagnesemia was 60% and more common in male. Male vs female percentage of hypomagnesemia were 61% vs 39%. Mean age was 54.16±11.72 yrs vs 57.52±10.59 yrs in group A vs group B. On admission serum magnesium level was 0.9218 vs 0.523 mmol/L(group A vs group B). The study showed that group B patients were more haemodynamically unstable and mean SBP and DBP were found 89.39±19.93 and 60.67±11.56 mm-Hg respectively. Troponin I was markedly increased in group B than A (i.e 4.7±1.79 vs 14.6±4.3 vs ng/ml). Adverse cardiac events such as cardiogenic shock (group A vs group B = 11.36% vs 28.27%) and ventricular arrhythmias(group A vs group B = 34% vs 72.73%) were also higher in group B than group A. Mean hospital stay for group B patient was higher than group A(6.78±0.85 vs 5.31±0.35 days). The study result showed that ventricular arrhythmia is negatively correlated with serum magnesium and the correlation coefficient was -0.541. It also showed that serum Magnesium is positively correlated with Potassium(r= 0.831, p<0.01) and Calcium(r= 0.902, p<0.001). Multiple logistic regression analysis showed that hypomagnesemia is an independent risk factor for ventricular arrhythmia.

Conclusions: This study showed that in patients with acute myocardial infarction, hypomagnesemia is common and it is significantly associated with ventricular arrhythmia. So the presence of hypomagnesemia should alert the physicians to adopt corrective measures as it increases both mortality and morbidity.

Keywords: Hypomagnesemia, Ventricular Arrythmia, Acute myocardial infarction.

(Bangladesh Heart Journal 2020; 35(1): 39-46)

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DOI: https://doi.org/10.3329/bhj.v35i1.49141

Introduction:

Myocardial infarction (MI) can be recognised by clinical features, including electrocardiographic (ECG) findings, elevated values of biochemical markers (biomarkers) of myocardial necrosis, and by imaging, or may be defined by pathology. It is a major cause of death and disability worldwide[1]. New ST elevation at J point in two contiguous leads with cut-points: e”1mm in all leads other than leads V2-V3 where the following cut points apply: e”2mm in men e”40 years; e”2.5mm in men <40 years or e”1.5 mm in women[1].

Acute myocardial infarction is associated with electrolyte imbalance most commonly hypomagnesemia and hypokalaemia. Both are associated with ventricular arrhythmia which can lead to increase hospital mortality and morbidity[2].

Magnesium is the 2nd most common intracellular cation after potassium and 4th abundant cation in the body .The total magnesium content in the body of an average adult is around 25 Gm or 1000 mmol. About 60% of the body reserve of magnesium is found in the skeletal bone mass, about 20% is in muscle and another 20% is in soft tissues and liver. Normal plasma Magnesium concentration is from 1.7 to 2.5 mg/dl[3].

Hypomagnesaemia is present in acute myocardial infarction (AMI) as shift of magnesium from extra cellular to intracellular compartments occur as it is taken up by adipocytes after catecholamine induced lipolysis and combined with soaps formed by free fatty acids[4,5]. Although the total body Mg contents may not change with the onset of AMI, extra cellular Mg declines markedly, especially over the first 24 to 48 hours after the onset of AMI[5,7]. Hypomagnesaemia in the initial phase of post AMI period is very critical, as ventricular tachyarrhythmia sudden cardiac death and re-infarction are the usual outcome.[4,5,6] Magnesium has been suggested as a possible intervention to be used in AMI since the early 1960s mainly because it was thought to be an antiarrhythmic agent, although no studies have conclusively shown this to be the mechanism of action for magnesium in reducing mortality.[6]

Magnesium, a divalent cation, is a physiologic calcium antagonist that inhibits calcium entry into vascular smooth muscle cells.[12,13] Furthermore, magnesium promotes coronary artery vasodilation and peripheral systemic arterial vasodilation, thereby increasing coronary blood flow and reducing afterload.[14,15] Magnesium may reduce ischemia and decrease sinus node and atrioventricular conduction.[16] Because of its ability to inhibit myocardial cell sodium and calcium influx as well as potassium egress, magnesium may diminish infarct related reperfusion injury and myocardial stunning, thereby limiting infarct size.[17]

Methods:

Prospective cross sectional study was conducted in the Department of Cardiology, DMCH, Dhaka, Bangladesh from January 2017 to Dec 2017. All the patients with Acute Myocardial infarction with or without hypomagnesaemia admitted in the department of Cardiology, DMCH, within the study period and who fulfilled the other inclusion and exclusion criteria was taken as sample.

Inclusion criteria:

All the Acute Myocardial infarction patients with or without hypomagnesemia presenting to CCU in DMCH within the study period. Acute coronary syndrome was included STEMI, non-STMI.

Exclusion criteria:

- Patients with history of any previous MI.
- Patients with history of PCI or CABG.
- Patients with any valvular heart disease, congenital heart disease, primary myocardial or pericardial disease, acute on chronic heart failure
- Patients with other co-morbid .conditions like COPD, end stage renal disease, nephrotic syndrome, liver disease, chest infection and bronchogenic carcinoma, stroke, hypothyroidism
- Post diarrhea MI(within last 3 days)
- Patients on Total parenteral nutrition
- Patients unwilling to give consent.

Ethical Consideration:

Prior to the commencement of this study, the research protocol was approved by the Research Review Committee of Department of Cardiology and the Ethical Review Committee of DMCH, Dhaka. The aims and objective of the study along with its procedure, alternative diagnostic methods, risk and benefits was explained to the patients in easily understandable local language and then informed consent will be taken from each patient. It was assured that all records was kept confidential and the procedure will be helpful for both the physician and patients in making rational approach regarding management of the case.

Statistical Analysis:

All statistical analysis was performed using the statistical package for social science (SPSS) program, version 22 for Windows. Continuous parameters was expressed as mean ±SD and categorical parameters as frequency and percentage. Comparisons between groups

(continuous parameters) was done by Student's t test. Categorical parameters was compared by Chi-Square test. Correlation analyses was done by Pearson correlation coefficient. The significance of the results as determined in 95.0% confidence interval and a value of p <0.05 was considerd statistically significant.

Methods of Data Collection:

All patients of Acute Myocardial infarction admitted in the department of cardiology, Dhaka Medical college hospital within the study period who fulfilled the inclusion and exclusion criteria was taken as sample. Information from the patients and relatives were collected through preformed proforma. Patients were evaluated based upon History, Clinical examination and investigations. After Admission Serum magnesium level was done concurrently Serum calcium, Serum potassium was done to exclude other confounding variables, Cardiac biomarkers were done to differentiate between STEMI, NSTEMI. Occurrence of Ventricular arrhythmia were counted on repeated regular ECG tracing on twice daily when admission in Hospital. Then occurrence of Ventricular arrhythmia of Acute Myocardial infarction patients with hypomagnesaemia and those without hypomagnesaemia were compared and analyzed. After compilation of collected data collection from all patients, statistical analysis were performed using the statistical package for social science(SPSS) program, version 22 for Windows. The confidentiality of the patient was maintained properly when observations were compiled by the investigator. Informed written consent were taken from each patient. Continuous parameters was expressed as mean±SD and categorical parameters as frequency and percentage. Study subjects were grouped into 2 groups, patients with hypomagnesemia (Plasma magnesium level <0.7 mmol/L as Group B and patients with normal plasma magnesium level e"0.7 mmol/L as Group A. Comparisons between groups (continuous parameters) was done by Student's t test. Categorical parameters was compared by Chi-Square test. Correlation analyses was done by Pearson correlation coefficient. The significance of the results as determined in 95.0% confidence interval and a value of p <0.05 was considered statistically significant.

Result :

This prospective observational study was conducted in the Department of Cardiology, Dhaka Medical College Hospital, Dhaka, over a period of one year from Jan 2017 to Dec 2017. The main objective of the study was to find out the association between low serum magnesium and ventricular arrythmia in patients with acute myocardial infarction. A total of 110 adult patients with acute myocardial infarction(both STEMI and NSTEMI) admitted in the department of cardiology, DMCH within the study period were included in the study. The study population was divided into two groups: Group A included AMI with normal serum magnesium level (e"0.7 mmol/dl) and Group B included AMI with low serum magnesium level (<0.7 mmol/dl). These patients were followed up during hospital stay to evaluate the prelevance of different types of ventricular arrhythmia(Frequent PVC, Idioventricular rhythm, Sustained VT, non sustained VT, VF). Appropriate statistical techniques were used for data analysis. Results were presented with tables and graphs where required.

Table-I

Distribution of study subjects by age (n=110)

Age in years	Group A (n=44)		Group B (n=66)		P value
	No.	%	No.	%	
31-40	9	20.45	7	10.61	
41-50	7	16	10	15.15	
51-60	15	34	15	22.73	
61-70 >70	84	18.1811.37	277	40.9110.6	
Total	44	100.0	66	100.0	
Mean±SD	54.16±11.70		58.45±9.47		<0.06[ns]
(Range mgm)	(42-66)		(46-68)		

P value reached from unpaired t-test.
Group A: Acute myocardial infarction patients with normal serum magnesium
Group B: Acute myocardial infarction patients with hypo-magnesemia
ns: not significant

Above table shows the age distribution of study subjects. It shows that maximum patients of Group A is in the age group of 51-60 yrs 15(34%) whereas maximum (27 or 40.91%) in Group B is in 61-70 yrs. The mean age is 54.16±11.70(yrs) vs 58.45±9.47(yrs) in Group A vs B. The mean difference between two Groups were statistically not significant (p<0.05).

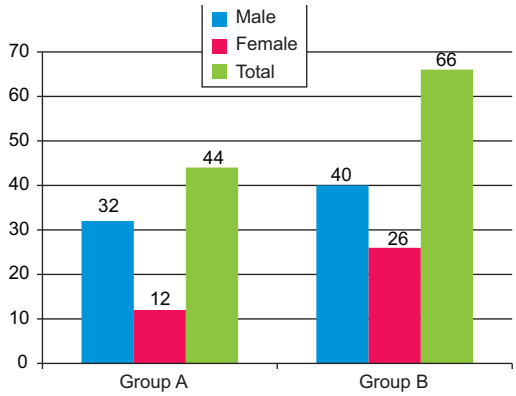

Fig.-1: *Bar diagram showing distribution of the sex between two groups (n=110)*

Fig.1: Bar diagram showing distribution of the sex between two groups. It shows Male is 32(72.7%) vs

Table-II

Comparison of biochemical parameters between two groups (n=110)

Laboratory parameters	Group A(n=44) Mena±SD	Group B(n=66) Mena±SD	P value
Troponin- I (ng/ml)	4.7±1.79	14.87±4.3	0.001^{s}
Serum creatinine (mg/dl)	0.807±0.168	0.92±0.185	0.511^{ns}
Serum Potassium(mmol/l)	3.84±0.16	2.54±0.41	0.001^{s}
Serum Calcium(mg/dl)	8.71±0.3	6.52±0.55	0.001^{s}

Data were expressed as mean±SD
P value reached from unpaired t-test.
Group A : Acute myocardial infarction with normal Serum magnesium
Group B : Acute myocardial infarction with hypomagnesemia
ns : not significant
s : significant
n : number of patients

Table-III

Comparison of in-hospital adverse cardiac events between the study groups (n=110)

Adverse cardiac events	Group A (n=44)		Group B (n=66)		Pvalue
	N	%	N	%	
Cardiogenic shock					
Yes	05	11.36	18	27.27	0.044^{s}
No	39	88.66	48	72.73	
Asystole					
Yes	04	9.09	08	12.13	0.6195^{NS}
No	40	90.91	58	87.87	
Ventricular Arrhythmia					
Yes	15	34.1	48	72.73	0.001^{s}
No	29	65.90	18	27.27	
Post MI angina					
Yes	10	22.72	10	15.15	0.3129^{ns}
No	34	77.28	56	84.85	
Death					
Yes	01	2.27	06	9.09	0.1512^{ns}
No	43	97.73	66	90.91	

P value reached from unpaired t-test.
Group A :Acute myocardial infarction with normal Serum magnesium
Group B :Acute myocardial infarction with hypomagnesemia
s=significant;
ns=not significant

40(60.6%) respectively in Group A vs Group B, Similarly Female is 12(27.3%) vs 26(39.3%) respectively in Group A and Group B. It shows, the difference between this two groups is not statistically significant (p<0.05)

Above table shows that mean troponin I is 4.7±1.79 vs 14.87±4.3(ng/dl) respectively in group A vs group B. Serum creatinine is 0.807±0.168 vs 0.92±0.185 respectively in group A vs group B. Serum Potassium is 3.84±0.16 vs 2.54±0.41 respectively in group A vs group B. Serum Calcium is 8.71±0.3 vs 6.52±0.55 respectively in group A vs group B. The mean difference of troponin I, serum Potassium, Calcium between group A and group B is statistically significant (p<0.05) but mean serum creatinine between this two groups is not statistically significant (P>0.05).

Table shows the distribution of adverse cardiac events namely cardiogenic shock, asystole, ventricular arrhythmia, post MI angina and Death. It shows that

Ventricular arrhythmia and Cardiogenic shock between group A and B is statistically significant (P<0.05) whereas Post MI angina, asystole and Death between group A and B are not statistically significant (p>0.05).

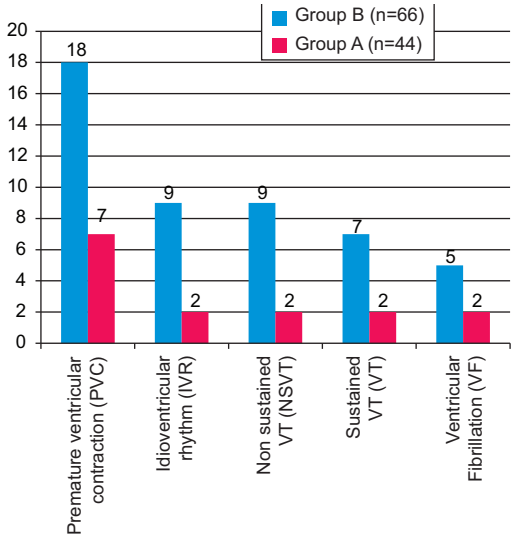

Fig.-2: *Bar Graph Showing Frequency distribution of Ventricular Arrythmia in Between Group (n=110)s*

The figure shows that premature ventricular contraction(PVC) is most frequent arrhythmia in both group - 7 (46.66%) vs 18(39%) respectively in group A vs Group B. Group B has more incidence of Ventricular Arrhythmia than group A, respectively 48(72.72%) vs 15(34.09%). This difference between two groups is statistically significant (p<0.05).

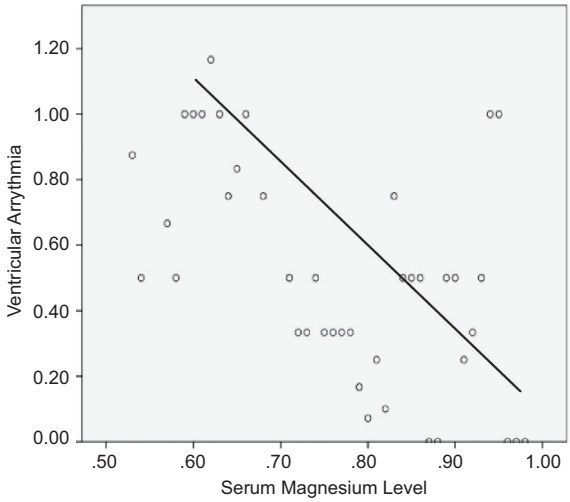

Fig.-3: *Showing correlation between serum magnesium level with occurrence of ventricular arrhythmia in Group B(n=66)*

The scattered diagram shows corerelation between ventricular arrhythmia and serum magnesium level. It shows serum magnesium level is negatively correlated with ventricular arrhythmia with correlation co efficient ®-.541

Table-IV

Correlation between Ventricular arrhythmia and other Biochemical parameters

	R	p-value
S. Magnesium	-0.541	<0.001[s]
S. Potassium	-0.436	0.010[s]
S. Calcium	-0.530	<0.001[s]

r =Pearson's correlation co-efficient.

s= significant (p< 0.05).

Table-V

Multivariate Logistic regression analysis of Ventricular arrhythmia with independent risk factors in patients with Acute Myocardial Infarction

Independent risk factors	B	S.E.	P value	Odd ratio	95% C.I. for EXP(B)	
					Lower	Upper
Obesity	-0.140	0.128	0.275	1.00	-0.485	0.007
Sytolic BP	-0.16	0.03	2.07	0.493	-0.011	0.01
Diastolic BP -0.02	-0.09	0.06		1	2.6.0	-0.003
Heart failure	-0.159	0.05	0.06	2	-0.281	-0.064
Cardiogenic shock	0.02	0.106	0.79	0.723	-0.174	0.25
Troponin I ng/ml	0.023	0.015	0.14	0.971	.932	1.010
Hospital stay	-0.067	0.044	0.87	1.066	.974	1.167
S. Potassium	-0.020	0.196	0.307	8.388	1.268	55.48
S. Calcium	-0.2	0.5	0.456	1	-0.33	0.2
S. Magnesium	16.380	5.90	0.001	136	136	1381

This table shows that there is a significant negative correlation between ventricular arrhythmia with serum magnesium (r= -0.541, p<0.001), serum potassium (r= -.436, p<0.01), serum calcium (r= -0.530, p<0.001). It also shows Serum magnesium is negatively correlated with serum calcium and serum potassium.

Table V: shows logistic regression analysis of Ventricular arrhythmia with independent risk factors. Out of 10 variables, only hypomagnesemia was observed as independent risk factor (OR-136,p-0.001), Other 9 variables such as Obesity, Systolic BP, Diastolic BP, Cardiogenic shock, Troponin I, Hospital stay, Serum potassium, Serum calcium and Heart Failure, none was observed as independent predictors for developing ventricular arrhythmia (OR-1,p-0.275; 2.07,0.493; 263,0.1; 2,0.06; 0.7,0.73; 0.9,0.14; 8.38,0.3; 1,0.456).

Discussion:

This prospective comparative observational study was conducted in the coronary care unit (CCU) of Department of Cardiology, Dhaka Medical College Hospital, Dhaka, over a period of one year from Jan 2017 to Dec 2017. The main objective of the study was to find out the association of ventricular arrhythmia with low serum magnesium in patient with acute myocardial infarction admitted in Dhaka Medical College Hospital during this time period.

For this purpose 110 newly diagnosed acute myocardial infarction patients were included according to exclusion and inclusion criteria. The study population was divided into two groups based on serum magnesium level. Those with Acute Myocardial infarction with normal magneseium was in Group A which includes 44 patients. In group B, 66 patient were included those with acute myocardial infarction with hypomagnesemia.

It was found that hypomagnesemia occurs in 86.66% in acute myocardial infarction[18], similar study found Hiralal Murmu[19]and it was 80% whereas our study showed it was around 60%(66). In our study male were more common in both group. It observed that age(years) incidence was 54.16±11.70 yrs and 58.45±9.47 yrs in between group A and group B respectively .

Our study showed male have higher incidence of hypomagnesemia 40(60.60%) vs 26 (39.40%), similar result observed by Jaffery, et al. study[20], the M:F ratio was were 2.66:1 (34 vs 16). i.e male have higher incidence than female. In our study it also showed that total male, female was 76 vs 34. Sex incidence was also higher in Male than female. In different study conducted by Akila, et al.[21]showed that male are predominance to hypomagnesemia than female and it male female ratio was 5.25:1. which supports our study.

Our study have shown serum magnesium in group A and group B was 0.9218±0.1 and 0.523±0.08 mmol/L respectively. The difference between two groups is statistically significant(<0.05). Other study conducted by Hiralal Murmu[19], showed the similar result, it was 2.2 meq/L(1.1±0.175 mmol/l) for control group and 1.01(0.55±0.07) for AMI group. Jaffery, et al.[20] also showed that mean serum magnesium level was 1.24±0.48 but no significant difference in between sex, which supports our study. Whereas Nasim B, et al.[8], showed mean serum magnesium was 1.7-2.5 meq/L(0.85-1.25 mmol/L) on the other hand Chowdhury, et al.[18] showed it was 0.7±0.13 mmol/L. In different study conducted by Akila et al[21] and it was found serum magnesium level in hypomagnesemia group was 1.65±0.26 mg/dl(0.82±0.16 mmol/dl).

In our study It has shown that group B patient had significant low DBP(mm-Hg) and it was 56.67±11.56(DBP). No such evidence found in any articles regarding this issue.

Akila et, al.[21] showed smoking, DM, HTN, CVD, Obesity, Dyslipidaemia are risk factors for cardiovascular disease whereas our study shown the similar result which supports our study. In another study conducted by Jaffrey, et al.[20] showed similar risk factors HTN. Obesity, CVD, DM, Smoking, Dyslipidaemia and Impaired Glucose tolerance test.

Our Study showed raised serum troponin in both group, yet that group B has triple fold rise of serum troponin than that of group A. The serum troponin level was 4.7±0.79 ng/ml and 14.87±4.3ng/ml in group A and group B respectively. This difference between two groups is statistically significant (p<0.05). It was also observed that raised troponin also associated with severity of hypomagnesemia.

Similarly serum Potassium between two group A and B was 3.84±0.16 vs 2.54±0.41 mmol/dl, The difference between two group was statistically significant (p<0.05). The difference of serum calcium level between two group was statistically significant.

Our study also showed that cardiogenic shock 05(11%) in group A and 18(27%) in group B. Group B patient has more shock event than group A. The difference between group is statistically significant (p<0.05). Our study also showed ventricular arrhythmia more in group B than group A respectively 15(34%) vs 48(73%). The Difference between two groups is statistically significant (p<0.05). Other adverse cardiac events such as asystole, post MI angina, Death were not statistically significant in between

group. It was observed in our study that hypomagnesemia is positively correlated with ventricular arrhythmia. The study also showed hypokalaemia ,hypocalcaemia and hypomagnesemia also positively correlated with each other.

Our study shows that group B has three times more chance of occurrence of ventricular arrythmia which is 15 vs 48 in between group A vs group B. The difference is statistically significant($p<0.05$). Similar study found by Hiralal Murmu[19]. He showed that hypomagnesemia group has 2-3 times more chances of ventricular arrythmia than control group which supports our study.

Ceremuynski L[22], showed that the mean plasma magnesium concentration was 1.83mgl/dl(0.76mmol/L) in patient with no abnormal rhythm, 1.68mg/dl(0.7 mmol/L) in those with multifocal premature complex and 1.5 mg/dl(90.65mmol/l) in those with unstained ventricular tachycardia. That is hypomagnesemia is positively correlated with occurrence of ventricular arrythmia. Similar results shown by our study which is hypomagnesemia is negatively correlated($r=-0.543$, $p<0.001$) with occurrence of Ventricular arrythmia.

Hiralal Murmu[19], showed that after Acute myocardial infarction hypomagnesemia occurs within 48hrs in most(80%) cases and which is the causes of ventricular arrythmia. Woods et al[24], showed in different study that this ventricular arrythmia improves after IV magnesium infusion. Multivariate logistic regression analysis showed that out of nine variable such as Obesity, SBP, DBP, Heart failure, Cardiogenic shock, Troponin I, Hospital stay, Serum potassium and Serum calcium , none was observed as idependent risk factor for ventricular arrhythmia.

Our study also showed that hypomagnesemia is also associated with hypokalaemia($r=0.831$,$p<0.01$), Multivariate regression analysis strongly disagree hypokalaemia is not independent risk factor for Ventricular arrythmia. Similar study was found by Chowdhury, et al.[18]. In Chowdhury et al[18] showed that mean level of Mg(mmol/L) was 0.59±0.09 in group I and 0.67±0.07 in group II. The mean level of serum K(mmol/L) in group I and group II were 3.28±0.45 and 3.63±0.43 respectively. Our study showed the similar data. The serum potassium(mml/L) level in between group A and B respectively 3.84±0.16 vs 2.54±0.41. This mean difference between group is statistically significant($p<0.005$). Similar result supported by Dyckner, et al.[24] and Kafka, et al.[25]. But no mechanism is yet explained why hypomagnesemia and hypokalaemia occurs concurrently Chowdhury, et al.[18]

Our study showed hypomagnesemia is strongly positively correlated with ventricular arrhythmia and the association was statistically significant. Our study also showed hypomagnesemia is independent variable for developing ventricular arrhythmia.

Conclusion:

This study showed that there is association of hypomagnesemia and occurrence of ventricular arrythmia in patient with acute myocardial infarction in comparison to normal serum magnesium. It is also showed hypomagnesemia is associated with hypokalaemia and hypocalcaemia, These two mask the hypomagnesemia clinical effects. So it is very difficult to diagnose clinically. Hypomagnesemia patient has bad in hospital prognostic outcome in comparison to normal serum magnesium.

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Original Article

Video Laryngoscopic Endotracheal Intubation in Cardiac Operation Theater - Experience at a Peripheral Tertiary Healthcare Centre of Bangladesh

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Abstract:

Background: Endotracheal intubation is an essential primary skill for all anesthesiologists. For cardiac anesthesiologists rapid and proper intubation is more important as failure may cause serious consequences. Video laryngoscope provides a better real time view of the larynx, epiglottis and vocal cords. It also keeps the intubating anesthetist away from the patient as compared to conventional laryngoscopy. This may be very important in this COVID-19 era. To the best of our knowledge the Department of Cardiac Surgery and Cardiac Anesthesia of Chattogram Medical College & Hospital is the first center in Bangladesh to introduce video laryngoscope in cardiac OT. The objective of this study was aimed to compare the intubation time, hemodynamic response to laryngoscopy, success rates and operator's comfort using the conventional Macintosh laryngoscope and video laryngoscope in adult patients undergoing cardiac surgery.

Materials and Methods: A total of 60 adult patients were included in this comparative study, subjected to general anesthesia for cardiac surgery, intubated using either conventional Macintosh direct laryngoscope or video laryngoscope. Patients were intubated by 3 different consultant anesthesiologists with equal competency of our department.

Results: There was not much difference between Video laryngoscopy and conventional laryngoscopy in terms of intubation time and success rate. Video laryngoscopy exhibited less hemodynamic response to laryngoscopy and intubation; however, the difference was not statistically significant in this small group of patients. Operators were much more comfortable with Video laryngoscope than conventional laryngoscope particularly with the cases of difficult intubation because of the better glottic view with the former.

Conclusion: Video laryngoscope is preferred by cardiac anesthetists because of better glottic view.

Key Words: Video laryngoscope, Macintosh direct laryngoscope, Hemodynamic response, Intubation time.

(Bangladesh Heart Journal 2020; 35(1): 47-53)

Introduction:

Anesthetic techniques have changed over the years to ensure safety and comfort of patients undergoing cardiothoracic surgery. Endotracheal intubation is an important maneuver routinely performed by the anesthesiologists in the operation theaters, intensive care units and in emergency departments. It is an

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DOI: https://doi.org/10.3329/bhj.v35i1.49142

essential primary skill for all anesthesiologists. For Cardiac Anesthesiologists, rapid and proper intubation is even more important as failure may cause serious consequences. Direct laryngoscopy has been the standard technique of endotracheal intubation for almost a century. But alternative intubation devices with video, optical or fiber optical imaging have seen to develop in the last two decades.

Traditionally, tracheal intubation is performed using direct laryngoscope. Video laryngoscope (VL) is an indirect laryngoscope, a new device that contains a miniaturized camera at the blade tip to indirectly visualize the glottis. Video laryngoscope was designed by Canadian vascular and general surgeon John Allen Pacey[1]. It has a high-resolution camera and light source embedded within the laryngoscope blade, which is bent through 60° at the midline and is available in four different sizes[1,2].

Video laryngoscope provides a better real time view of the larynx, epiglottis and vocal cords with much easier laryngeal exposure without alignment of the oral, pharyngeal and tracheal axis. By Video Laryngoscopy multiple doctors can observe the procedure at a time. Moreover, the regional supraglottic tissue tension which elicits a vagal response and stimulates cardio-accelerator fibers is less in case of video laryngoscopic endotracheal intubation. Considering its advantages over direct laryngoscopic endotracheal intubation, the Department of Cardiac Surgery of Chattogram Medical College Hospital is the first center in this region introduces this novel device in cardiac operation theater.

Objectives of the Study:

The objective of this comparative study was aimed to compare the intubation time, hemodynamic response to laryngoscopy, success rates and operator's comfort using the conventional Macintosh direct laryngoscope (ML) and video laryngoscope (VL) in adult patients undergoing cardiac surgery. In addition, this study would help to compare the success rate of endotracheal intubation in difficult cases by using the conventional Macintosh and the video laryngoscope.

Materials and Methods:

This study was conducted by the Department of Cardiac Surgery and Cardiac Anesthesia, Chattogram Medical College & Hospital between July 2019 and March 2020. After obtaining written informed consent, a total of 60 adult patients were randomly included in this prospective randomized comparative study, subjected to general anesthesia for cardiac surgery, were intubated using either conventional Macintosh direct laryngoscope (ML) or video laryngoscope (VL). Patients with known left main coronary artery disease, patients who needed rapid sequence intubation and patients with Mallampati class 4 airway score were excluded from this study. Patients were randomly allocated to two groups. Patients were intubated by 3 different consultant anesthesiologists with comparable competency of our department.

Pre-anesthetic checkup was done a day prior to the proposed day of surgery. According to standard protocol all patients were kept nil per orally and received premedication as required. Following arrival at the OT, patients were placed into supine position by placing a cushion under the head and connected to the standard monitors including ECG and pulse oximeter. Oxygen face mask was put with 5 liter of oxygen. After intravenous access and intra-arterial cannulation followed by placement of intra-arterial pressure monitoring line, setup was done with all standard facilities. All the patients were preoxygenated with 8-10 liters of 100% oxygen for 5 minutes. Anesthesia was induced with 0.05 mg/kg Midazolam, 1 ¼g/kg Fentanyl, 0.1 mg/kg Vecuronium bromide and titrated doses of Thiopental sodium was administered to facilitate endotracheal intubation and anesthetic depth. Ventilation was maintained with mask using 100% oxygen until tracheal intubation. Endotracheal intubation was attempted 3 minutes after the administration of Vecuronium bromide. In video laryngoscope (VL) group a "J" shaped stylet bent through 60° was inserted into the endotracheal tube (ETT) to facilitate intubation.

The parameters documented during the study were the intubation time (time to achieve endotracheal intubation), hemodynamic response to intubation, success rate of intubation and operator's ease (requirement of external laryngeal pressure to facilitate glottic visualization and the number of attempts required to secure the endotracheal tube). Intubation time was recorded as the time from the insertion of the laryngoscope blade into the mouth to the time the blade was removed from the mouth after successful intubation by using a stopwatch. Preinduction, preintubation, immediate postintubation and 3 minutes postintubation arterial blood pressures (ABP) and heart rates were recorded. If laryngoscopy exceeded 120 seconds or if the oxygen saturation dropped below 90% or if the handle of the laryngoscope was removed out of the mouth to facilitate proper insertion, intubation was stopped and bag-mask

ventilation was commenced with airway tube. Patients were mask ventilated for 1 minute with 1% halothane in 100% oxygen between the attempts if repeated attempts for intubation were required. After successful intubation, the cuff of the ETT was inflated with air. Anesthesia was maintained with 1% halothane in 50% oxygen and 50% nitrous oxide.

Statistical analysis:

SPSS software (Version 23.0) was used to analyze the data. Mean and standard deviation were calculated for different parameters. Data were statistically described as frequency (number of cases) when appropriate. The observed results were analyzed using Student's *t*-test for quantitative data. *P* <0.05 was considered statistically significant.

Results:

A total of 60 patients were included in the study. The study population was divided into two groups: ML (Macintosh direct laryngoscope) and VL (video laryngoscope) group. 15 patients in ML group and 14 patients in VL group had Mallampati class 1 airway score. 11 patients in ML group and 10 patients in VL group had Mallampati class 2 airway score. 4 patients in ML group and 6 patients in VL group had Mallampati class 3 airway score [Table 1]. Patients of Mallampati class 4 airway score were excluded from this study. There was no statistical significant difference between the two groups regarding Mallampati class distribution.

Continuous data are expressed as mean +SD. *P*<0.05 was considered statistically significant. ML=Macintosh laryngoscope, VL= Video laryngoscope, SD= Standard deviation

The mean intubation time was less in group ML (33.63 + 2.98 seconds) compared to group VL (36.11 + 5.99 seconds). But the results were not statistically significant (*P* >0.05) [Table 2].

Data is expressed as mean +SD. *P*<0.05 was considered statistically significant. ML=Macintosh laryngoscope, VL= Video laryngoscope, SD= Standard deviation

Patients in ML group had a higher rise than VL group in mean systolic, diastolic, mean arterial pressures and heart rate immediately and 3 minutes after intubation but the difference was not statistically significant [Table 3, 4].

Data is expressed as mean +SD. *P*<0.05 was considered statistically significant. ML=Macintosh laryngoscope, VL= Video laryngoscope, SD= Standard deviation

Cormack-Lehane (CL) laryngoscopic view is used to describe the glottic view. Regarding CL laryngoscopic view significantly less number of patients had grade 1 CL laryngoscopic view in group ML (16 patients) as compared to group VL (26 patients). 10 patients from ML group and 3 patients from VL group had grade 2 CL laryngoscopic view. 4 patients from ML group had grade 3 CL laryngoscopic view against 1 patient in ML group [Table 5]. Requirement of external laryngeal pressure to facilitate endotracheal intubation was significantly (*P* <0.05) more in group ML (14 patients) as compared to group VL (4 patients). Four patients in group ML required the second attempt to facilitate glottic visualization and intubation whereas all the patients in group VL were intubated at the first attempt. No patient from either group required more than 120 seconds for laryngoscopy nor had a drop in oxygen saturation below 90% requiring mask ventilation.

Table-I

Demographic data with ASA and Mallampati class of ML and VL groups -

Variable	Group ML	Group VL	*P*	
Age (Years)	48.96 + 10.94	49.66 + 9.61	0.79	
Height (Cm)	157.23 + 8.34	160.21 + 9.01	0.19	
Weight (Kg)	57.93 + 10.43	61.86 + 10.10	0.14	
BMI	23.46 + 4.24	24.16 + 3.66	>0.05	
Sex (no. of patient)	Male	17 (28%)	18 (30%)	>0.5
	Female	13 (22%)	12 (20%)	
ASA (no. of patients)	Grade 2	4 (7%)	3 (5%)	
	Grade 3	15 (25%)	21 (35%)	
	Grade 4	11 (18%)	6 (10%)	
Mallampati (no. of patients)	Class 1	15 (25%)	14 (23%)	
	Class 2	11 (18%)	10 (17%)	
	Class 3	4 (7%)	6 (10%)	

Table-II

Intubation time in ML and VL groups

Variable	Group ML	Group VL	*P*
Intubation time (seconds)	33.63 + 2.98	36.1 + 5.99	>0.05

Table-III

Hemodynamic variables (systolic blood pressure and diastolic blood pressure in mm Hg) in ML and VL groups

Variable	Group ML	Group VL	*P*
Systolic blood pressure (mm of Hg)			
Pre-induction	124.46 + 11.79	127.73 + 10.18	0.26
Pre-intubation	92.06 + 5.86	92.01 + 4.51	0.96
Immediate post-intubation	158.53 + 18.65	163.83 + 16.83	0.25
3 minutes post-intubation	126.83 + 14.09	130.66 + 13.12	0.28
Diastolic blood pressure (mm of Hg)			
Pre-induction	81.83 + 4.97	81.66 + 4.48	0.89
Pre-intubation	60.53 + 4.19	59.33 + 3.14	0.22
Immediate post-intubation	104.11 + 8.786	104.56 + 8.17	0.83
3 minutes post-intubation)	82.76 + 7.66	83.86 + 6.31	0.55

Data is expressed as mean +SD. *P* <0.05 was considered statistically significant. ML=Macintosh laryngoscope, VL= Video laryngoscope, SD= Standard deviation

Table-IV

Hemodynamic variables (MAP in mm Hg, HR in beats/min) in ML and VL groups

Variable	Group ML	Group VL	*P*
Mean arterial blood pressure (mm of Hg)			
Pre-induction	96.03 + 7.02	97.11+ 6.24	0.54
Pre-intubation	71.03 + 4.39	70.16 + 3.32	0.49
Immediate post-intubation	122.26 + 11.7	124.41 + 10.87	0.47
3 minutes post-intubation	97.36 + 9.79	99.43 + 8.35	0.38
Heart rate (beats/minute)			
Pre-induction	84.53 + 6.74	86.76 + 7.45	0.23
Pre-intubation	71.63 + 5.22	74.71 + 5.87	0.037
Immediate post-intubation	98.96 + 7.13	102.43 + 6.87	0.06
3 minutes post-intubation	84.26 + 7.79	87.71 + 6.51	0.069

Table-V

Conditions for intubation with ML and VL

Variable (no. of patient)		Group ML	Group VL	*P*
Intubation in the 1st attempt		30	26	>0.05
Application of BURP		14	4	<0.05
Cormack-Lehane (CL)	Grade-1	16	26	<0.05
laryngoscopic view	Grade-2	10	3	<0.05
	Grade-3	4	1	<0.05

The results are expressed as number of patients. *P*<0.05 was considered statistically significant. VL= Video laryngoscope, ML=Macintosh laryngoscope, BURP= Backward, Upward, Rightward pressure

Discussion:

Our study demonstrated that there was not much difference between conventional Macintosh direct laryngoscopy and video laryngoscopy in terms of intubation time and success rate. A little longer time was required for video laryngoscopic intubation due to the time required to negotiate the endotracheal tube (ETT) through the vocal cords. The exaggerated curvature of the video laryngoscope blade with enhanced optics, offers the advantage of being able to "look around the corner," allowing better view of the glottis. Improved glottic view with video laryngoscopy did not shorten the intubation time, as it does not provide line of sight view of the glottis. A greater number of patients in ML group required the application of external laryngeal pressure to facilitate glottic visualization, but intubation time was shorter. Proper positioning of the laryngoscope in VL group took a greater number of attempts and required removal and repositioning in a greater number of patients when compared to ML group, this may be due to operators' relative inexperience with this newly acquired device. However, though the intubation time was less in ML group, the time needed for intubation was not statistically significant between the two groups. The duration of laryngoscopy is important for the cardiovascular responses to endotracheal intubation[3]. The intubation time is longer with various VL than ML[4,5]. However, this did not affect the hemodynamic parameters for a long time. It was also similar to the study by Kanchi and colleagues[5].

Regarding hemodynamic response to laryngoscopy and intubation, the difference of values of variables were not statistically significant between the two groups in this small number of patients. Both laryngoscopy and endotracheal intubation causes increased blood pressure, heart rate and catecholamine concentrations[6]. The hemodynamic responses during laryngoscopy and endotracheal intubation may vary by premedication, social habits, preoperative medications, narcotic and neuromuscular blocker doses and speed of anesthetic agent administration[7]. Drug combinations may be required in order to minimize both heart rate and blood pressure effectively[8]. Various anesthetic agents, adjuvants and analgesics have been used to blunt the level of stimulation and the stress response to the manipulation and stimulation of airway during laryngoscopy and intubation. Fentanyl, beta-adrenergic receptor blockers and lignocaine have all been used with varying results[9,10]. Weiss-Bloom *et al*. showed reduced hemodynamic responses to endotracheal intubation with induction by 5-10 μg/kg fentanyl and 0.3 mg/kg etomidate in patients scheduled for coronary artery bypass graft surgery[11]. We used fentanyl (1 μg/kg) in both groups to maintain the hemodynamics. Nearly similar and stable hemodynamic responses were achieved with both laryngoscopes.

Our study results were comparable to results of previous studies that reported improved glottic visualization and better Cormack-Lehane (CL) laryngoscopic view with VL when compared to ML[2,12]. A study by Ezri *et al.* found that the ratio of CL laryngoscopic grade 3 and 4 was 5.2% in the overall patient population compared to 10% in patients who had cardiac surgery due to various reasons such as age and restricted neck movement[13]. In both groups, we intubated the grade 3 patients without any problems. VL provides a better laryngeal view; however, an improved laryngeal view does not always mean an easy and successful intubation[14].

This study showed that VL does not possess an added advantage over an ML for endotracheal intubation in patients with uncomplicated airways. Various studies by experienced and novice users, in patients with normal and difficult airways, in adult and pediatric patients have compared VL with direct laryngoscopy, which showed the added advantages of VL[15-17]. In a randomized clinical trial by Sun *et al*., the majority of patients showed improvement in the CL grade ($P < 0.001$) obtained with the VL, when compared with ML[2]. A study by Solimana *et al*. compared VL with ML in 100 adult patients undergoing cardiac surgery and found a higher catecholamine levels after the use of VL. They also demonstrated a longer intubation time, more intubation response and mucosal trauma in VL group. However, VL was found to be useful in patients with anticipated difficult intubation with restricted cervical spine mobility[16,18,19]. Bathory *et al*. evaluated a high tracheal intubation success rate without clinically relevant injuries in patients having their cervical spine immobilized by VL with a better CL laryngoscopic glottic view compared to ML.[18]

COVID-19 crisis in Bangladesh has devastated the medical arena. As of Mid-July, more than 80 doctors have succumbed to the disease. Many of them are anesthetists and critical care specialists. Video laryngoscopy is ideally recommended in patients infected with COVID-19 to increase the distance between the operator's face and the patient's face to minimize the risk of contamination.[19] Ibinson *et al*. using a propensity score-matched analysis found a greater first-attempt success rate with a VL than a direct laryngoscopy (Macintosh or Miller blade). VL was found to be 99% successful for intubation after the initial failure of direct

laryngoscopy performed by anesthesiologists, nurses or trainees; however, at the expense of a higher rate of minor mucosal injury[20]. The competency of the intubating person might have affected the results. This could be due to the fact that direct laryngoscopy generally requires a steeper learning curve and a longer duration to master the technique as compared with the VL. In a study by Aqil, when comparing VL to a fiberoptic bronchoscope, the VL group required external laryngeal manipulation in more cases to facilitate endotracheal intubation. They reported more hemodynamic response in VL group which could be due to external laryngeal manipulation, despite an excellent CL glottic view in VL group[21].

The limitations of the study were, it was not possible to blind the person performing the endotracheal intubation to the intubation device being use, but the intubation time and hemodynamic measurements were recorded by an independent observer. All the intubations were not done by the same person, but all the consultant anesthesiologists who participated in the study were equally trained to perform endotracheal intubation. Certain measurements such as laryngoscopic grade are subjective and a cross over study would be more ideal as each patient varies in the degree of intubation difficulty.

Conclusion:

Video laryngoscope is preferred by cardiac anesthetists because of better glottic view. Though Video laryngoscope provided a better laryngoscopic view, there is still a need for stylet and it took a little longer time to negotiate the endotracheal tube and thus the intubation time is little more when compared to Macintosh direct laryngoscope. The hemodynamic response during intubation and success rate of intubation were nearly similar in the two groups.

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Original Article

Retrograde transradial Approach for Hemodialysis Access Intervention: A Single-Center Study

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Abstract:

Perianastomotic stenosis is a common scenario after creation of arteriovenous fistula for hemodialysis. Most of the interventionists prefer transvenous approach. But transradial approach can easily visualize radial artery and cephalic venous tree up to central vein. This retrospective study was performed from November 2012 to January 2017 in Ibn Sina Hospital, Dhanmondi, Dhaka. Total patients undergoing hemodialysis access were 148 (male 74, female 74, male-female ratio 1:1). Number of radiocephalic fistula was 95 (64%), brachiocephalic fistula 50 (34%) & others 3 (2%). Most of the punctures were done by palpation. Sometimes puncture was made by ultrasonogram guidance. Puncture needle size was 21 gauge, 2.5cm or 4cm long. Sheath size was 6 F x 4 cm or 7 F x 4cm. Majority of the cases (140) were successfully approached through retrograde transradial route. Few cases (8) were approached through retrograde venous route due to thrombosis of radial artery for previous intervention or creation of radiocephalic fistula in an end to end fashion. It was concluded that retrograde transradial approach to dilate perianastomotic stenosis as well as outflow vein is a good option.

Key words: Arteriovenous Fistula (AVF), Transradial Approach (TRA)

(Bangladesh Heart Journal 2020; 35(1): 54-60)

Introduction:

Maintenance of dialysis access patency is crucial for patients with end-stage renal disease who are on hemodialysis. Dysfunctional dialysis access is a common cause of morbidity and hospitalization in these patients. Stenotic lesions often threaten the patency of an arteriovenous (AV) access. These lesions can occur at various locations of the access circuit, including the juxta-anastomotic area, outûow vein, or central venous system. Percutaneous angioplasty is indicated in ûstulas with >50% stenosis in arterial or venous limbs.[1] The traditional approach for intervening on malfunctioning dialysis access has been the direct antegrade or retrograde puncture of the fistula itself.

Transvenous approach is generally considered the standard approach. Transvenous access is usually relatively simple because the access vein is dilated in mature fistulas and only rarely spasm. The dilated vein is also well suited to accommodate large sheaths that may be needed for larger diameter angioplasty balloons and stents. Drawbacks of the antegrade transvenous approach include 1) difficulty to identify the AV anastomosis and afferent artery during reflux angiography

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DOI: https://doi.org/10.3329/bhj.v35i1.49143

that is done during cuff inflation or balloon occlusion of the venous outflow 2) a possible puncture site occlusion during compression after the procedure and 3) a potential risk for distal embolization into the hand when crossing anastomotic occlusive lesions containing thrombus in a retrograde fashion. The TRA approach offers unique potential advantages for the evaluation and treatment of dysfunctional AVFs. The radial artery is easily accessible by manual palpation or duplex sonography, and operator fluoroscopic exposure is substantially reduced with this approach. Most fundamentally, the radial approach permits evaluation and treatment of the entire fistula from the afferent artery through to the central veins with only a single puncture. Finally, postprocedure hemostasis of a radial puncture is easily achieved despite the intraprocedural use of heparin or thrombolytic agents because of its favorable anatomic location and easy compressibility. There are also several potential drawbacks to the use of TRA. Technically, the TRA puncture can be difficult for those who are not comfortable with this technique; however, there is short learning curve to perform the puncture. Puncture of the radial artery may be difficult if the pulse is weak. This can be overcome with the use of ultrasonography.

Access site for diagnosis and management of any hemodialysis fistula varies due to operator preferences, suspected type and sites of abnormality and the anatomic pattern of the fistula. Decisions regarding the puncture sites are predicated on physical examination, knowledge of previous surgery and review of previous imaging studies. The goal for the interventionist is to choose an access site that is well suited to identify and treat all of these lesions to reduce needle punctures, lessen procedure time and variation, and allow rapid restoration of access function so that the patient can quickly return to hemodialysis. Figure 1 shows different types of arteriovenous fistula for hemodialysis.

Material and Methods:

We retrospectively studied 148 cases from 2012 to 2017. Inclusion criteria included palpable radial artery & dysfunctional radiocephalic or brachiocephalic or brachiobasilic transposition fistula. Exclusion criteria included impalpable radial artery, oximetry <90% after occlusion of radial artery, abnormal Allen's test or infected fistula. Number of successful puncture of radial artery followed by fistuloplasty was evaluated. Periprocedural complications like radial artery thrombosis dissection or hematoma were also evaluated.

Technique of retrograde cannulation of radial artery:

When considering a patient for TRA, the interventionist must evaluate the radial artery and assess the radial/ ulnar artery circulation. This can be accomplished by performing the Allen's test. To perform the Allen's test, both the radial and ulnar arteries are compressed until blanching of the hand occurs. The examiner then releases pressure on the ulnar artery to determine if flow returns to the radial aspect of the hand, implying patency

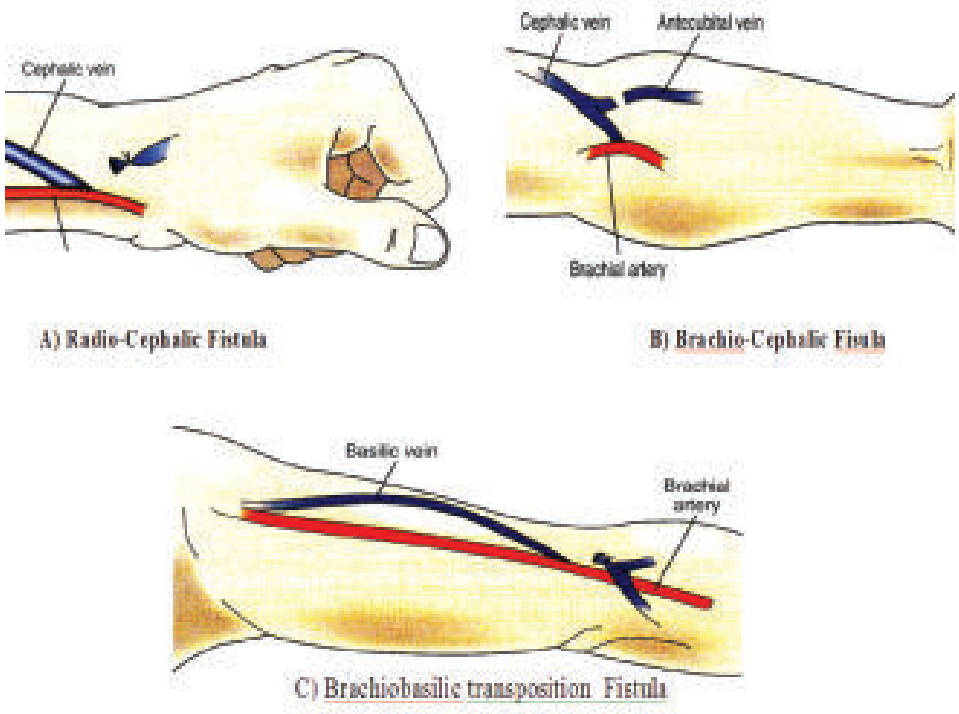


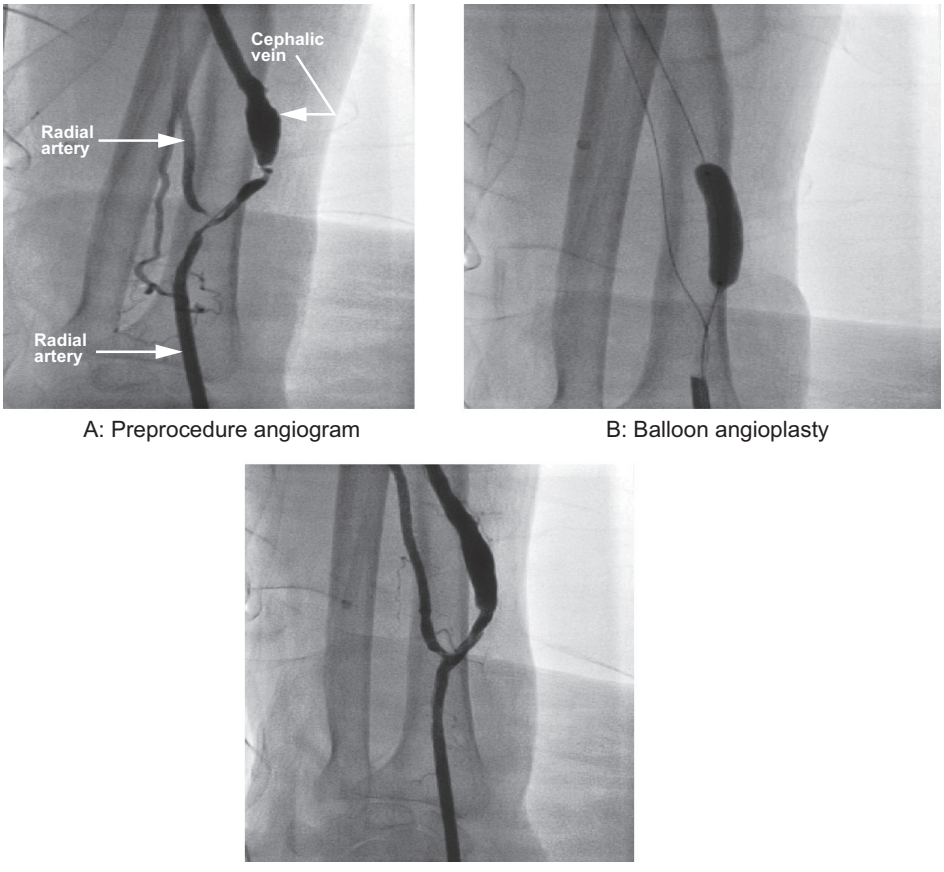
Fig.-1: *Different types of arteriovenous fistula for hemodialysis*

of the palmar arch. If hyperemia does not occur (usually within 5–7 seconds), radial access should be avoided as the patient does not have dual circulation to the hand. TRA in cases of an abnormal Allen's test may result in hand ischemia and a substantial risk of radial artery occlusion.[2] Correct positioning of the wrist is important. The wrist should be hyperextended 60º and may be supported by placement of a towel underneath the wrist. Using physical examination or sonography, the radial artery should be punctured at least 2 to 3 cm distal to the arteriovenous anastomosis to allow sufficient distance for sheath insertion and anastomotic interventions. When evaluating upper arm fistulas using a TRA approach, the radial artery can be punctured at its most accessible location as determined by the pulse examination.

We generally perform the transradial puncture with a 21 gauge, 2.5 or 4 cm long needle either by direct palpation or under direct ultrasound guidance. Advancement of the 0.018 inch guidewire into the radial artery can be visualized with fluoroscopic guidance. In most cases, complete angiographic assessment of the dysfunctional AVF can be performed through 6F x 4cm or 7F x 4cm radial sheath. Interestingly, due to preferential flow into a nonthrombosed fistula, the direction of flow in the radial artery is often retrograde. Interestingly 60% volume of blood in venous limb composed from radial artery proximal to anastomosis and that of 40% from distal to anastomosis and the tip of the sheath are kept distal to anastomosis.

Using this approach, dilation and insertion of a larger sheath was only performed once it is deemed that intervention is required. We generally advanced a 6F to 7F sheath into the radial artery distal to the anastomosis. 2500 IU Heparin with 100 microgram GTN was injected via sheath and just before angioplasty another 2500 IU heparin was injected via intravenous cannula. Once the anastomosis was seen, roadmap guidance was performed to guide catheterization of the fistula using a 4F angled catheter. If it was necessary to maintain the wire position while injecting contrast, this can be achieved by injecting through the 4F catheter over a 0.018 or 0.014-inch wire using an attached Check-Flo sidearm adapter (Cook Medical). It was performed in radial artery & venous outflow upto central vein were easily visualized.

Figure 2 shows retrograde transradial approach, Figure 3 shows retgrograde transvenous approach to treat

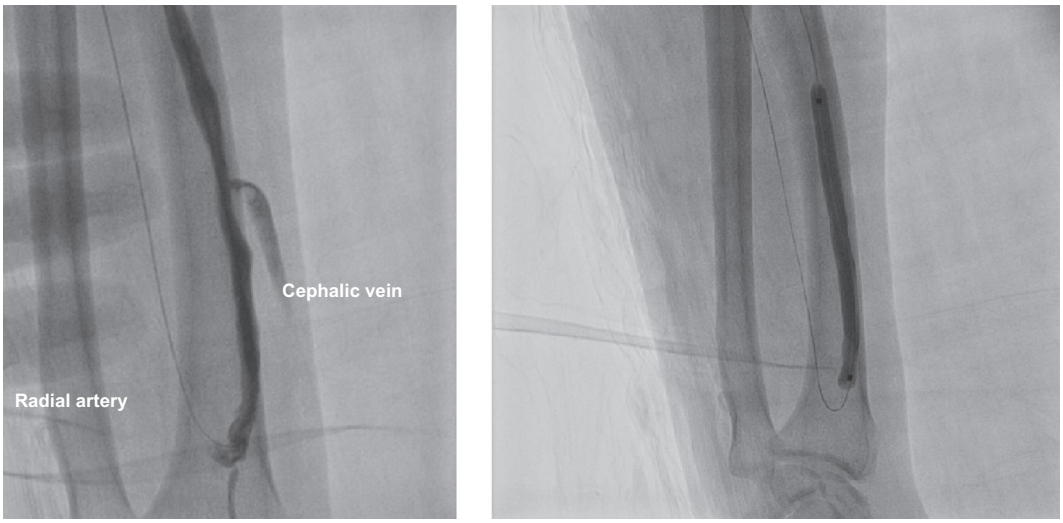


A: Preprocedure angiogram

B: Balloon angioplasty

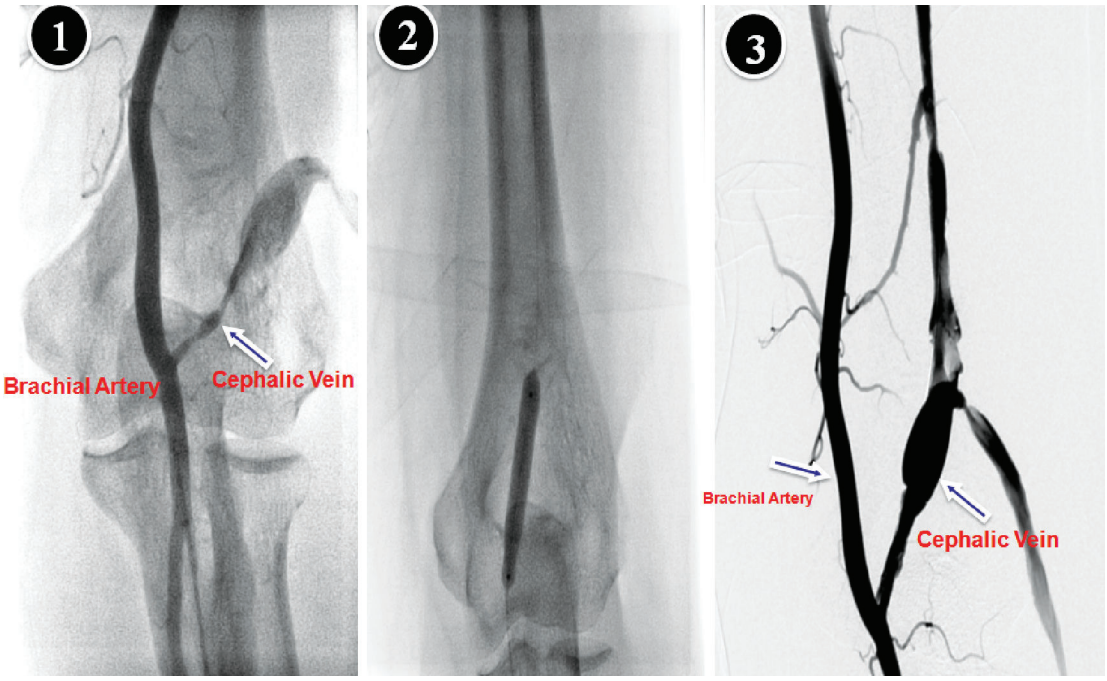
C: Post procedure angiogram

Fig.-2 (A, B, C): *Retrograde transradial approach to treat radiocephalic fistula malfunction.*



A: Preprocedure angiogram B: Balloon angioplasty

Fig.-3: *Retrograde transvenous angioplasty of radiocephalic fistula*



A: Preprocedure angiogram B: Balloon angioplasty C: Post procedure angiogram

Fig.-4: *Retrograde transradial approach for brachiocephalic fistula*

radiocephalic fistula malfunction & Figure 4 shows retrograde transradial approach to treat brachiocephalic fistula malfunction.

Once TRA was established, it was relatively simple to complete, including balloon angioplasty using standard noncompliant balloon. Dilation and mobilization of thrombus from the arterial anastomosis through the venous outflow was then performed using a 4- to 5-mm PTA balloon with low-pressure hand inflation. Once thrombus was cleared and flow was restored, angioplasty and other interventions were then performed in the usual fashion. One important technical

consideration is notable in our experience. After the procedure, we did not use the radial artery compression bands that are typically described for hemostasis after transradial puncture for cardiac catheterization. Instead, we achieved hemostasis using nonocclusive manual compression. Despite this technical factor, we had no occurrence of hand ischemia and only rare instances in which there was subsequent occlusion of the radial artery preventing future access.

Results:

From November 2012 to January 2017, total 148 patients (male:female=1:1) were evaluated. Types of arteriovenous fistula were radiocephalic 95 (64%), brachiocephalic 50 (34%) & brachiobasilic transposition 3 (2%). 146 cases were approached through retrograde transradial artery & only 2 cases through retrograde cephalic vein as they have side to side anastomosis. During secondary procedure 6 patients (4.1 %) developed radial artery thrombosis due to previous procedure and no patient developed hand ischemia or hematoma.

Discussion:

Now a day percutaneous fistuloplasty for hemodialysis is routinely done to maintain patency but most interventionist do it by retrograde venous approach. But transradial approach is an alternative to retrograde venous approach in patients having patent radial artery, intact palmar arch, juxta anastomotic stenosis, multiple venous outflow stenoses or lesions in both arterial & venous limbs.[3]

By using one retrograde radial sheath, one can evaluate both arterial side as well as venous limb upto central vein. Transradial approach can solve juxta-anastomic lesion as well as lesions in outflow vein.

The use of transradial approach (TRA) is a widely accepted and well-described technique for coronary artery interventions and for the diagnosis and treatment of iliac and mesenteric diseases.[4] Since 2006, several reports from Asian investigators have shown that the use of TRA for the dysfunctional AVF is safe and feasible.[5-8] Kawarada et al initially described the use of TRA in 11 patients with predominantly nonthrombosed Brescia-Cimino fistulas. There was no incidence of hand ischemia or puncture site complications observed out to 6 months after intervention.[9] Heparin and isosorbide dinitrate were administered through the radial sheath to prevent spasm and thrombosis.[5] Lin et al subsequently reported on transradial interventions in 165 upper arm fistulas, more than half of which were performed for thrombosed accesses. Heparin was used, but vasodilator was not administered. Two episodes of radial artery spasm causing thrombosis and two asymptomatic radial dissections occurred, although no patient developed hand ischemia.[8] Chen and associates described their experience with 154 transradial Brescia-Cimino fistula treatments (including 99 thrombosed accesses). There was a differential technical success for nonoccluded fistulas compared to fistulas having a “fibrous” occlusion, with success noted in 99% and 46%, respectively. Overall 30-day primary patency was 75%.[5] Taken together, the anatomic or clinical success rates from these reports are comparable to those reported in previous studies using the more traditional transvenous approach.[5-8]

The TRA approach is not recommended in patients with a positive Allen test result, and caution should be exercised in using this approach in patients without a palpable radial pulse. Second, this approach can be associated with a learning curve, and it is key that the operator be proûcient at using ultrasound imaging to gain anterior wall access by a single puncture only. Multiple failed attempts may lead to radial artery spasm and hematoma. Third, a hydrophilic transradial tapered sheath allows for a smooth entry into the radial artery, thereby decreasing the chance of a radial artery injury or rupture. Lastly, use of a solution containing a vasodilator and a calcium channel blocker intermittently during the TRA intervention minimizes radial artery vasospasm and thrombosis.

Infiltration of the subcutaneous periradial tissues with lidocaine containing 500 µg of nitroglycerin can also cause radial artery vasodilation and facilitate puncture.[10] Temporary radial artery occlusion can occur during puncture and was seen in < 5% of patients undergoing TRA for coronary interventions.[11] Repeated puncture of the radial artery for access may lead to eventual occlusion or stenosis and prevent this approach for access; however, Chen et al found that 98.7% (152/154) of patients had a good palpable pulse at follow-up.[6] Due to the relatively small size of the radial artery, sheath size may be limited to a 6-F or 7-F sheath. This potentially prevents the use of larger balloon catheters for central venous angioplasty, necessitating an additional transvenous puncture if such devices are necessary. The availability of newer low profile monorail balloons (e.g., Sterling balloon catheter, Boston Scientific Corporation, Natick, MA) provides the ability to perform 8 mm percutaneous transluminal angioplasty.

Multiple studies have also documented that the TRA for coronary interventions has lower bleeding and access site complications compared with brachial

approaches.[3,14,15] The complication rate for a brachial approach can be up to 12%;[16] by comparison, complication rates for radial artery approaches are very minimal. Puncture failure rates and radial artery occlusions are as low as 0.25% and 0.7% respectively.[17,18]

In a recent study, no local complications from the puncture site occurred and 6 patients underwent multiple TRA procedures with thrombosis of radial artery. No patients complained of hand ischemia or hematoma in follow-up. Patients seen in the clinic underwent a clinical pulse examination; therefore, an arterial duplex to evaluate radial artery patency at post intervention was not routinely ordered.[19] In our study, complication rate was 4.1%. Wu et al documented a complication rate of 4% in their study of the TRA approach in occluded radiocephalic AVFs.[20] Lin et al reported a complication rate of 9.7% that included interventions for stenosis and thrombosis in AVFs.[21]

A limitation to the TRA is the inability to accommodate large sheath sizes, although most interventions in the AV access should be able to perform through a 6F sheath. In our study, the largest sheath size used for a TRA was 7F. Large noncompliant balloons that treat central venous lesions require larger sheaths, thereby making the TRA approach a poor option in these cases.

In our study, we highlighted the versatility of the TRA approach as evidenced by its efûcacy in treating juxta-anastomotic lesions as well as treating different AVF types. The most common type of AVF treated in this cohort was the distal radiocephalic conûguration. We have proven that despite minimal running room, distal radiocephalic AVFs can be treated successfully. Accessing the radial artery allows a more direct route to the lesion than the traditional venous route that may require crossing difûcult angles and kinks to reach a juxta-anastomotic lesion.

Conclusion:

Retrograde transradial approach is safe and effective to treat malfunctioning hemodialyhsis access. It allows visualization as well as treatment of stenosis or occlusion of arterial and venous limbs in a single puncture. The procedure is easy to learn having very few complications.

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Original Article

In-hospital Outcome of Percutaneous Coronary Intervention among Very Elderly Patients with Ischemic Heart Disease in a Dedicated Cardiac Hospital

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Abstract:

Background: **Cardiovascular disease, and ischemic heart disease (IHD), is a major cause of morbidity and mortality in the very elderly patients (>80 years) worldwide. These patients represent a rapidly growing cohort presenting for percutaneous coronary intervention (PCI), now constituting more than one in five patients treated with PCI in real-world practice. Furthermore, they often have greater ischemic burden than their younger counterparts, suggesting that they have greater scope of benefit from coronary revascularization therapy. The elderly usually has higher prevalence of co morbidities and more often experience complications during and after revascularization procedures. Our aim was to evaluate clinical outcomes of PCI in patients older than 80 years, compared to their younger counterparts.**

Materials and methods: **From July 2017 to July 2018 we included 212 patients with IHD purposively in Cardiology department of National Institute of Cardiovascular Diseases undergone PCI who were divided into 2 groups according to age: e" 80 years (n = 74) and < 80 years (n = 138). Baseline clinical characteristics, indications for coronary intervention, in hospital outcomes were obtained. Study endpoint were Renal impairment, MI, LVF, emergency revascularization and death.**

Results: **Very elderly patients were more frequently male (86%) and nonsmoker at present (41% vs. 63%, p=0.003), had higher prevalence of hypertension (60% vs. 50%, p<0.13), and more often presented with NSTEMI (54% vs. 23%, p<0.001). Elderly group had higher incidence of TVD and LM disease (36% vs. 26% and 9.5% vs. 2.9%, p=0.07) and more incidence of ostial (16.2% vs.5.1%,p=0.007) and calcified lesions (31.1% vs. 14.5%, p=0.004). Procedural success (TIMI III) were high in both groups, but still lower in the elderly as compared to younger group (95% vs. 97%, p=0.65). Very elderly patients had higher incidence of post PCI bleeding, CIN, MI, LVF and death (9.5% vs.6.1%, 8.2% vs.3.7%, 6.8% vs.5.8%, 9.5% vs. 5.1% and 5.4%vs.3.6%,p=0.07), whereas emergency revascularization were higher in younger group (5.4% vs. 6.5%, p=0.07).**

Conclusion: **Very elderly patients aged ≥80 years face more vascular site complications during PCI, usually have more LM and TVD with more ostial and calcified lesions in comparison with younger group. Though procedural success is similar with younger group, they face more post PCI CIN, LVF and MI. Repeat revascularization was higher in younger group.**

Key words: Outcome of PCI, Very elderly patients, Ischemic Heart Disease

(Bangladesh Heart Journal 2020; 35(1): 61-65)

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DOI: https://doi.org/10.3329/bhj.v35i1.49144

Introduction:

Population ageing is a major public health issue in developing countries. Aging is an independent major risk factor of ischemic heart disease. Coronary artery disease is a leading cause of mortality and morbidity in very elderly patients.[1] Morbidity and mortality from ischemic heart disease are strongly associated with age, especially for people over 80 years old (very elderly patients). Elderly patients usually have comorbidities such as chronic kidney disease, hypertension, and diabetes mellitus.[2,3] They are more likely to have tortuous vasculature, arterial calcification, and complex coronary lesions .[4,5] Hence, percutaneous coronary intervention (PCI) for the elderly is always challenging.

In-hospital mortality among very elderly aged e"80 years or very elderly patients after PCI was reported to be up to 4.1% in 2007.[5] The rates were 3.8% in the National Cardiovascular Network data (1994-1997)6 and 3.8% in the American College of Cardiology/National Cardiovascular Data Registry (1998-2000),[6] indicating a 4-fold increase in risk. PCI environments such as expert cardiac catheterization laboratories, transradial access, and drug-eluting stent are generally believed to be able to improve the outcome of PCI in this patient group.[7,8] However, the safety and efficacy of PCI in very elderly patients remain controversial.[9,10] therefore, the objective of this study was to observe the clinical outcomes of multivessel coronary intervention in very elderly patients hospitalized for acute coronary syndrome and compared to that with younger counterparts

Materials and methods

From July 2017 to July 2018 we included 212 patients purposively with IHD undergoing Coronary angiogram followed by Percutaneous coronary intervention where indicated in Cardiology department of National Institute of Cardiovascular Diseases. Study populations were divided into 2 groups according to age; e" 80 years (n = 74) were in group I and < 80 years (n = 138) were in group II. Baseline clinical characteristics including age, sex, risk factors of coronary artery diseases (Hypertension, Diabetes Mellitus, Dyslipidemia and Smoking), indications for coronary intervention (Chronic stable angina, unstable angina, Non STEMI, STEMI), Angiographic findings, in hospital outcomes were evaluated. All patients received a heparin bolus (5000–10000 IU). Routine antiplatelets treatment included long term Aspirin, and Clopidogrel for at least one year or preferably lifelong. Study endpoint was in-hospital outcome such as Vascular site complication (bleeding that requires transfusion, retroperitoneal hemorrhage and nonhemorrhagic complications such as pseudoaneurysm, arteriovenous fistula, arterial dissection, thrombosis and limb ischemia), Contrast induced nephropathy(Elevation of serum creatinine of more than 25% or e"0.5 mg/dl from baseline within 48 h), Myocardial infarction, left ventricular failure, emergency revascularization and Death) & 1 year follow up for Myocardial infarction, Repeat revascularization and death.

Data obtained from the study were analyzed and significance of differences were estimated by using statistical methods. Variables were analyzed by chi-square test and t-test where applicable. P value P<0.05 were considered as significant. Statistical analyses were performed with SPSS, version 16.0 (SPSS Inc).

Results and discussion

Study population were divided into two groups. 74 patients were in group I aged e" 80 years and (138 patients were in group II aged <80 years. Mean age was 83.65±4.53 years for group I and 56.44±9.67 years for group II. Male were significantly higher among very elderly (86.5% vs.73.9%, p=0.03). Among the risk factors diabetes mellitus and dyslipidemia were significantly higher in very elderly (62.2% vs.37.7% for diabetes, p=0.001 and 60.8% vs 50.6% for dyslipidemia, p= 0.001), whereas Current smoking were significantly higher in younger group (41.9% vs.63.0%, p= 0.003).

Among the population of group I and groups II STEMI, NSTEMI, UA and CSA were 12 (16.2%) vs. 24 (17.4%), 40 (54.1%) vs. 32 (23.2%), 12 (16.2%) vs. 44 (31.9%) and 10 (13.5%) vs. 38 (27.5%) respectively. NSTEMI was significantly higher among very elderly patients whereas STEMI, UA, CSA were significantly higher in younger group (p= 0.001). Echocardiographic findings showed left ventricular ejection fraction (LVEF) were significantly higher in very elderly patients (16.2% vs. 6.5%, p= 0.024) (Table I).

Coronary angiogram of study population (Table II) showed triple vessel disease(TVD)(36.1% vs. 26.1%) and left main disease(LMD) (9.5% vs. 2.9%) were more in very elderly patients whereas SVD and DVD were more in younger group, although the differences were not statistically significant (p=0.70). On the other hand, ostial (16.2% vs. 2.9%, p=0.007) and calcified (31.1% vs. 14.5%, 0.004) lesions were significantly higher in very elderly patients.

Study of in-hospital outcomes (Table III) showed vascular site complications were significantly higher in very elderly patients (9.5% vs. 6.1%, p= 0.031). Post PCI MI (6.8% vs.5.8%), LVF (9.5% vs. 5.1%), CIN (8.2% vs.3.6%) and

Table-I

Baseline characteristics of study population

Variables	Age ≥80 years(n= 74)	Age < 80 years(n=138)	P value
Mean age (years)	83.65±4.53	56.44±9.67	
Male	64 (86.5%)	102 (73.9%)	0.03
Hypertension	45 (60.8%)	69 (50.6%)	0.132
Diabetes mellitus	46 (62.2%)	52 (37.7%)	0.001
Dyslipidemia	42 (56.8%)	73 (52.9%)	0.31
Current smoking	31 (41.9%)	87 (63.0%)	0.003
Diagnosis			
ST elevation MI	12 (16.2%)	24 (17.4%)	<0.001
Non ST elevation MI	40 (54.1%)	32 (23.2%)	
Unstable angina	12 (16.2%)	44 (31.9%)	
Chronic stable angina	10 (13.5%)	38 (27.5%)	
Echocardiographic finding			
LV EF <50%	12 (16.2%)	9 (6.5%)	0.024

Table-II

Angiographic findings of study population

Variables	Age ≥80 years(n= 74)	Age < 80 years(n=138)	P value
Single vessel disease	21 (28.4%)	50 (36.2%)	0.70
Double vessel disease	19 (25.4%)	48 (34.8%)	
Triple vessel disease	27 (36.1%)	36 (26.1%)	
Left main disease	7 (9.5%)	4 (2.9%)	
Lesion Characteristics			
Ostial	12 (16.2%)	7 (5.1%)	0.007
Calcified	23 (31.1%)	20 (14.5%)	0.004

Table-III

In-hospital outcome

Variables	Age ≥80 years(n= 74)	Age < 80 years(n=138)	P value
Vascular site complication	10 (9.5%)	7 (6.1%)	0.031
Post PCI infarction	5(6.8%)	8 (5.8%)	0.07
Post PCI LV failure	7 (9.5%)	7 (5.1%)	
Emergency revascularization	4 (5.4%)	9 (6.5%)	
Death	4 (5.4%)	5 (3.6%)	
Contrast nephropathy	8 (8.2%)	5 (3.6%)	
TIMI III	73 (95.6%)	137(97.3%)	

death (5.4% vs. 3.6%) were numerically (p= 0.07) higher in very elderly patients whereas post PCI TIMI III flow (95.6% vs.97.3%) and emergency revascularization were higher in younger group.

Discussion:

Some previous studies have compared the outcomes of PCI in patients with different ages and found that adverse events are increased with age and severity of the disease.[11,12] Therefore, physicians are often reluctant to treat elderly patients aggressively. Elderly patients are usually referred late for revascularization. In addition, PCI in very elderly patients is often performed to relieve symptoms rather than for complete revascularization, although they have more extensive coronary disease than their younger counterparts.[13] In addition, the elderly do

not receive proper diagnosis or treatment in a timely manner for a number of reasons, including economic conditions.[14] Therefore, coronary disease in the elderly is more progressive, and the prognosis of PCI in the elderly is usually poor than that of their younger counterparts.

Our results revealed that very elderly patients undergoing PCI due to ACS were mostly hypertensive male, and usually present with NSTEMI and poor LV function. They face more bleeding and vascular site complications during PCI, usually have more LM and TVD with more ostial and calcified lesions in comparison to younger group. Though procedural success is similar with younger group, very elderly patients undergo more post PCI bleeding, CIN, LVF and MI. Repeat revascularization was higher in younger group.

The clinical characteristics were not significantly different between the two groups. The incidence of major complications that would increase the mortality was not significantly different between the two groups. Despite of the high risk factor with old age, previous reports on invasive treatment in the elderly with coronary artery disease have shown that PCI results in the elderly are not inferior compared to PCI in younger patients.[15]

The APPROACH (Alberta Provincial Project for Outcomes Assessment in Coronary Heart Disease) Registry has demonstrated long-term survival benefit in very elderly patients with coronary artery disease who are treated with either surgical or percutaneous revascularization compared to those who are treated with medical therapy.[16] Thrombolysis in Myocardial infarction (TIMI) trial has also demonstrated that invasive strategy can provide early symptom relief and better quality of life compared to those who receive optimal medical treatment (Reference).[17]In patients aged >80 years with acute coronary syndrome, early PCI has been shown to be able to achieve better outcomes than medical treatment alone.[17-19] In the era of drug eluting stent (DES), Hassani et al.[20] have demonstrated a low mortality rate in very elderly patients with stable angina (4.1%) at 6 months.

Some studies have found that mortality rates in acute coronary syndrome (15%) and ST elevation in myocardial infarction 31%) among very elderly patients remained significantly high.[21] Meanwhile, other studies have shown that mortality and incidence of major complications after PCI in very elderly patients with acute coronary syndrome are not higher than those in their younger counterparts.[22]

Conclusion:

Very elderly patients undergoing PCI due to ACS are mostly hypertensive male, usually present with NSTEMI and poor LV function. They face more bleeding and vascular site complications during PCI, usually have more LM and TVD with more ostial and calcified lesions in comparison with younger group. Though procedural success is similar with younger group, very elderly patients experience more post PCI bleeding, CIN, LVF and MI. Emergency repeat revascularization was higher in younger group. Although immediate interventional procedure related complications are more in very elderly patients, long term outcomes seem to be promising & comparable with younger counterparts. As it is a single center, non-randomized, small sample study further studies into the optimal pharmacologic and interventional ACS management strategies in very elderly patients are warranted.

Limitations

This study was conducted in Cardiology department of National Institute of cardiovascular diseases which was a single center study. In this study small numbers of subjects were included fulfilling pre-defined inclusion and exclusion criteria. Sampling method was purposive and follow up time was short.

Conflict of Interest - None.

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Case Report

Successful Management of a Giant Mycotic Coronary Artery Aneurysm Develeped after Multivessel PCI with Drug-Eluting Stent

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Abstract:

Coronary artery stent infection has been reported with both bare metal stent and drug eluting stent and can present as mycotic coronary artery aneurysm, pseudoaneurysm. myocardial abscess, pericarditis or exudative effusion. Infection at the site of coronary stent implantation is rare and is believed to result typically from either direct stent contamination at the time of delivery or transient bacteraemia from access site. Recently, several case reports of pseudoaneurysm formation after DES implantation have been reported in the literature. We describe the successful surgical management of giant mycotic pseudoaneurysm of RCA presenting as fever of unknown origin with AMI (inferior) three months after multivessel PCI in LAD & RCA with DES in radial route. This report illustrates the importance of early detection and prompt management of these rare coronary pseudoaneurysms, which is a highly lethal condition. At three months follow-up after surgery, the patient was asymptomatic with fair LVEF 58% .

Keyword: Mycotic aneurysm, Coronary artery, Percutaneous coronary intervention

(Bangladesh Heart Journal 2020; 35(1): 66-70)

Introduction:

One of the rare complications of DES is coronary artery aneurysm. Coronary Artery Aneurysm (CAA), defined as localized dilatation of the coronary artery exceeding 50% of the reference vessel diameter is considered as very rare, with a reported incidence of 0.3-6% after percutaneous coronary intervention[1]. It is termed as giant if diameter exceeds the reference vessel diameter by four times or if the aneurysm is 8 mm or more[2]. Possible mechanisms of aneurysm formation after DES implantation apart from infection are delayed re-endothelialization, inflammation, and hypersensitivity reactions, deep arterial wall injury (rupture or resection of the vessel media), and residual dissection[3,4]. Treatment of CAA is somewhat controversial, and there is no consensus on the modality of treatment in a given clinical situation. We report a case of giant CAA after DES implantation presenting with low grade fever followed by acute myocardial infarction which was treated by surgically.

Case Report:

A 57-year-old diabetic normotensive male presented with stable angina (CCS class-II). ECG was normal.Left ventricular ejection fraction was normal (LVEF-62%). ETT was positive. We did radial coronary angiogram & diagnosed a case of DVD, 85% stenosis in the proximal LAD & 90% stenosis in mid RCA. He underwent percutaneous coronary intervention (PCI) and stenting to left anterior desending (LAD) & right coronary artery (RCA) using Everolimus Eluting Stent (Promus Eliment Plus, Boston Scientific) in our hospital three months prior to this episode. Two weeks after stenting he came back

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DOI: https://doi.org/10.3329/bhj.v35i1.49145

with low grade fever with anorexia. ESR was 80 mm 1st hr. TC was 11000/ cmm with predominant Neutriphillia (N-70%) but blood culture was sterile.Empirical antibiotics (intravenous Meropenum) given for two weeks. Fever subsides but after two months he came back withsevere retrosternal chest pain of 6 hours duration. On general examination, the patient was restless with sweating. His pulse rate was 90/ min, regular, low volume; with blood pressure of 100/60 mm Hg. Examination of cardiovascular system did not reveal any specific findings except muffle heart sounds. 12-lead electrocardiogram showed sinus inferior ST-elevation myocardial infarction (3 mm ST elevation in lead II, III, and AVF). Cardiac bio-marker was elevated (Troponin-I=35 ng/ml). Echocardiogram revealed inferior and posterior hypokinaesia, mild mitral regurgitation, and mild left ventricular dysfunction (LVEF-50%). At this stage, probable clinical diagnosis was early (sub-acute) stent thrombosis. So, it was decided to subject him for coronary angiogram with the intention to do primary PCI. After informed consent, coronary angiogram was done from right femoral route which revealed patent stent in left anterior descending coronary artery(LAD) (Fig-4). Right coronary injection revealed opening of the mid right coronary artery into a large spherical cavity (30x26 mm in diameter) that filled with contrast medium in a swirling fashion with slow opacification without visualization of the distal artery.(Fig-1,2). RCA stent was distorted by pressure of the aneurysm from its mid part (Fig-3).

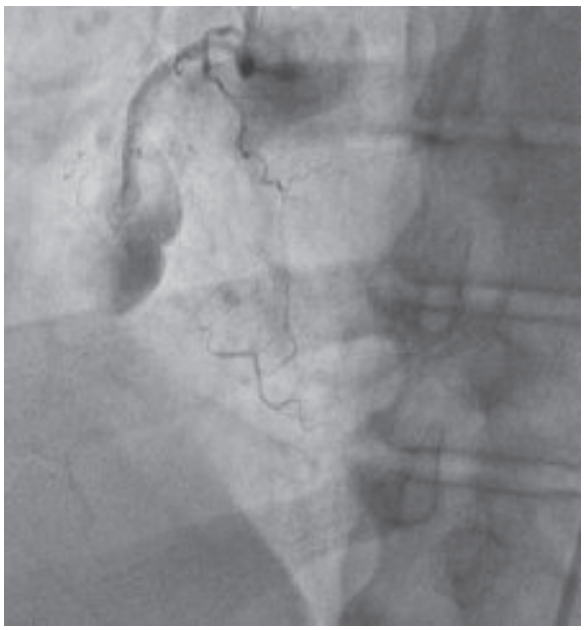

Fig.-1: *Right coronary angiogram showing a giant coronary aneurysm.*

The patient underwent aneurysmectomy with ligation of proximal RCA with RSVG to distal RCA grafting. Intraoperative findings included extensive 5 cm aneurysm of the RCA (Fig. 5). The aneurysm was cleaned of the thrombus in which the stent was also found (Fig. 6). The thrombus and necrotic material was sent for culture and sensitivity. The narrow neck of the pseudoaneurysm was formed by proximal RCA. RCA opening in pseudoaneurysm was closed by pledgeted

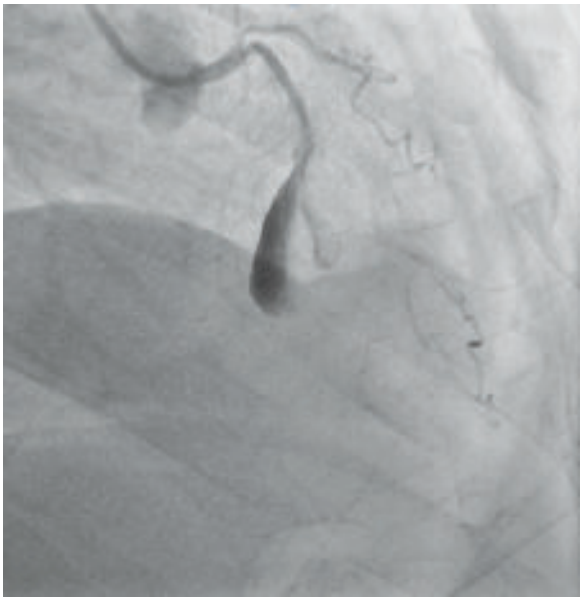

Fig.-2: *A large spherical cavity (50x25 mm in diameter) that filled with contrast medium in a swirling fashion with slow opacification without visualization of the distal artery.*

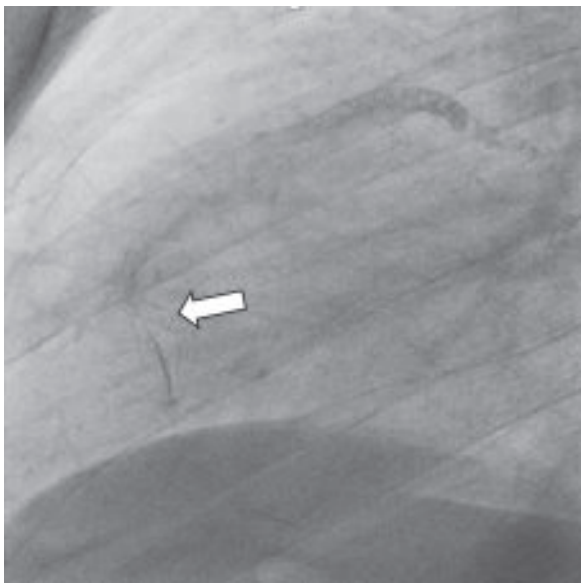

Fig.-3 : *RCA Stent is distorted by aneurysm.*

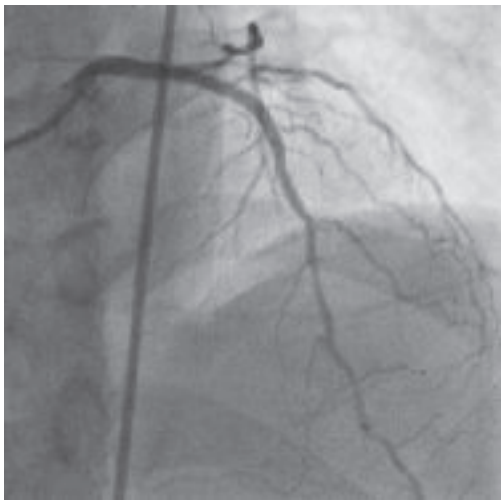

Fig.-4: *Patent stent in LAD*

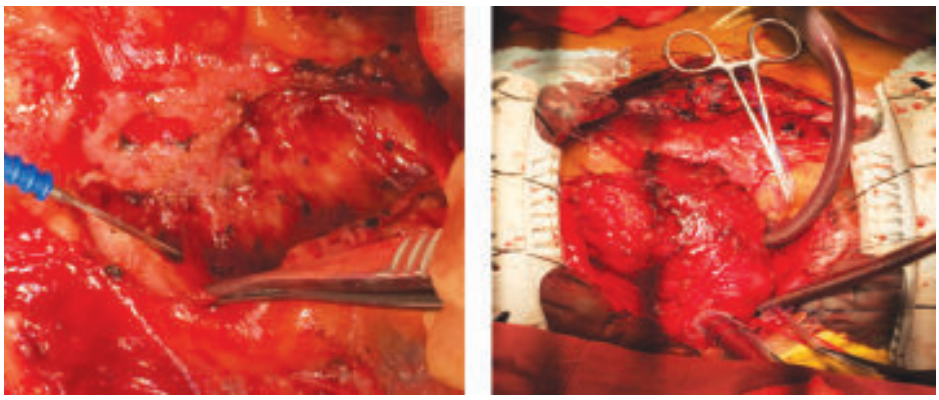

Fig.-4: *Patent stent in LAD*

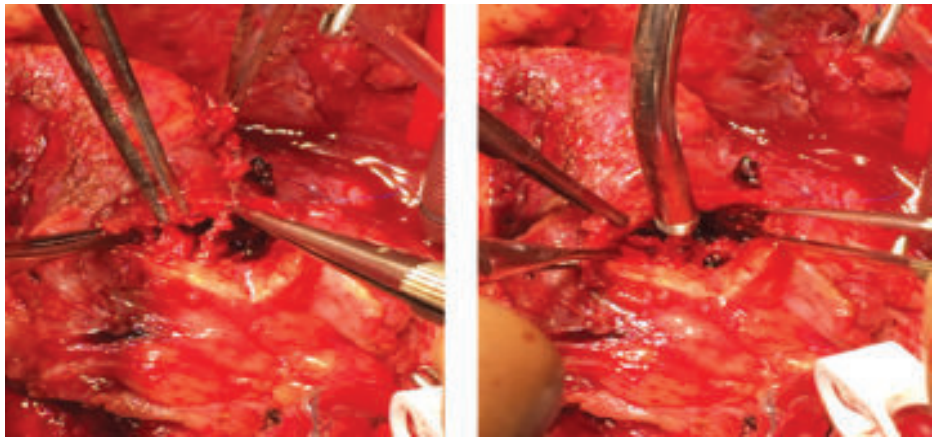

Fig.-6: *During aneurysmectomy removal of stent.*

sutures. All necrotic tissue was excised, a reverse-saphenous vein graft (rSVG) to the Distal RCA was grafted. The resected aneurysm wall was sent to pathology for further analysis. The operation was otherwise uneventful.

On postoperative day (POD) 1, the patient was extubated. The culture report of the aneurysm material showed pseudomonas infection which was sensitive to most antibiotics, including the ones he was already on.

Discussion:

The development of a mycotic coronary aneurysm is a rare entity being first reported by Bougon in 1812.[5,6] The majority of coronary pseudoaneurysms occur in the setting of atherosclerosis with congenital aneurysms, vasculitis (*e.g.*, Kawasaki syndrome) and connective tissue disorders.[5,6,7] A distinct occurrence is a mycotic coronary pseudoaneurysm (MCA) post-percutaneous coronary intervention (0.3–0.6%) with only 19 cases reported in the international literature.[8] Mechanical factors, infection and inflammation are three major contributors reported to lead to the development of mycotic coronary pseudoaneurysms in these cases.[8] The arterial wall injury caused by oversized balloons and stents might be the potential mechanical factors, *Staphylococcus aureus* is the primary infectious agent in the majority of cases. The direct stent contamination at the time of delivery, repeated femoral access and femoral artery sheaths left in place for a long duration may facilitate bacteraemia of *S. aureus*, which is a normal skin commensal.[8] Late stent infection may be caused by drug-eluting stent related local problems like delayed endothelialization of the stent struts, inhibition of neointimal growth, late incomplete healing of any injury, stent apposition, and coronary aneurysm formation.[9,10]Coronary pseudoaneurysms have been reported from 3 days to up to 4 years after DES implantation procedures, with varying clinical presentations.[11,12]

Interestingly, our patient had pseudomonas infection which has also been reported by Chen et al.[8] in 3 of 19 patients as etiological organism.

Potential complications secondary to mycotic coronary aneurysms include rupture, cardiac tamponade, fistulisation, myocardial ischemia or infarction secondary to septic embolization and sudden cardiac death.[9,10]In this case the huge mycotic aneurysm had formed slowly over three months after percutaneous transluminal coronary angioplasty (PTCA) and subsequent pseudomonas bacteraemia from the infected stent.

Coronary ligation with resection appears to offer the most uncomplicated approach, assuming viable target vessels exist for grafting. Proximal RCA was ligated and distal RCA was bypassed with an rSVG. In view of dense adhesions of pericardium to chest wall and active infection in the area, internal mammary artery was not harvested. Without appropriate target vessels, the complexity of such a surgical approach increases significantly.

The unusual nature was because of the huge size, compression to RV with distortion of stent by aneurysm and infection of the aneurysm by pseudomonas in an otherwise healthy 57-year-old male. Given the limited experience with huge RCA aneurysm, clinical management is still evolving, as the majority of reported cases have been documented post-mortem.[5]

As evidenced by this case, clinical scenario correlating findings of paramount importance in the management of these rare coronary aneurysms. Early diagnosis, appropriate antibiotic therapy and prompt surgery remain the mainstay of current therapy.

Conflicts of interest:

No conflict of interest.

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Case Report

A Case of Massive Metoprolol Overdose Successfully Managed

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(Bangladesh Heart Journal 2020; 35(1): 71-73)

Introduction:

Overdoses with cardiovascular drugs are associated with significant morbidity and mortality. Beta-adrenergic blockers is one of the most important classes of cardiovascular drugs. Overdoses with Beta- blockers typically result from exploratory ingestions by children or intentional ingestions by suicidal adults.

Case report:

A 28 years old, non-hypertensive, non-diabetic lady got admitted into Dhaka Medial Hospital with the complaints of allegedly ingested 98 tablets of 50-mg metoprolol succinate followed by decrease level of consciousness. In that hospital her blood pressure and pulse are non-recordable, GCS 8/15 and ECG shows 2:1 AV block (Fig.-1). Immediately patient got gastric lavage and shock was treated with normal saline, then transferred to ICHRI for the better management. In ICHRI her oxygen saturation suddenly fell to 65%, ABG was done which revealed PaO2 42mmHg, bicarbonate 11.8 mmol/L and lactate 11 mmol/L, serum electrolyte analysis showed a

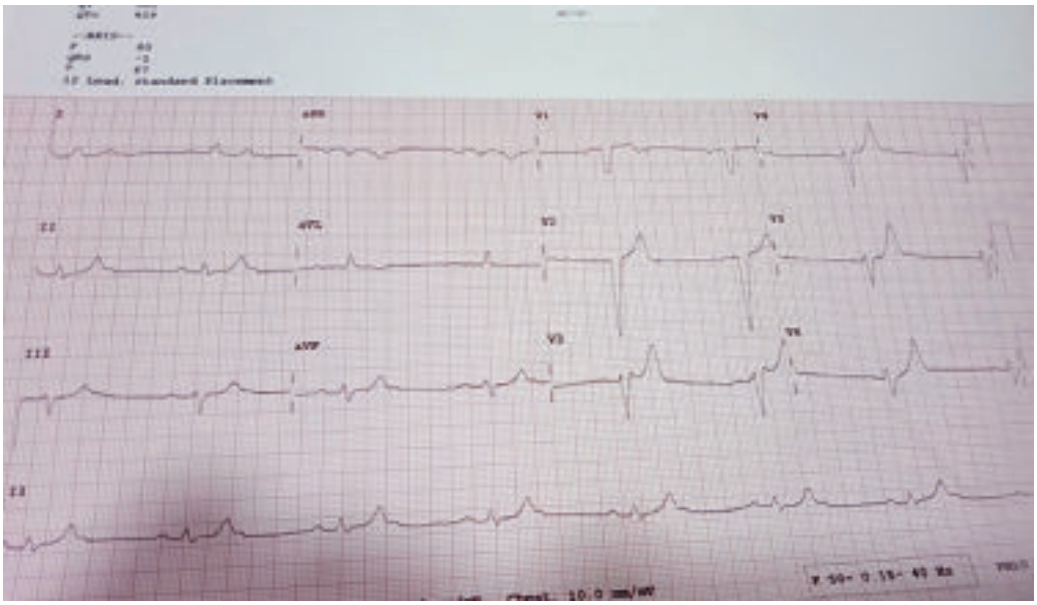

Fig.-1: *12-Lead ECG showing 2:1 AV block.*

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DOI: https://doi.org/10.3329/bhj.v35i1.49147

persisting low potassium level of 2.9 mmol/L. She was intubated and put on mechanical ventilator; transferred to Evercare Hospital Dhaka for multidisciplinary care. After admission, she was diagnosed as the case of Metoprolol overdose, 2:1 AV block, hypotension, aspiration pneumonia, AKI with Electrolyte Imbalance. Immediately Infusion Noradrenalin and Normal Saline were started for hypotension. When Inj. Atropine failed to increase the heart rate, Temporary Pace Maker was done. There were no improvements in BP (90/50 mmHg) and ABG parameters (pH 7.21, bicarbonate 14.4 mmol/L and lactate 10 mmol/L) on the second day of hospital stay despite the above interventions and hypokalemia developed which was corrected with oral potassium chloride 1 g three times daily. These led to the initiation of 2 ampoule IV loading calcium gluconate followed by a daily maintenance dose which the systolic BP subsequently rose to 110 mmHg. On day 3 of admission, high-dose insulin -euglycemia (HIE) treatment was started @ 1 IU /Kg with 25% DA followed by .5 IU/Kg/hr to augment cardiac contractility. Both metabolic and lactic acidosis were resolved by conservative treatment and there was also sign of good tissue perfusion as seen from the patient's urine output rate (more than 1.0 ml/kg/hour). Inj. Diazepam was administered to prevent seizure. She was extubated on Day 4 and her BP was supported solely by IV noradrenaline. Her junctional bradycardia resolved followed by removal of TPM. IV calcium was discontinued on Day 5 with the patient's BP within the range of 125/63 to 134/71 mmHg. The patient was subsequently discharged on Day 7.

Table-I

Metoprolol pharmacologic profiles

Bioavailability	50%
Protein binding	12%
Metabolism	Liver via CYP2D6, CYP3A4
Elimination half-life	3–7 hours
Excretion	Kidney
Adrenergic Receptor Blocking Activity	β1
Lipid Solubility	Moderate
Intrinsic Sympathomimetic Activity	No
Sodium Channel Blocking	No
Threshold Dose	
• Adult	• 400 mg
• Child	• 5 mg/kg
Lowest Reported Toxic Dose·	
Adult	• 7500 mg
• Child	• N/C

Table-II

Clinical Manifestation of overdose:

- Bradycardia
- Hypotension and shock
- Hypoglycemia
- Hypoglycemia
- Hypothermia
- Seizure
- Altered mental status
- QTc prolongation
- QRS widening

Discussion:

Metoprolol selectively antagonize â 1-adrenergic receptors that are linked to G proteins. Beta-1 receptors primarily regulate myocardial tissue and affect the rate of contraction via impulse conduction. In an overdose situation, receptor selectivity is lost, and effects not normally seen at therapeutic doses can occur. (1) In addition, some â-blockers may antagonize cardiac sodium channels, producing quinidine-like effects that will increase toxicity in overdose. An important determinant of adverse effects with â-blockers is lipid solubility. Highly lipophilic agents can cross the blood–brain barrier which result in unwanted central nervous system (CNS) effects. Table 1 and 2 displays Metoprolol's pharmacologic profiles (2) and clinical manifestation of overdose subsequently (1).

Due to intrinsic lipophilicity, beta blockers may cause CNS depression. Prompt management of airway is, therefore crucial. Gastrointestinal decontamination with gastric lavage may be necessary for patients who present shortly after massive ingestions and/or with serious symptoms. Administer activated charcoal to limit drug absorption to patients with minor symptoms who present later than an hour after ingestion. Benzodiazepines are the first line of treatment for seizures that may occur due to high lipophilicity of certain beta blockers. Administer sodium bicarbonate for QRS widening and magnesium sulfate for QTc prolongation. Although there have been no controlled trials, glucagon is considered as a first treatment of choice in poisoning beta-blocker overdose. Premedication with antiemetic may be considered since treatment with glucagon may induce vomiting.

Epinephrine & Norepinephrine are the first line medications for hypotension, other options are fluid, Isoprinosine and Dopamine. Treatment with calcium salts may provide benefit for hypotensive patients who

overdosed. High-dose insulin with euglycemia is a safe and simple way to augment cardiac contractility and does not need invasive monitoring[3]. High-dose insulin with euglycemia can cause profound hypokalemia and hypoglycemia that can potentiate the cardiotoxicity. So Potassium and glucose should, therefore, be checked before initiation of high-dose insulin.

IV Atropine and TPM can be done in case of symptomatic Bradycardia. Now a days Intralipid emulsion also can be given @ 1.5 ml/Kg bolus as a binding agent. Hemodialysis is no help in case of Metoprolol overdose because it's not a water soluble drug.

Conclusion:

The outcomes after Metoprolol depend on when the patient presents and the amount ingested. Overall, this lipid soluble beta blockers are more toxic than the water-soluble agents because of their quinidine-like effects. Individuals with underlying heart and lung disease are most susceptible to the toxic effects. Poisoning by â-blockers usually produces hypotension and bradycardia, which may be refractory to standard resuscitation measures. When symptomatic bradycardia and hypotension are present, high-dose glucagon is considered the first-line antidote. Calcium salts improve BP albeit in a short-lived manner[4] via positive inotropic effects[5]. Over the years, the numbers of beta blocker associated toxicity have slightly increased, but the fatalities have decreased because of prompt diagnosis and treatment. When patients present with suspected beta-blocker toxicity, the patients should be admitted to the ICU. Any patient with an intentional overdose should be referred to a mental health counselor prior to discharge.

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Case Report

Tetralogy of Fallot with Absent Pulmonary Valve Syndrome with Absent Left Pulmonary Artery - A Rare Presentation

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Abstract::

Absent left pulmonary artery with Tetralogy of Fallot (TOF) with absent pulmonary valve syndrome (APVS), is a rare congenital cardiac anomaly. Here we present such a case of A 2 year 11 month old girl with cyanosis, exertional dyspnoea. Her diagnosis is confirmed by echocardiography and CT angiogram. There are very few cases have been reported till date with high post-operative mortality. Although per operative decision making was challenging regarding pulmonary valve and size of the RPA, we performed ICR with RPA reductionplasty and creation of monocuspid pulmonary valve with success. As it is a rare association and we have overcome the hindrance we came across per operatively, we are reporting this case.

Keyword: Tetralogy of Fallot, Absent Left pulmonary artery, absent pulmonary valve syndrome.

(Bangladesh Heart Journal 2020; 35(1): 74-77)

Introduction:

Absent pulmonary valve syndrome (APVS) is an uncommon form of congenital heart disease. It occurs in 2.4% to 6.3% of patients with tetralogy of Fallot (TOF).[1–3] The primary symptoms are recurrent wheezing and dyspnea, which occur due to compression of the bronchi and trachea by aneurysmal pulmonary arteries. This syndrome was first reported in 1830.[4,5] APVS may occur alone or in association with other forms of congenital heart disease, particularly TOF.[6,7] Absence of the pulmonary artery in association with an absent pulmonary valve is an extremely rare scenario. [5] McCaughan et al.[8] found a 14.3% incidence of true (complete) absence left pulmonary artery (ALPA) in a group of 35 patients with APVS. We have presented one patient with TOF and APVS with true (complete) absence of the left pulmonary artery.

Case report:

2 Yrs 11 Months old a pretty girl who is the only child of her non consanguinal parent came to our hospital with a diagnosed case of congenital heart disease and presented with complaints of bluish discoloration of skin & palpitation. She was cyanosed and dyspnic. NYHA class-II, no clubbing, and oxygen saturation at room air was 86%, heart rate 120beats/min. She had systolic murmur at the middle of left sternal border. Chest bilaterally Clear.

Echocardiography revealed Tetralogy of Fallot dysplastic pulmonary valve with severe PS with moderate to severe PR Hugely dilated MPA & absent LPA Left aortic arch Good biventricular function.

CT angiography of heart and great vessel show situs solitus levocardia. Pulmonary infundibulum severely

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DOI: https://doi.org/10.3329/bhj.v35i1.49148

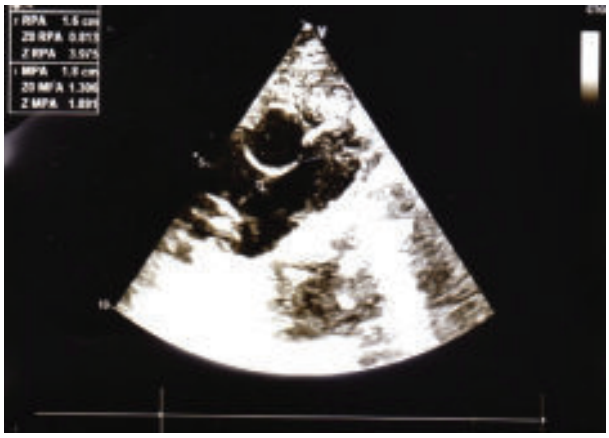

Fig.-1: *Absent LPA, dilated RPA, dysplastic PV*

stenosed with absent pulmonary valve, left pulmonary artery. Hugely dilated right pulmonary artery. Peri-membranous type of Ventricular septal defect. Bovine type of aortic arch. Aberrant origin of right sub-clavian artery. Hypertrophied right ventricle.

McGoon Ratio 3.54 Nakata Index 1293 mm^2/BS. With proper counseling with her parent we planned for intra cardiac repair.

Routine induction of General Anesthesia and placement of monitoring lines. Standard median sternotomy done. Thymus dissected off. Pericardium harvested. Systemic heparinization (300 U/kg) and aorto-bicaval canulation established. CPB temperatur cooled to 28^0C. Aorta cross-clamped and heart arrested with cold Del Nido cardioplegia delivered antegradely through the aortic root. Cavae snared . LV vented through RA.

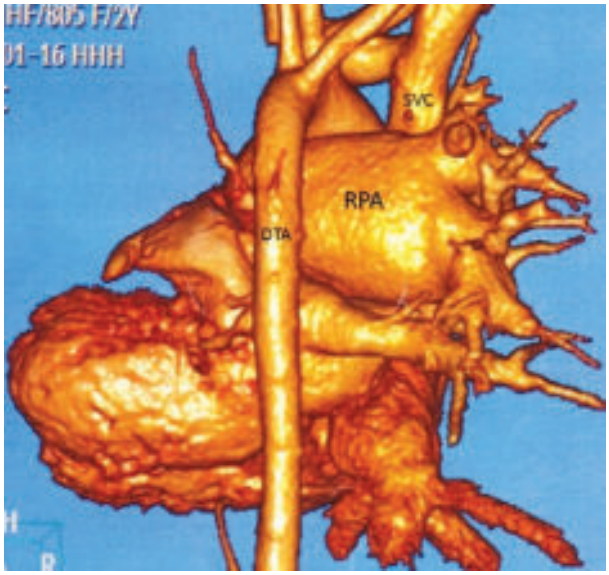

Fig.-2: *Absent LPA*

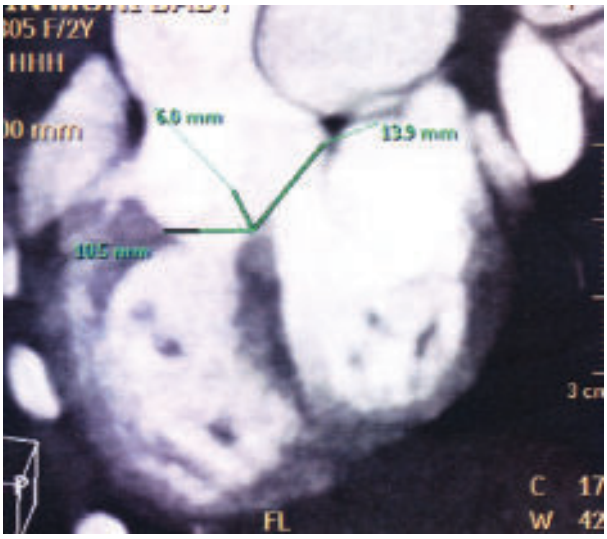

Fig.-3: *large VSD, aortic overriding*

PA tomy & Right ventricular outflow tract tomy done. VSD repair with Dacron patch. Hypertrophied bands of RVOT excised through RVOT. RPA reduction plasty done at posterior & anterior wall. Augmentation of RVOT & MPA by transannular patch of pericardium with creation of PTFE monoleaflet PV. Fenestration was kept in IAS. Rewarming started. Deairing the heart done. Cross clamp released. RA closure with 6-0 prolene. Patient weaned off CPB with NSR. Postoperative PA pressure was high. We allow the high PA pressure and give protamine. Decannulation done. 2 pacing wire attached with RV, 2 with RA. Chest closure done in layers keeping 02 mediastinal and right pleural drain in situ. She was shifted to ICU with stable hemodynamics and on inotrope (Dobutamine and milrinone) support.

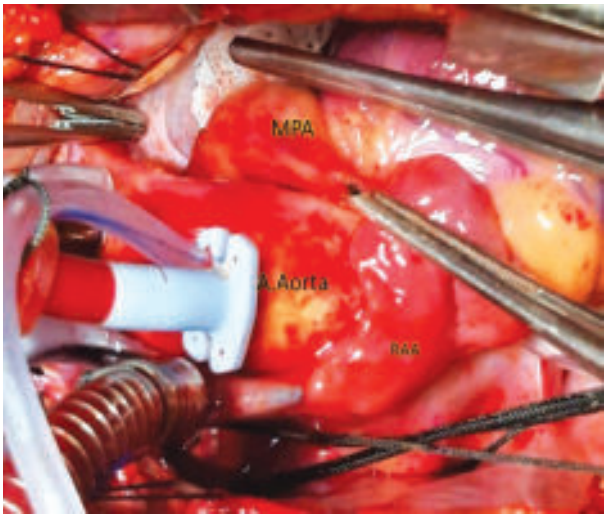

Fig.-4: *Absent LPA*

Her ICU stay was a bit stormy initially but she recovered well. She was extubated on 2nd POD total ventilation time was 45 hrs 30 min.

She was shifted to ward on 6th POD and discharged from hospital on 9th POD. She was doing well on her first follow up one month after discharge.

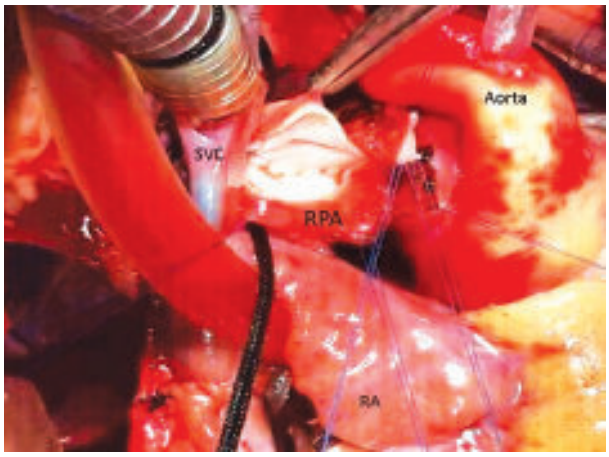

Fig.-5: *posterior wall of the RPA sutured for reduction*

Discussion:

APVS is a rare congenital cardiac malformation characterized by a rudimentary or dysplastic pulmonary valve and the aneurysmal dilatation of the main pulmonary artery and one or both of its proximalbranches.[9]Pulmonary regurgitation plays an important role in the expansion of the main pulmonary artery and its proximal branches. Turbulence due to severe pulmonary regurgitation at the narrow pulmonary annulus and poststenotic dilatation result in expansion of the pulmonary arteries.[10] Pulmonary expansion results from increased pulse pressure in the pulmonary artery due to pulmonary regurgitation, as well as increased RV stroke volume and increased blood volume in the RV during diastole and subsequent turbulence at the stenotic pulmonary annulus, followed by post-stenotic dilatation. [10] These findings are supported by the subsequent decrease in pulmonary artery diameter following surgery for pulmonary regurgitation.[11] APVS patients are separated into two groups based on their ages and clinical courses: The patients in the first group are newborn babies or infants who present with dyspnea, recurrent lung infections, pulmonary emphysema, and atelectasis as a result of compression of bronchi secondary to pulmonary artery dilatation. The second group includes older patients with mild symptoms who survive infancy. For these patients, closure of their VSD and relief of their pulmonary stenosis may be performed later on an elective basis with minimal risk.[12,13] Absent pulmonary valve with true (complete) absence of the left pulmonary artery represents an extremely rare combination in TOF. The absence of the left pulmonary artery is believed to be the result of a continued link between the fetal ductus arteriosus and the intrapulmonary aspect of the pulmonary artery during the in utero phase, as well as the involution of the 6th aortic arch (the extrapulmonary portion of pulmonary artery). Severe hypoplasia occurs in the pulmonary artery due to closure of the ductus after birth.[14] Surgical correction of APVS is both extremely challenging and controversial.[3] The types of surgical correction used have evolved over time and should be individualized based on the patient's age and clinical symptoms. In a literature review by Calder et al.,[5] 13.3% to 40% mortality rate was reported following total corrective surgery involving patients in all age groups. The operative mortality may be as high as 58.3% in symptomatic infants.[8] Patients with minimal symptoms often present later in life and have a relatively low risk of mortality (5%) with elective surgery.[24]

Surgical correction of APVS is even more challenging when the former is associated with ALPA because it is associated with a higher mortality rate. Total correction is possible without reconstruction of the pulmonary valve, but the long-term results of this procedure are unknown.[3] McCaughan et al.[8] recommend valve insertion in all patients with APVS and ALPA. While the unilateral absence of the pulmonary artery will ameliorate the development of pulmonary hypertension, it may also worsen pulmonary regurgitation and right ventricular dysfunction.

Conclusion:

Cases of APVS and TOF with unilateral absence of the pulmonary artery are very rare and have high mortality rates. Per operative decision making also crucial regarding size of the RPA, competency of pulmonary valve and early development of pulmonary hypertension because all are contribute to the good post-operative outcome.

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