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Nepalese Heart Journal (NHJ) is a biannual, peer-reviewed, open-access, international medical journal. NHJ publishes original research and critical reviews dealing with all disciplines of cardiovascular medicine. It is the official journal of the Cardiac Society of Nepal and is published twice a year (May and November). Each issue of NHJ publishes original articles, review articles, case reports, editorials and letters to the editor. Invited articles, editorials and review of selected topics will be published from time to time. Authors do not have to pay for the submission, processing or publication of articles in NHJ.

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This journal provides immediate open access to its content on the principle that making research freely available to the public supports a greater global exchange of knowledge.

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Editorial

Nepalese Heart Journal 2025; Vol 22(1), 1-2

Plagiarism and Artificial Intelligence: Balancing Innovation with Academic Integrity

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Introduction

Currently, the intersection of artificial intelligence (AI) and plagiarism has become a pressing issue in academia, journalism, and creative fields. This convergence raises important questions about authorship, originality, and the ethical considerations surrounding the use of technology for content generation. The rapid evolution of AI tools invites profound reflection on how these technologies can affect integrity and creativity in the production of academic and creative works. Some individuals argue that using AI is advantageous, particularly for non-native speakers, while others contend that it may lead to scientific misconduct. Therefore, striking the right balance between innovation and upholding academic integrity is essential at this time.

Understanding Plagiarism

Plagiarism is defined as the unauthorized use of someone else's work, ideas, or expressions without giving appropriate credit, thereby presenting them as one's own.[1] The World Association of Medical Editors (WAME) defines plagiarism as "the use of others' published and unpublished ideas or words (or other intellectual property) without attribution or permission, and presenting them as new and original rather than derived from an existing source.".

The Committee on Publication Ethics (COPE) has categorized various levels of plagiarism, which may occur in several forms, including direct plagiarism, mosaic plagiarism, self-plagiarism, and improper paraphrasing. Such actions can result in consequences ranging from manuscript rejection to the retraction of published works in severe cases.[2]

Various tools have been developed to address the issue of plagiarism, which poses significant challenges to academic integrity and the originality of scholarly work. Among these tools, software programs such as iThenticate and Turnitin have gained prominence, becoming essential resources for educational institutions and academic journals alike.

The emergence of AI-generated content complicates our definition of plagiarism, challenging traditional notions of originality and ownership. As AI tools become more sophisticated, the line between original creation and the use of technology for writing assistance becomes increasingly blurred.

The Impact of AI on Content Creation

Artificial intelligence technologies have profoundly transformed how content is created. Tools such as AI chatbots and automatic text generators have facilitated the generation of ideas and the drafting of complete texts. These tools help in improving grammatical accuracy, coherence, and writing styles. This accessibility has led many to rely on these technologies not just as assistants but as primary sources of content. However, this dependence can obscure the line between authentic creation and simple access to preexisting formulations. Educational institutions must clearly define how to use these tools ethically so that they do not become pathways to unintentional or intentional plagiarism.

Navigating Plagiarism in the Age of AI

One key criterion for authorship is accountability for every aspect of the work. Therefore, chatbots cannot be listed as authors since they cannot be held responsible for the accuracy, integrity, and originality of the work.[3] As we navigate the complexities of plagiarism related to AI, it is essential to strike a balance between embracing technological advancements and upholding principles of intellectual integrity. Content generation should integrate technology while honoring individual creativity and effort.

It is crucial to cultivate a culture that values original thought and creativity in both academic and creative endeavors while recognizing the potential benefits of AI as a tool for inspiration and enhancement. For instance, peer review processes and rigorous evaluations can help validate the originality and quality of work produced with AI assistance.

Strategies for Avoiding Plagiarism While Using AI

To use AI responsibly, it is crucial to approach these tools as sources of inspiration and assistance rather than presenting AI-generated texts as original creations. Education serves as the foundation for improving research quality and should include training on how to ethically leverage AI tools.

Many scientific journals have reached a general agreement on the importance of reporting the use of generative artificial intelligence. Consequently, many have begun implementing guidelines to enhance transparency in the use and reporting of this technology(4). The International Journal Committee of Medical Editors recommends recognizing and acknowledging the contribution of AI, including full citation.[2] The GAIT (Generative AI Transparency) 2024 guidelines, which are based on a consensus about reporting the use of generative artificial intelligence(GAI) in scientific writing and involve 124 surgeons from 46 countries, state the following: 1) The use of GAI should be documented in a GAIT statement, specifying the model and its version; 2) The application of GAI should be aligned with CRediT criteria; 3) Specific prompts used must be included in a supplement; 4) Authors should maintain final responsibility for their work.[5]

Implementing plagiarism detection tools capable of identifying AI-generated content can also be beneficial, allowing educators and creators to recognize and appropriately address any ethical violations in academic practice.

Conclusion

As technology advances, it is essential to cultivate a culture of integrity and transparency to uphold ethical responsibility in academia. By recognizing the power of AI tools and their potential to enrich the creative process, we must be proactive in establishing frameworks that guide their responsible use. Institutions, educators, and content creators share the responsibility to ensure that technological innovation does not undermine the principles of authorship and originality in the works they present.

The relationship between AI and plagiarism is complex and evolving; careful attention and ongoing education are vital to address the challenges it poses. Creating an academic future where AI and integrity coexist harmoniously will depend on the collective efforts of all involved, ensuring that technological advancement does not overshadow respect for human creativity and the value of ideas.

Furthermore, institutions and researchers must establish clear guidelines for the ethical and effective use of AI, including the proper citation of any contributions made by technology. For instance, when using an AI text generator to structure ideas, we should emphasize the importance of attributing content that is not exclusively based on the author's personal analysis or experience. Therefore, researchers must be transparent about their use of AI in their manuscripts, and journals should offer clear guidelines on what is acceptable to maintain the integrity of the study.

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Original Article

Nepalese Heart Journal 2025; Vol 22(1), 3-9

Effect of Aerobika® Device in Sputum Induction, Pulmonary Function and Thoracic Expansion in Phase One Cardiac Rehabilitation for Post CABG Subjects: A Randomized Prospective Controlled Trial

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Abstract

Background: Patients who undergo coronary artery bypass graft (CABG) surgery frequently ex-perienced pulmonary complications shortly after the procedure due to reduced lung function and a weakened cough reflex. The recent study aimed to determine and evaluate the effects of Aerobika® device on sputum induction, pulmonary function and thoracic expansion in phase one cardiac rehabilitation for post CABG subjects.

Methods: A Randomized prospective controlled trail was conducted on 36 participants with me-dian sternotomy. Participants were assigned to either Group A (n=18) or Group B (n=18) . The session was carried for 30 minutes twice a day for a week. Outcome measures in the present study were sputum volume, thoracic expansion measurements, peak expiratory flow meter and maximal inspiratory pressure. The outcome measures were evaluated on daily basis i.e., pre and post of every session.

Statistical analysis used:Statistical analysis was done using SPSS 23. Wilcoxon test was used for within group pre test and post test comparison whereas Mann Whitney Test was used for between the group comparison. The level of significance was set at 5%.

Results: Within-group analysis indicated that both groups demonstrated statistically significant improvements in all parameters individually (p-value = 0.001< 0.05). Between group comparison demonstrated that the experimental group was more effective in enhancing secretion clearance, thoracic expansion, maximal inspiratory pressure and peak expiratory flow meter as evidenced by significant differences (p-value = 0.001<0.05).

Conclusion: The study concluded that phase one cardiac rehabilitation along with the use of Aerobika® device are effective in improving the sputum induction, pulmonary function and tho-racic expansion of the lung.

Keywords: Phase one cardiac rehabilitation, CABG surgeries.

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Introduction

Coronary artery disease involves impairment of blood flow through the coronary arteries, most commonly by theromas. Clinical presentations include silent ischemia, angina pectoris, acute coronary syndromes and sudden cardiac death.Coronary artery disease is a leading cause of mor-tality and morbidity around the world[1]. According to recent estimates from epidemiological studies conducted across India, the prevalence of CAD is between 2%- 7% in rural and 7%-13% in urban[2].The average age for people who have CABG surgery is around 66 years old. About 72% of the people who undergo it are men.

CABG is most commonly used procedure for CAD. CABG surgery restores blood flow to areas of heart that are not getting enough blood circulation. Due to median sternotomy patient often develop pulmonary complication in the post-operative period as result of decreased lung function and impaired cough[3]. Acute respiratory failure, pneumonia, atelectasis, and pulmonary edema are typical postoperative pulmonary consequences, especially following abdominal and thoracic surgery. The length of hospital stay and greater morbidity are linked to postoperative pneumo-nia.Acute respiratory failure, pneumonia, atelectasis, and pulmonary edema are typical postopera-tive pulmonary consequences, especially following abdominal and thoracic surgery. The length of hospital stay and greater morbidity are linked to postoperative pneumonia. Acute respiratory fail-ure is a potentially fatal pulmonary condition that calls for the use of mechanical ventilation, ad-mission to an intensive care unit, and a higher risk of infection linked to ventilator use[4]. After surgery, patients often avoid coughing due to extended anesthesia and pain at the site of surgery, causing cough to build in the bronchial tree. Cardiac rehabilitation reduces mortality , mobility and avoidable hospital admissions while improving exercise capacity, quality of life and mental health.Inpatient cardiac rehabilitation, sometimes referred to as Phase 1 program which is utilized after heart surgeries to promote early mobility and enhance post-operative care[5,6].

Oscillatory positive expiratory pressure(OPEP) devices have been used as an additional therapy to traditional chest physiotherapy(CPT) to enhance the clearance of respiratory secretion in indi-vidual with reduced coughing skills[7]. OPEP device increase in pressure is transmitted to airways creating back pressure stenting them during exhalation, preventing premature airway closure and reducing gas trapping .The Aerobika® device has an innovative pressure-oscillation mechanism that creates positive pressure pulses when patient exhales .The positive pressure created can assist with opening weak and collapsed airways[8]. The Aerobika® device a drug-free portable oscillat-ing positive expiratory pressure (OPEP) device developed to help people remove mucus from the lungs, open airways, boost lung function and improve QoL and function[9].The oscillations or vibrations produced in the airway can help to thin and loosen mucus, naturally moving it to the upper airways where it can be coughed out easily[10].

Method

Present study was conducted in Intensive Thoracic Unit of tertiary care hospital, in Belagavi city from December 2024 to May 2024 . An ethical clearance from institutional ethical committee was obtained.

A Randomized controlled trial was conducted on 36 subjects who had undergone CABG surgery. Participants were assigned to either Group A (n=18) received traditional chest physiotherapy or Group B (n=18) received aerobic device with traditional chest physiotherapy. The participants were randomly alloted in the experimental and control group through an opaque envelop method.Participants were screened for inclusion and exclusion criteria. Following the screening , eligible and willing participants were included in the study and consent form was signed before commencement of the study. The study was a single- blinded study. The statistician involved for this study was blinded to the intervention and control group to ensure unbiased data analysis. Demographic data , pre and post assessment of the outcome measure were noted on a daily basis.

Participants

Inclusion criteria: Participants aged between 40-65 years of age of both the genders. Participants who are oriented, conscious, co-operative and willing to participate were included.

Exclusion criteria: Participants who are uncooperative. Participants who can not understand how to use the device. Participants who are hemodynamically unstable, fragile and participants who had systemic illness were excluded.

Intervention

Similar post-operative medical treatment, nebulizer(budecort 0.5mg, duolin nebulizer solution), chest binder and incentive spirometer (800 cc/sec) were administered to all the participants. The treatment was started on POD2 for both the groups. Same therapist had given treatment for both the groups.Each participant was given demonstration and instructions about the intervention. Par-ticipants were randomly allotted in Group A (control) or Group B (experimental) through envelope method. Intervention lasted for 30 minutes twice a day, for a week in both the groups.

Control group:(Group A)

The treatment included standardized protocol of phase 1 cardiac rehabilitation.

Step 1 : diaphragmatic breathing exercises. (5 repetitions, 3sets), Active assisted ROM bilateral upper limb and lower limb (5repetitions, 3 sets) Ankle toe movements(5 repetitions, 3 sets), tho-racic mobility exercises (5 repetitions, 3 sets)

Step 2 : repeat step 1, sitting on the edge of the bed, active range of motion bilateral upper limb (shoulder abduction were limited to below 90 degree) and lower limb (5 repetitions, 4 sets)

Step 3 : repeat step1, repeat step 2, supported room ambulation.

Step 4 : repeat step1, repeat step 2, repeat step 3, trunk mobility exercises (5 repetitions, 3 sets), and unsupported ward ambulation (2 rounds)

Step 5 : repeat step 4 and downstairs 2-flight (2 times/day), progression of ambulation10[21] .

Interventional group:(Group B)

In interventional group participants were treated with Aerobika® device and standardized protocol that is used in phase 1 cardiac

rehabilitation.The participant were seated in long sitting position on bed.The participant were asked to hold the device via the mouthpiece. Participant was asked to breath in through the mouthpiece and hold the breath for 2-3 seconds and steadily blow out into the mouthpiece. The process was repeated for 10-20 times followed by huffing and coughing for 5-6 times. During huffing and coughing participant should wear the chest binder and place both the hands placed over the binder and cough slowly so that the sutures are se-cured.To help maintain the 4 seconds expiratory time, resistance was changed accordingly.

Outcome measures

The study utilized pre and post data collection through various methods to evaluate respiratory function and capacity in subjects. Baseline scores were taken on day one i.e., before the interven-tion and on day 7th post completion intervention.

Peak expiratory flow rate

The participant were seated comfortably in a chair or in long sitting position on bed.The partici-pate was instructed to inhale as deeply as possible and blow out into the mouthpiece as rapidly as possible. This method was carried out three times for accurate measurements, and the average of the three was calculated(for each session/day[11,12].

Sputum volume

Sputum was collected in a sputum container to indicate the volume of sputum expectorated dur-ing the procedure(for each session/day[13,6].

Thoracic expansion measurements

The participant were in comfortable upright sitting position and the readings were taken at the three levels that is axillary, nipple and xiphisternum were marked.They were instructed to take a few normal breaths first and then asked for full exhalation, followed by a full inhalation.

Maximal inspiratory pressure

The participant were asked to sit either on the chair or in long sitting position.The participants were asked to hold the mouthpiece through lip and were asked to inhale as quickly as possible after a maximal expiration.This method was carried out three times for accurate measurements, and the average of the three was calculated(for each session/day).

Statistical Analysis

The various statistical measures such as mean, standard deviation,Mann-Whitney, normality test using Shapiro-Wilk were required.Within group outcome measures like thoracic expansion meas-urements, peak flow meter, maximal inspiratory pressure and sputum volume was done using Paired sample Wilcoxon test and for between group it was done by independent test like Sample Mann Whitney test.

Results

We aimed to include 36 participants for our study, in which either groups that is Group A had 18 participants and Group B had 18 participants. These 36 participants met the inclusion and exclusion criteria of the study.Baseline scores were taken on day one i.e., before the intervention and on day 7th post completion intervention.

Table 1 shows the age, height, weight and BMI of the participants in both the groups. There was no significant difference seen in the demographic data.

In Table 2 within group analysis of outcome measures chest expansion , peak flow rate , maximal inspiratory pressure and sputum volume.Both the groups showed significant difference in all out-come measures, but Group B was more significant then the Group A.

In Table 3 it is observed that between groups analysis is not significant for Chest expansion, Peak Expiratory Flow meter, Maximum Inspiratory Pressure and Sputum Volume at 5% level signifi-cance as the p-value is more than 5%. It shows non-significant differences between the groups. From the Table 3 it is observed that between groups analysis is significant for Chest expansion, Peak Expiratory Flow meter, Maximum Inspiratory Pressure and Sputum Volume at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups.

Table 1: Comparison of Groups with Mann Whitney test

Variable	Group	Mean	SD	z-value	p-value
Age	Grp-A	60.44	4.57	0.986	0.324
	Grp-B	57.50	7.21		
Height	Grp-A	162.89	7.84	1.431	0.152
	Grp-B	158.72	8.48		
Weight	Grp-A	63.39	5.96	0.974	0.330
	Grp-B	60.33	8.55		
BMI	Grp-A	23.97	2.00	0.032	0.975
	Grp-B	23.96	2.21		

Table 2: Within group Analysis of Chest expansion, Peak Expiratory Flow Rate, Maximum In-spiratory Pressure, Sputum Volume, using paired sample Wilcoxon test

Chest Expansion at Axillary Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.09	0.10	0.57	0.08	6.74	3.804	0.001*
	Post	1.66	0.16					
Group B	Pre	1.06	0.11	0.91	0.10	8.91	3.839	0.001
	Post	103.79	18.66					
Chest Expansion at T4 Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.24	0.05	1.08	0.22	4.87	3.762	0.001
	Post	2.32	0.24					
Group B	Pre	1.33	0.14	1.13	0.17	6.48	3.760	0.001
	Post	2.47	0.08					
Chest Expansion at Xiphisternal Level								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.07	0.40	1.15	0.26	4.39	3.771	0.001
	Post	2.22	0.44					
Group B	Pre	1.51	0.09	1.02	0.12	8.84	3.942	0.001
	Post	2.52	0.07					
Peak Expiratory Flow Rate								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	104.33	0.69	3.72	1.18	3.16	3.754	0.001
	Post	108.06	1.43					
Group B	Pre	104.89	1.02	12.00	3.01	3.99	3.748	0.001
	Post	116.89	3.05					
Maximum Inspiratory Pressure								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	-8.67	3.43	3.39	1.82	1.86	3.767	0.001
	Post	-12.06	2.58					
Group B	Pre	-3.17	1.29	8.22	1.83	4.49	3.734	0.001
	Post	-11.39	1.09					
Sputum Volume								
Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	2.61	0.50	2.08	0.65	3.22	3.805	0.001
	Post	0.53	0.50					
Group B	Pre	5.50	1.20	5.28	1.18	4.48	3.745	0.001
	Post	0.22	0.35					

*p-value= 0.001<0.05

Table 3: Between group Analysis of Chest expansion, Peak Expiratory Flow Rate, Maximum In-spiratory Pressure, Sputum Volume, using Mann Whitney Test

Variable	Time	Group	Mean	SD	z-value	p-value
Chest Expansion Axillary	Pre	Group A	1.09	0.10	3.162	0.002
		Group B	1.00	0.00		
	Post	Group A	1.66	0.16	4.125	0.001
		Group B	1.91	0.10		
T4	Pre	Group A	1.24	0.05	1.588	0.112
		Group B	1.33	0.14		
	Post	Group A	2.32	0.24	1.811	0.070
		Group B	2.47	0.08		
Xiphoid	Pre	Group A	1.07	0.40	3.420	0.001
		Group B	1.51	0.09		
	Post	Group A	2.22	0.44	2.224	0.026
		Group B	2.52	0.07		
Peak Expiaratory Flow Rate	Pre	Group A	104.33	0.69	1.905	0.057
		Group B	104.89	1.02		
	Post	Group A	108.06	1.43	5.117	0.001
		Group B	116.89	3.05		
Maximum Inspiratory Pressure	Pre	Group A	-8.67	3.43	4.658	0.001
		Group B	-3.17	1.29		
	Post	Group A	-12.06	2.58	1.468	0.142
		Group B	-11.39	1.09		
Sputum Volume	Pre	Group A	2.61	0.50	5.250	0.001
		Group B	5.50	1.20		
	Post	Group A	0.53	0.50	1.877	0.060
		Group B	0.22	0.35		

*p-value= 0.001<0.05

Discussion

The present study was undertaken to evaluate and comparative the effectiveness of Aerobika® device with conventional cardiac rehabilitation on sputum volume, peak flow rate , thoracic ex-pansion and maximal inspiratory pressure in phase one cardiac rehabilitation. Total number of participants recruited in the study were (n=36) in phase one cardiac rehabilitation with median sternotomy incision. The experimental group was treated for twice a day for 7 consecutive days, followed by conventional physiotherapy exercises it showed a significant improvement in reduc-tion of sputum, chest expansion measurements, peak expiratory flow rate and maximal inspirato-ry pressure.

Siti N.S et, al research stated that administration of Aerobika® device in COPD subjects showed significant improvement in sputum clearance in these subjects. In our recent study carried out on CABG subjects in phase one cardiac rehabilitation showed that using Aerobika® device along with conventional physiotherapy showed a significant difference in sputum clearance[14].

Coughing becomes less effective when lung volumes are lowered in the post-operative period be-cause expiratory flow rate is directly proportional to lung capacity. The Aerobika® device im-proves peak expiratory flow rate by raising intrapulmonary pressure, resulting in an increase in functional residual capacity. Peak expiratory flow rate increased as a result of the recreation being cleared from the lungs, which increases the lung volume[15]. This supports the findings in both the groups, which showed a considerable increase in peak expiratory flow rate following interven-tion in conjunction with conventional physiotherapy activities[16].

In our study, a significant improvement was seen in both groups. But maximal inspiratory pres-sure in group B, it may be due to the exposure of inspiratory muscle to being attributed to load of resistance with 1 to 5 pressure setting in which Aerobika® provides gradual rise in pressure fol-lowed by a sudden drop by rapid onset of high velocity airflow , which is regularly repeated for 10 times with huffing and coughing in between, so that there is increase in sarcomere, expansion of muscular mass and strength generating capacity of the muscle[17]. Furthermore , the improve-ment in inspiratory muscle strength might be related to physiological adaptations generated by Aerobika® which may have increased the aerobic capacity of respiratory[18].

In the current study, Group B (interventional group) showed a significant improvement in thorac-ic expansion, possibly because the thoracic expansion exercises activated the collateral ventilato-ry system, allowing air to pass distal to mucus plugs in the peripheral airway[19]. This might be explained by a decrease in rib cage muscle tension and an improvement in mechanical character-istics brought about by rib cage movement[17]. The underlying mechanism of Aerobika® has proven useful in enhancing lung expansion because it is connected with peak force experienced at the mucus surface caused by continually changing air pressure, which overcomes the adhesive bindings between the mucus layer and afflicted airways[20].

Conclusion

The randomized controlled study investigated the effective of conventional physiotherapy exer-cises with combination of both Aerobika ®and conventional therapy on various health parameters in subjects who had undergone CABG surgeries. The results indicated that the use of Aerobika ® device along with standard cardiac rehabilitation significantly improved outcomes that includes thoracic expansion, peak expiratory flow rate ,better maximal inspiratory pressure more effective sputum clearance. Overall administration of Aerobika® device to the standard cardiac rehabilita-tion provides a better improvement in management of CABG patients in phase one of cardiac re-habilitation.

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Original Article

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Efficacy of Transversus Thoracic Muscle Plane Block for Analgesia After Pediatric Cardiac Surgery

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Abstract

Background: Perioperative pain management plays a key role in the management of patients undergoing pediatric cardiac surgery. We studied the effect of transversus thoracic muscle plane block (TTPB) on acute postoperative pain and 24-hour opioid consumption in pediatric cardiac surgical patients.

Methods: Patients in whom transversus thoracic muscle plane catheter was placed were kept in one group and in the other group patients who were given conventional medicines for pain management were kept. The primary study end point was to compare the consumption of fentanyl and to assess FLACC pain scale in postoperative period in the first 24 hours post extubation in both groups.

Results: The 24-hour fentanyl consumption was 8.00 +/- 5.49 micrograms in the transversus thoracic muscle plane group and 32.20 +/- 10.53 micrograms in the control group in the first 24 hours postoperatively, which was statistically significant ($p < 0.001$). The FLACC score was also significantly lesser in the TTPB group compared to the control group in the first 24 hours postoperatively.

Conclusion: Transversus thoracic plane block is superior to the conventional opioid injection method for postoperative pain management in pediatric cardiac surgical patients.

Keywords: Opioids, Pain, TTPB

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Background

Cardiac surgery, which is performed via midline sternotomy, causes significant postoperative pain.[1] If the postoperative pain isn't adequately managed, it will lead to various systemic complications, including pulmonary atelectasis, pneumonia, increased oxygen consumption, and tachycardia, resulting in prolonged ICU stay as well as increased cost. Systemic opioids have been used for pain management for a long; however, they are associated with side effects like nausea and vomiting, respiratory depression, and delayed extubation.[2] Fast-track protocols have been introduced to clinical practice recently. This has enabled early extubation by the development of multimodal analgesic strategies, which aim at reducing perioperative opioid use.[3]

The introduction of ultrasonography into regional anesthesia practice paved the way for less-invasive techniques, most recently with the increased use of interfascial plane blocks.[4] These blocks drew attention in cardiac procedures because they are relatively safe and simple and bear the advantage of proximity to the surgical field.[5] Ultrasound-guided transversus thoracic muscle plane block (TTPB) is a newly developed technique that was defined by Ueshima et al. in 2015. Local anesthetic (LA) is injected into the fascial plane between the transversus thoracic muscle and the internal intercostal muscles

to block the anterior cutaneous branches of intercostal nerves from thoracic (Th) 2 to Th 6[6]. Blockage of these nerves can contribute to the management of pain associated with surgical procedures involving the anterior thorax and sternum.

There are only a few studies in the literature, mainly consisting of case reports, regarding the efficacy of TTPB[7]. The aim of this study is to evaluate whether this technique improves the acute postoperative pain and reduced the opioids consumption in pediatric cardiac surgery patients.

Methods

This was a prospective observational cohort study performed at Shahid Gangalal National Heart Center of Nepal. After obtaining Institutional review board approval, the routine pediatric cardiac surgical patients undergoing open heart surgery via median sternotomy under cardiopulmonary bypass with the ages between 2 to 6 years were enrolled in the study. The exclusion criteria were the patients who were hemodynamically unstable or intubated preoperatively requiring emergency surgery, patients with a known history of hypersensitivity reaction to local anesthetics, and patients who remained intubated more than 6 hours post-surgery.

The sample size was calculated from a previous similar study done by Meltem Cakmak et al.,[8] and 30 patients were taken in each group for the study.

Some anaesthesiologist prefer the conventional opioids technique for postoperative pain management, and some prefer doing TTPB. The duration of the study was from May 2024 to October 2024. There were a total of 30 pediatric cardiac surgical patients who underwent cardiac surgery with sternotomy who had undergone TTPB block at the end of surgery and were placed in group T. For comparison, 30 pediatric cardiac surgical patients who underwent cardiac surgery with sternotomy and for whom pain management was done by conventional opioid injection method were kept in group C. Patients under group T underwent ultrasound-guided transversus thoracic muscle plane block postoperatively after completion of surgery and received local anesthetic bupivacaine 0.25% (0.25ml/kg) on each side. Both groups of patients received 15mg/kg of IV paracetamol six hours in the postoperative period. Postoperatively, patients having pain (FLACC score >4) were given rescue analgesics (Fentanyl 0.5 mcg/kg) in both of the groups. The cumulative dose of opioids consumed in the 24 hours post-extubation was recorded from the ICU chart. FLACC scores at 0,6,12, 18, and 24 hours post-extubation were recorded from the ICU chart.

Collected data were analyzed by means of the statistical software SPSS22. Statistical analysis for demographic variables was done by chi-square test, and student's paired t-test was applied to compare the mean 24-hour opioid consumption and FLACC score at 0,6,12,18 and 24 hours post extubation in both groups. A P-value of < 0.05 was considered to be statistically significant.

Results

The demographic data of the two groups were comparable, as shown in Table 1. The 24-hour fentanyl consumption was 8.00 +/- 5.49 micrograms in the Transversus thoracic muscle plane group and 32.20 +/- 10.53 micrograms in the control group in the first 24 hours postoperatively, which was statistically significant ($p < 0.001$) as shown in Table 2. The FLACC score was also significantly lesser in the TTPB group compared to the control group in the first 24 hours postoperatively, as shown in Table 3 and Figure 1.

Table 1: Demographic data of the patients

Variables	Group T	Group C
Age in years median (Range)	4(3-5)	3(2-6)
Gender male: female	12:18	14:16
Weight in kg median (Range)	14 (11.15-18.20)	10.15 (8.25-19.00)
Height in cm median (Range)	98(86-114)	85(80-117)
BMI in kg/m^2 median (Range)	14(13.5-16.5)	13.8 (12.3-15.9)

Table 2: Comparison of total Fentanyl consumption

	Group T (mean +/- SD)	Group C (mean+/- SD)	P value
Fentanyl (mcg)	8.00 +/- 5.49	32.20 +/- 10.53	<0.000

Table 3: Comparison of FLACC score

Time(Hours post extubation)	Group T (mean +/- SD)	Group C (mean+/- SD)	P value
0	2.6 +/- 1.22	5.60+/- 0.81	0.001
6	3.0+/-1.43	6.60+/-1.03	0.006
12	4.6+/-1.88	7.0+/-0.64	<0.001
18	2.0+/-0.64	6.6+/-1.03	0.045
24	1.8+/-0.40	5.0+/-1.11	<0.001

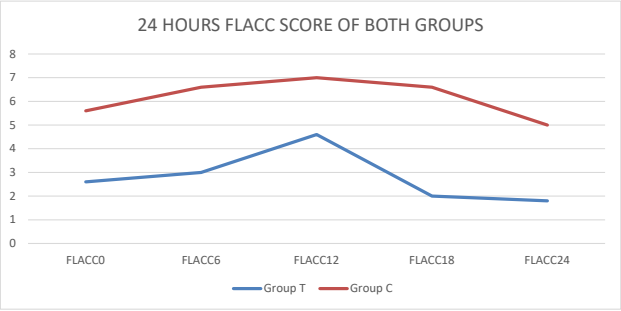

Figure 1: *Comparison of 24 hours FLACC score in both groups*

Discussion

The perioperative pain management plays a key role in the management of patients undergoing cardiac surgery. Postoperative surgical pain due to sternotomy and sternal retraction is severe.[1] Ineffective pain management results in systemic complications for example, pulmonary atelectasis, pneumonia, increased oxygen consumption and tachycardia, resulting in prolonged ICU stay as well as increase cost.[9]

Numerous modalities of pain management techniques have been used for cardiac surgery, like Thoracic Epidural Anesthesia (TEA),

Paravertebral block (PVB), and Erector Spinae Plane (ESP) Block, as well as perioperative opioids. Cardiac surgery is often performed in patients receiving anticoagulant therapy. Hence, Thoracic Epidural Anesthesia is associated with epidural hematoma and hypotension.[10] PVB, on the other hand, has a high risk of puncturing the pleura, resulting in pneumothorax.[11] The use of perioperative opioids produces side effects such as nausea and vomiting, respiratory depression, postoperative chronic opioid use, and increased risk of chronic pain.[12]

However, the Ultrasound-guided fascial plane block technique can be performed safely in anticoagulated patient as compared to TEA and PVB, as the fascial plane has less number of vessel and it avoids epidural vessels.[13]

The result of this study has demonstrated that the use of Transversus thoracic muscle plane block has significantly reduced the consumption of opioids in the TTPB group in comparison to the control group in the first 24 hours post extubation postoperatively. Furthermore, the TTPB block group showed that the FLACC pain score was significantly lower than in the control group in the postoperative period, which signifies adequate pain management. The result of our study was consistent with the findings in the study done by Meltem Cakmak et al.[8] We also didn't notice any significant procedure-related complications in our study. and local site hematoma formation. This was the limitation of our study.

Though there are very few studies describing TTPB in pediatric cardiac surgical patients, the study findings have shown promising results in reducing postoperative pain. So, we recommend using the TTPB technique in all pediatric cardiac surgical patients as it significantly reduces overall opioid consumption and significantly allays pain, thereby contributing to the patient's comfort and satisfaction.

Conclusion

Transversus thoracic plane block is superior to the conventional opioid injection method for postoperative pain management in pediatric cardiac surgical patients. TTPB block not only decreases the overall opioid consumption but also the FLACC pain score in these patients.

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Conflict of interest statement: We declare no perceived or potential conflicts of interest within the past 36 months related to this study.

Authors' Contributions: SS Parajuli and S Shrestha designed the study, took part in the acquisition, analysis, and interpretation of data, created the initial draft of the manuscript, and made critical revisions.

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Original Artticle

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Prevalence of Coronary Artery Disease Among Patients Presenting with Chest Pain of Suspected Cardiac Origin at A Tertiary Care General Hospital in Gandaki Province of Nepal

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Abstract

Background and Aim: The prevalence of coronary artery disease among patients presenting with chest pain of suspected cardiac origin in western part of Nepal is not known. We aimed to study the prevalence of coronary artery disease among patients presenting with chest pain of suspected cardiac origin in an emergency department of a general tertiary care hospital in Gandaki province of Nepal.

Methods: This was a prospective cross-sectional study conducted over a period of 5 months that included all patients aged 16 years and above presenting to the emergency department with acute chest pain of suspected or diagnosed cardiac origin. The primary outcome measure was to calculate the prevalence of coronary artery disease and secondary outcome measures included identification of common ECG changes in such patients and the relationship of such changes with the provisional diagnoses of the patients.

Results: One hundred fifty patients were enrolled in the study. The prevalence of coronary artery disease was 44% (66/150) among those patients with chest pain of cardiac origin. T wave inversion was the most prevalent ECG change (44%), followed by ST-T segment depression (28%), Left bundle branch block 11.33%, ST segment elevation 10.66%, left ventricular hypertrophy 10%. Pathological Q waves were present in 6.66% and poor R-wave progression was seen in 3% of the patients. ECG had high diagnostic accuracy to detect ischaemia.

Conclusion: The prevalence of coronary artery disease among patients with chest pain of suspected cardiac origin in the emergency department of tertiary care general hospital is around 44%. The common ECG changes are ST depression and T wave inversion. ECG detected most of the myocardial ischaemia in the emergency department.

Keywords: Chest pain; Electrocardiogram; Emergency department; Myocardial ischaemia

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Introduction

Coronary artery disease (CAD) is a leading cause of morbidity and mortality worldwide, and its prevalence is increasing due to changing lifestyles and an aging population.[1] Studying the prevalence of CAD among patients presenting with chest pain of suspected cardiac origin is crucial for identifying high-risk patients and improving the quality of care in emergency departments of tertiary care general hospitals. These patients when discharged inadvertently from the emergency department have a short term mortality of 2%.[2] Previous studies have reported the prevalence of CAD in the general population and in cardiac center settings[2], but there is a lack of data on the prevalence of CAD among patients presenting with chest pain of suspected cardiac origin in an emergency department of a general tertiary care hospital in Nepal. This knowledge gap needs to be addressed to improve patient outcomes. We hypothesize that a significant proportion of patients presenting with chest pain of suspected cardiac origin in an emergency department of a general tertiary care hospital in Nepal will have CAD. The aim of this study is to determine the prevalence of CAD among patients presenting with chest pain of suspected cardiac origin in an emergency department of a general tertiary care hospital in Nepal.

Methods

Study design

This was a prospective cross-sectional study carried out at Manipal teaching hospital, Pokhara over a period of 12 months. The data collection was done over a period of 5 months after approval was obtained from the institutional review board of Manipal college of medical sciences. A written informed consent was taken from all the patients/guardians of patients participating in the study.

Sample size calculation

Sample size was calculated considering confidence level (CL) =95%, expected proportion of positive ECG for myocardial infarction (P) = 0.28 taken from the report by Challa et al[3] and total width of confidence interval (W)=0.15; calculation was done using the formula for sample size of observational studies suggested by Hulley et al and a final sample of 150 participants was taken.[4] We used a non-probability consecutive sampling technique for enrolling the patients.

Inclusion Criteria

All patients aged 16 years and above presenting to the emergency department of tertiary care hospital with acute chest pain of suspected or diagnosed cardiac origin were included in the study.

Exclusion Criteria

We excluded patients attending with chest pain who did not wish to participate in the study and the patients presenting with traumatic chest pain.

Demographic data

Personal and demographic information was obtained. The data regarding family history, personal medical history, risk factors of heart disease, provisional diagnosis was recorded.

Recording of electrocardiogram: A 12 lead electrocardiogram was recorded during the resting state. Data from the ECG was collected for heart rate, QRS axis and deviation, p-wave, atrial fibrillation or junctional rhythm was sought for if p-wave was absent, PR interval and heart blocks, QRS analysis on narrow, incomplete or complete bundle branch blocks, QT interval, analysis of Q waves, R waves and S waves, T wave abnormalities, ST segment analysis. Any remaining ECG abnormalities were classified and captured as others.

Variables, Definitions and diagnostic criteria

1. Chest pain of cardiac origin was defined as in the NICE guidance 2010[5]
2. Chest pain of non-cardiac origin was defined as mentioned by Kachintorn U[6]
3. ST elevation[7], ST-depression[8], and Myocardial infarction[9] were defined as stated in the cited papers.
4. The measurements of the different intervals were made as per American heart association guidelines.[10]
5. The ECG changes were classified into four categories as Challa et al.[3]

Category 1 consists of a "normal" electrocardiogram with upright T waves, isoelectric ST segments, and no Q waves. Category 1 ECGs include normal sinus rhythm, sinus tachycardia, sinus bradycardia, premature atrial contractions and premature ventricular contractions.

Category 2 consists of abnormal ECG with no clear evidence of ischemia. For example, heart block, Left Bundle Branch Block (LBBB), Right Bundle Branch Block (RBBB), atrial fibrillation, paced rhythm, supraventricular tachycardia, left axis deviation, and left ventricular hypertrophy.

Category 3 consists of an abnormal electrocardiogram with changes questionable for ischemia. These ECGs questionable for ischemia were defined as nonspecific ST segment and T wave changes, ST elevation/depression in single leads or ≤0.1 mV, and Q waves <25% the height of the subsequent R wave.

Category 4 consists of an abnormal electrocardiogram showing evidence of ischemia, (i.e., transient or permanent ST segment elevation) or depression ≥ 0.1 mV in two contiguous leads and q waves that are greater than 25% of the height of the subsequent R wave.Determination of Cardiac Biomarker

Troponin I was qualitatively evaluated in patients suspected to have acute coronary syndrome. The result was recorded as positive or negative.

The primary outcome measure was to calculate the prevalence of coronary artery disease in patients presenting to the emergency department with chest pain of suspected cardiac origin. The secondary outcome measures included identification of common ECG changes in such patients and the relationship of such changes with the provisional diagnoses of the patients.

Bias: Since this study had a possibility of measurement bias in terms of interobserver variability when different clinicians may interpret symptoms differently. Whenever possible, the patients were evaluated by at least two clinicians independently, one from the emergency department and another from the internal medicine/ cardiology department to reduce the chance of this bias.

Statistical Analysis

Descriptive statistics was presented in proportion percentage, mean and its standard deviation. Crosstabulation was done to identify the

relationship between ECG changes and provisional diagnosis and Troponin I.

Prevalence of coronary artery disease among patients presenting with chest pain was calculated using the following formula:

Prevalence=(all chronic stable angina and acute coronary syndrome cases / total number of patients presenting with chest pain of suspected cardiac origin) x 100 (%)population.

The data was entered in Microsoft Excel Program And was analyzed using SPSS (Statistical Package for Social Sciences) for Windows version 16.0. A p value of <0.05 was considered statistically significant whenever indicated.

Results

During the data collection period of five months, a total of 8349 patients visited the emergency department of Manipal teaching hospital. Among them, 987 patients presented with a complaint of chest pain (cardiac and non-cardiac origin). Out of those 987 patients, only 150 consecutive patients with the principal complaint of chest pain that met the definition of suspected cardiac origin were recruited for this prospective study. The demographic characteristics are shown in table 1.

Table 1: Demographic characteristics

Variable	Mean	Standard Deviation	Minimum - Maximum
Age (in years)	59.2	15.08	28-93
Age group	Number (%)		
40 or less	18 (12.0)		
41-60 years	62 (41.33)		
61-75 years	48 (32.0)		
> 75 years	22 (14.67)		
Gender	Male n (%)	Female n (%)	Other n (%)
	94 (62.66%)	56 (37.33%)	0 (0)
Type of chest pain	n (%)		
Typical	100 (66.6)		
Atypical	50 (33.4)		
History of heart disease	n (%)		
Present	79 (52.66)		
Absent	71 (47.34)		

Presence of risk factors for coronary artery disease is shown in the following Figure 2.

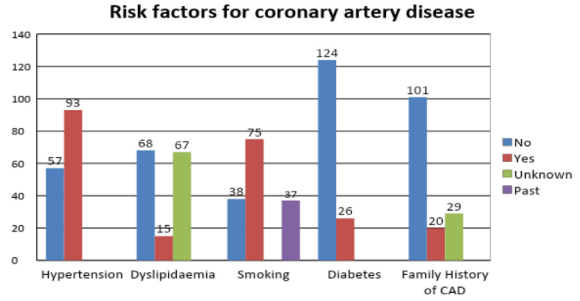

Figure 1: *Risk factors for coronary artery disease:*

Electrocardiographic characteristics

Heart rate

The mean heart rate at presentation was 82.96 ± 16.15 beats per minute and ranged from 48 to 155 beats per minute, with 3 (2%) patients having heart rate more than 120 beats per minute.

P wave

Normal P-wave was present in 145 patients. Remaining 5 (3.3%) patients presented with atrial fibrillation.

PR interval

A PR interval could be calculated in only 144 patients as five (3.3%) patients had atrial fibrillation and one (0.66%) patient presented with complete heart block and among remaining 144 patients, 4 (2.7%) had a PR interval longer than 120ms. All four patients had first degree heart block.

QRS complex

The QRS complex was narrow in 130 (86.66%) patients. There were 3 (2%) patients with incomplete left bundle branch block (QRS complex width more than 80 ms but less than 120 ms) and 17 (11.33%) presented with LBBB (QRS complex width more than or equal to 120ms). There were no cases of RBBB.

QT interval

We defined a prolonged QT interval as present if QTc> 440 ms in men or > 460 ms in women. A short QTc interval on an ECG was defined as QTc of ≤ 300 ms that does not significantly change with heart rate. There were 4 (2.7%) patients with prolonged QTc among all 150 patients. There were no patients with a short QT interval.

Q wave

Q waves were present in 10 (6.66%) of the patients who presented with chest pain. Q waves were most common in inferior and anterior leads.

T wave abnormalities

T wave inversion was present in 66 (44%) of the patients. Thirteen (8.66%) patients had T wave inversion of all the leads. T inversion was present in 18 (12%) patients in II, III, aVF leads. Similarly, T wave inversion was present in leads II, III, aVF, V1-V4 in one (0.66%) patient, in leads II, III, aVF, V2-V6 in also one (0.66%) patient, in II III aVL V1-V6 in another one (0.66%) patient.

Isolated T inversion was present in lead III in three (2%) patients. In the precordial leads, T inversion was present in leads V1-V3 in 1 (0.66%) patient, in leads V1-V4 in 11 (7.33%) patients, in leads V1-V6 in 1 (0.66%), in leads V3-V6 in 4 (2.66%), and in leads V4-V6 in 12 (8%) patients. Remaining 84 (56%) patients had no T wave abnormalities.

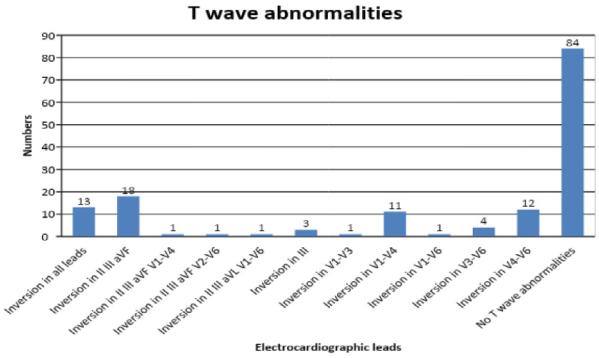

Figure 2: *Types of T-wave abnormalities*

ST Segment analysis

The ST segment was normal in 92 (61.33%) patients. ST segment elevation was seen in 16 (10.66%) patients. ST segment depression was seen in 42 (28%) patients. The following figure 8 shows results of ST segment analysis.

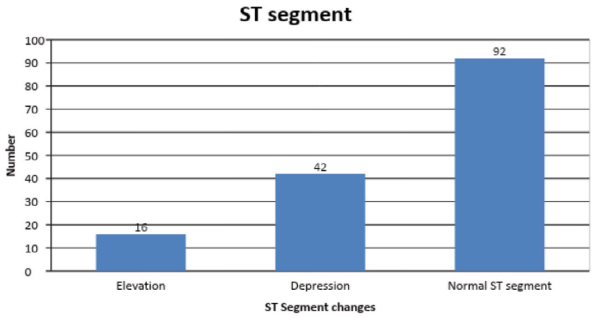

Figure 3: *Distribution of ST-segment changes*

ST segment elevation

Among 16 patients with ST segment elevation (Figure 9), 10 patients had ST elevation in leads V1-V4, 4 patients had ST elevation in leads II, III, aVF, and one patient each had ST elevation in leads V1-V6 and V4-V6.

ST segment depression

ST segment depression was more common in inferior leads (II, III, aVF, 15 patients {10%}), (V1-V4 10 patients {6.66%}) and all leads (6 patients 4%).

Other ECG abnormalities

There were other ECG abnormalities present in the patients (Figure 11). Patients had left ventricular hypertrophy, poor R wave progression, and 3 patients presented with supraventricular tachycardia as a cause of chest discomfort.

Provisional Diagnosis at the emergency department

Of 150 patients, 80 (53.33%) patients had no definite evidence of ischaemia based on clinical findings, ECG, and biomarkers. Three (2%) patients were diagnosed with chronic stable angina. Unstable angina was diagnosed in 39 (26%) patients and myocardial infarction in the emergency department was diagnosed in 24 (16%) patients. Among remaining patients 3 (2%) patients had paroxysmal supraventricular tachycardia and 1 (0.66%) patient had complete heart block as the cause of chest pain.

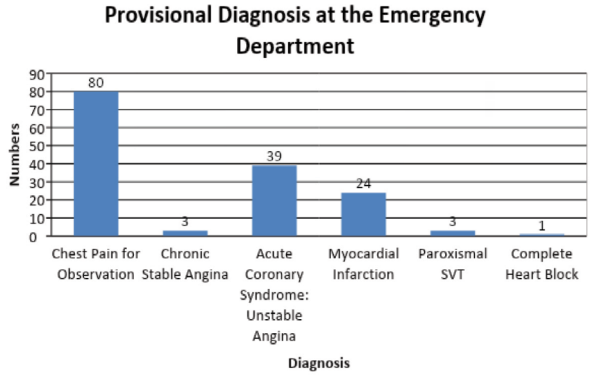

Figure 4: *Provisional diagnosis of patients presenting with chest pain of suspected cardiac origin*

To calculate the prevalence of coronary artery disease (CAD) among patients presenting with chest pain, all new and old cases of angina and myocardial infarction was taken in the numerator, that included acute coronary syndromes (unstable angina and myocardial infarction) and chronic stable angina) and total number of patients with chest pain of suspected cardiac origin was taken as denominator.

Prevalence of CAD= (66/150)*100% = 44% patients with chest pain of suspected cardiac origin.

Among 150 patients, myocardial infarction (MI) as confirmed by elevated troponin was diagnosed in 24 patients in the emergency department. However, the troponin test was not conducted in 20 (13.33%) patients.

Altogether 79 (52.66%) patients were admitted. Fourteen (9.33%) patients were kept under observation and 48 (32%) of patients were discharged from the emergency department. However, there were 7 (4.66%) patients who left against medical advice (LAMA) and 2 (1.33%) patients were discharged on the patients' request.

An association was sought between the provisional diagnosis and ECG changes. Only one patient with myocardial infarction had normal ECG. However, there were 9 patients who had typical chest pain and diagnosed as unstable angina had normal ECG. Similarly, definite evidence of ischaemia were seen only in patients with myocardial infarction and unstable angina. The association between all the diagnoses and electrographic changes is shown in the following table.

Table 2: Association between all the diagnoses and electrographic changes

Category According to Challa et al	Myocardial infarction (n=24)	Unstable Angina (n=39)	Chest pain for observation (n=80)	Chronic stable angina (n=3)	Complete heart block (n=1)	Paroxysmal SVT (n=3)
I Normal ECG with no evidence of ischaemia (n=56)	1	9	44	0	0	2
II (abnormal ECG but with no clear evidence of ischaemia) (n=44)	3	10	28	2	0	1
III (abnormal ECG with changes questionable for ischaemia) (n=29)	1	19	7	1	1	0
IV (abnormal ECG with evidence of ischaemia) (n=20)	19	1	0	0	0	0

Relation between tropinin I and ECG changes was also studied. Troponin I was negative only in 1 patient with category IV ECG

changes (definite evidence of ischaemia) and was positive in 1 patient with category I ECG (normal ECG). The complete relationship between the ECG changes and Troponin I is shown in the following table.

Table 3: Relationship between the ECG changes and Troponin I

Category According to Challa et al	Troponin I positive (n=24)	Troponin I Negative (n=106)	Troponin I not performed (n=20)
I (n=56)	1	43	12
II (n=44)	3	34	7
III (n=29)	1	27	1
IV (n=20)	19	1	0

Discussion

This study was conducted to evaluate the prevalence of coronary artery disease and the spectrum of ECG changes in patients with chest pain of suspected cardiac origin presented to the Emergency Department of Manipal Teaching Hospital, a tertiary care center in Western Nepal.

In the clinical assessment of patients presenting in ER with chest pain, interpretation of the ECG is an essential adjunct to the history and examination. Reaching a rapid and accurate clinical diagnosis is of great importance to improve prognosis in patients with myocardial infarction. Patients presenting to the ED with chest pain are triaged to early reperfusion therapies based on their initial ECG. Manipal teaching hospital is currently the only hospital in the western region of Nepal that has a cath lab with coronary intervention facility. The initial presenting ECG is the primary modalities of investigation in conjunction with clinical symptoms that help emergency physicians decide on immediate reperfusion therapy even before biomarker evidence of infarction and results of biochemical analysis are available. This study not only tries to present the electrocardiographic profile of patients presenting to ER with chest pain, but also describes several other clinical aspects including risk factors of coronary artery disease in the Western region of Nepal.

ECG changes and chest pain

Among our 150 patients, only one patient with myocardial infarction had normal ECG. However, there were 9 patients who had typical chest pain and diagnosed as unstable angina had normal ECG. Similarly, category IV ECG changes (definite evidence of ischaemia) were seen only in patients with myocardial infarction and unstable angina. In 2000, Bassan et al[4,5] evaluated all consecutive patients presenting to an emergency department for a period of two years and 1003 patients with the principal complaint of chest pain were analyzed. The admittance electrocardiogram (available in 971 patients) showed ST elevation in 106 (11%), ST depression or inversion of T wave in 159 (16%), left bundle-branch block in 38 (4%) and absence of these changes (normal or nonspecific ECG) in 668 (69%). Of 1003 patients studied, 165 (16%) had the final diagnosis of acute myocardial infarction, 225 (22%) of unstable angina, 324 (32%) of the absence of acute coronary syndrome and 289 (29%) had an indefinite diagnosis. They concluded that electrocardiogram has a crucial part in the interpretation of the clinical history and will determine the greater efficiency of the medical approach and the lower cost of emergency treatment.

Similarly, in 2007, Challa and colleagues[3] studied the initial presenting electrocardiogram as determinant for hospital admission in patients presenting to the emergency department with chest pain. They retrospectively reviewed initial ECG records of 250 patients for abnormalities and compared with the final diagnosis. Seventy-five patients (30%) had Category 1 (normal) ECGs. Fifty-five patients (22%) had Category 2 ECGs (abnormal without evidence of ischemia). Forty-eight patients (19.2%) had Category 3 ECGs (abnormal questionable for ischemia). Seventy-two patients (28.8%) had Category 4 ECGs (abnormal with evidence of ischemia).

ST segment changes

In our study population, the ST segment was normal in 92 (61.33%) patients. ST segment elevation was seen in 16 (10.66%) patients. ST segment depression was seen in 42 (28%) patients. Among 16 patients with ST segment elevation, 10 patients had ST elevation in leads V1-V4, 4 patients had ST elevation in leads II, III, aVF, and one patient each had ST elevation in leads V1-V6 and V4-V6. ST segment depression was more common in inferior leads (II, III, aVF). Although many conditions affect the ST segment, its elevation or depression are considered hallmarks of myocardial ischaemia. However, there are several causes of ST-segment elevation besides acute myocardial infarction. The most common causes of ST-segment elevation are left ventricular hypertrophy, left bundle-branch block, early repolarization, and ventricular aneurysm. Some of these conditions can be misdiagnosed as acute infarction, resulting in unwarranted thrombolytic therapy or emergency angiography.[10]

T-wave changes

The T-wave changes were one of the most common changes present in the patients with chest pain of cardiac origin. T wave inversion was present in 66 (44%) of the patients. Remaining 84 (56%) patients had no T wave abnormalities. The earliest electrocardiographic finding resulting from AMI is the hyperacute T wave which may appear minutes after the interruption of blood flow; the R wave also increases in amplitude at this stage. The hyperacute T wave is noted as early as 30 minutes after the onset of coronary occlusion and transmural infarction. It tends to be a short lived structure which evolves rapidly on to ST segment elevation. Our patients probably presented a little late and no patients had hyperactive T waves. Later, after a myocardial infarction T wave inversion occurs. T wave inversion may be a cause of myocardial ischaemia and may be a non-specific abnormality associated with other myocardial disease conditions like hypertension, aortic stenosis or myocarditis etc.[8] The high prevalence of hypertension in our study population might be the reason for T wave inversion.

Left Bundle Branch Block

There were 17 (11.33%) patients who presented to our emergency department with LBBB. The challenge of appropriately recognizing MI in patients with LBBB, who represent about 7% of patients with MI in a sample from the National Registry of MI 2 (NRMI 2), may be increased by the frequency with which they present with atypical symptoms. Left bundle-branch block patients with MI are older (76 vs. 68 years) and more likely to be women (50% vs. 41%) than patients with MI and without LBBB, and they have a higher prevalence of diabetes (36% vs. 26%)—all characteristics associated with an atypical presentation of MI. A recent study from NRMI 2

demonstrated that nearly half of LBBB patients with MI presented to medical attention without chest pain (compared with 30% of MI patients without LBBB) but did not address potential differences in treatment or survival in this subgroup.[11]

Atrial fibrillation and chest pain

A total of 5 (3.3%) patients presented with atrial fibrillation. Atrial fibrillation is one of the most commonly encountered clinical arrhythmia, often complicates chest pain and acute myocardial infarction with an incidence between 6 and 21%.[12] Predictors of the arrhythmia in the setting of AMI include advanced age, heart failure symptoms, and depressed left ventricular function.

PR interval and heart block

A PR interval could be calculated in only 144 patients as five (3.3%) patients had atrial fibrillation and one (0.66%) patient presented with complete heart block and among remaining 144 patients, 4 (2.7%) had a PR interval longer than 120ms. All four patients had first degree heart block. First degree block was seen in around 10% of all myocardial infarction patients; one-third of these-many with a P-R interval of 0.24 seconds or more-progressed to a higher level of block. Some myocardial infarction patients (around 5%) demonstrate second-degree block. Mobitz Type I block (Wenckebach) occurs much more frequently than type II. Complete heart block occurs in around 5% of myocardial infarction patients.[13]

QT interval

In our study population, 4 (2.66%) patients had prolonged QTc among all 150 patients. There were no patients with a short QT interval. The exact incidence of prolonged QT and QTc during chest pain of cardiac origin is unknown. However, lengthening of the Q-T interval is common 12 to 24 hours after the onset of an acute myocardial infarction and that prolongation of up to 20 percent over the initial values may occur in cases not complicated by severe ventricular arrhythmias.[14] Since we evaluated the QTc at the time of presentation with chest pain, our study population showed an increase in QTc interval in only 4 (2.66%) of patients.

ECG changes and reperfusion therapy

Sixteen (10.66%) of our patients had ECG indication for reperfusion therapy. However, due to the cross-sectional nature of our study, we did not follow the patients till actual reperfusion therapy was administered.

One of the aims of our study was to find any association between the provisional diagnosis and ECG changes. We used clinical, electrocardiographic and biomarkers to make the provisional diagnosis. Only one patient with myocardial infarction had normal ECG. However, there were 9 patients who had typical chest pain and diagnosed as unstable angina had normal ECG. Similarly, category IV ECG changes (definite evidence of ischaemia) were seen only in patients with myocardial infarction and unstable angina.

Similarly, to study the relation between troponin I and ECG changes was also one of the aims of our study. Troponin I was negative only in 1 patient with category IV ECG changes (definite evidence of ischaemia) and was positive in 1 patient with category I ECG (normal ECG). The results show that initial presenting ECG has a very high chance of detecting myocardial ischaemia.

Limitations: This study was the first of its kind to determine the ECG changes, and it identified T-wave abnormalities as major changes in patients presenting to the emergency department with chest pain of suspected cardiac origin. However, a detailed further subanalysis of such changes were not planned during the development of the research protocol and is a major limitation of this study.

Conclusions

In our study, we observed a noteworthy prevalence of coronary artery disease, calculated at 44% patients presenting with suspected cardiac origin chest pain. T wave inversion emerged as the most prevalent electrocardiographic change, evident in 44% of cases. Additionally, ST segment elevation in 10.66%, and ST segment depression in 28% of patients. Further findings included left ventricular hypertrophy (10%), Q waves (6.66%), and LBBB (11.33%). Acute coronary syndrome was primarily identified in patients with ECG evidence of ischemia, as only one patient with a normal ECG presented with this condition. The combined assessment of electrocardiographic changes, clinical history, and cardiac biomarkers exhibited substantial efficacy in detecting and ruling out coronary artery disease and acute coronary syndrome within the emergency department setting in a regional tertiary level hospital of western Nepal.

Conflict of Interests: None

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Pattern of Coronary Artery Involvement in Patients Undergoing Coronary Angiography at Cardiac Center in Western Nepal

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Abstract

Background and purpose: Around the globe coronary artery disease (CAD) is the most prevalent cause of death which requires effective diagnosis and management. Coronary angiography (CAG) is the most trusted method for the diagnosis. This study aims to identify the indications, findings, and associated risk factors among the patients undergoing CAG and its correlation to gender and ethnicity.

Methods: The research involved a retrospective study of patients who underwent CAG from September 2017 to September 2023.

Result: A total of 2335 individuals were included in the study. The mean age was 58.99±11.60years. Male were 1463(62.7%) and females were 872(37.3%). The most common indication for CAG was acute coronary syndrome (ACS) 1270(54.8%) more common among males 860(67.24%). The most common arterial access was radial artery 2000(85.7%). Obstructive coronary artery disease was the most common finding, seen in 1,794 cases (76.8%), with a higher prevalence among males (1,202 cases, 67%). It was also more frequent among Muslims (84.3%), Terai/Madhesi (82.4%), and Dalits (82.3%). Multivessel involvement was the most common pattern, found in 1,060 cases (45.4%). It was more frequent in males (713 cases, 67.26%) and showed higher prevalence among Muslims (56.9%), Terai/Madhesi (53.2%), and Dalit groups (48.7%). The single vessel, double-vessel, and triple-vessel diseases were 734(40.91%), 516(28.76%), and 544(30.32%) respectively. The left main coronary artery disease was involved in 95(4.1%). Hypertension stood as the leading risk factor present in 903(38.7%) followed by Diabetes Mellitus in 714(30.6%) and Smoking in 563(24.1%).

Conclusion: The high prevalence of obstructive coronary artery disease and multivessel involvement, particularly among males, and individuals from the Terai/Madhesi, Dalit, and Muslim communities, underscores the need for targeted screening and early intervention strategies in these high-risk groups. Clinicians should maintain a high index of suspicion and prioritize timely diagnostic evaluation in these populations to improve outcomes and reduce cardiovascular burden.

Keywords: coronary angiography, coronary artery disease, acute coronary syndrome

DOI: https://doi.org/10.3126/nhj.v22i1.78203

Introduction

The global burden of cardiovascular diseases is increasing day by day and the burden is disproportionately more among low and middle-income countries.[1,2] The disease burden is also on the rise in developing countries like Nepal. Cardiovascular disease has now emerged as a major public health problem in Nepal.[3] The most life-threatening disease among them is coronary artery disease. The presentation can be dramatic with patients presenting with acute coronary syndrome, including chest pain due to angina, or even be asymptomatic.[4]

A myriad of investigational tools is available nowadays for the evaluation of CAD. Among them, invasive coronary angiography has established itself as a gold standard method for the assessment of the presence of obstructive CAD both in stable CAD and for ACS.[4,5] This is the largest study of its kind conducted in this region of Nepal, addressing the existing gap in data on coronary angiographic profiles..

Materials and Methods

Study design

This was a hospital-based retrospective cross-sectional observational study performed for six years, from September 2017 to September 2023.

Inclusion criteria and exclusion criteria

A coronary angiogram of all the individuals was recorded. Both genders were included in the study. Patients aged below 18 years and those with incomplete records and missing data were excluded.

Sample size and sampling

A total of 2440coronary angiography cases were analyzed in this study. Due to missing data and incomplete records, 105 were excluded and 2335 were included in the study. A Non-probability convenience sampling method was used for the data collection. Coronary angiogram was reviewed by at least two experienced interventional cardiologists. Visual estimation of severity was done and the lesion was classified as normal (0% luminal stenosis in all vessels), mild coronary stenosis (1-49% luminal stenosis in at least 1 vessel), and obstructive CAD (≥50% in at least 1 vessel) as described by Pizzi C et al.[6] Findings were correlated with gender, ethnicity and their risk factors.

The ethnic classification of the individuals was by the Demographic and Health Survey. Population Division, Ministry of Health and Population, Government of Nepal, 2008.[7]

1. Brahmin and Chhetri
2. Terai/ Madhesi
3. Dalit
4. Newar
5. Janajati
6. Muslim
7. Others

Statistical analysis

The results are presented as mean (SD) for quantitative variables and as number (%) for categorical variables. For dichotomous variables, groups were compared using the Chi-square test. The means of the samples were compared using a t-test. A P-value of less than 0.05 was considered statistically significant. All statistical analyses were performed using the Statistical Package for Social Sciences, version 22.

Result

Of the total 2440 CAGs performed during the study period, 2335 were included. The mean age was 58.99±11.60 years. Of the total participants, 1,463 (62.7%) were male and 872 (37.3%) were female. The mean age of males was 59.26 years and females were 58.54 years.

Coronary angiogram results

Radial access was the most common vascular route 2000(85.7%) followed by femoral 327(14%) and ulnar 8(0.3%). Radial to femoral crossover rate was 4.5%.

Indications of CAG

The most common indication was ACS 1279(54.8%), followed by nonspecific chest pain 632(27.06%) and stable CAD 424(18.15%) as shown in Figure 1. Among the ACS, anterior wall MI was present in 539(42.14%), Inferior wall MI in 477(37.29%), NSTEMI in 165(12.9%) and unstable angina in 98(7.66%).

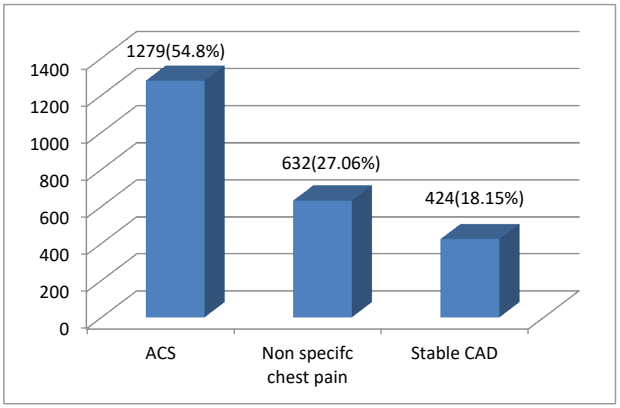

***Figure 1**: Distribution of indication for coronary angiogram*

Diagnosis

Normal CAG was 352(15.1%), mild coronary stenosis 189(8.1%) and obstructive coronary artery disease (CAD) was 1794(76.8%) as shown in figure 2.

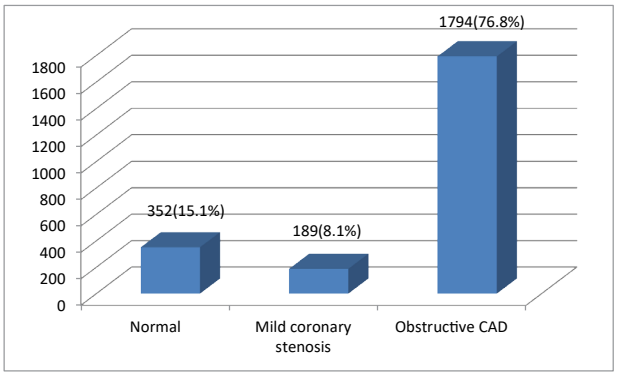

***Figure 2**: Coronary angiogram findings*

Among the obstructive CAD, Single vessel disease (SVD), double vessel disease (DVD), and Triple vessel disease (TVD) were seen in 734(40.91%), 516(22.1%), and 544(23.3%) respectively.

Among the patients with IWMI, the Right coronary artery (RCA) was involved in 360(75.5%) and left circumflex (LCX) in 117(24.5%). Multi-vessel involvement was seen in 1060(45.4%). In single vessel disease, the Left anterior descending artery (LAD) was involved in

406(55.31%) followed by RCA 222(30.24%) and LCX 106(14.44%). Left main disease (LMD) was present in 95 (4.1%) of the patients and among them, 10(0.4%) had isolated left main disease.

Risk Factor Evaluation

A total of 1680(71.9%) of patients had some risk factors. Hypertension (HTN) was the most common, present in 903(38.7%), followed by diabetes mellitus (DM) 714(30.6%), smoking status 563(24.1%), tobacco use 409(17.5%), alcohol use 337(14.4%) and dyslipidemia in 171(7.3%).

Distribution according to the gender

Table 1. Gender distribution and its correlation

Gender	Total-2335 (%)	Male 1463(62.7%)	Female 872(37.3%)	P-value
Indications for CAG				
Nonspecific chest pain	632(27.1)	335(22.9)	297(34.1)	
Stable CAD	424(18.2)	268(18.3)	156(17.9)	
ACS	1279(54.8)	860(58.8)	419(48.1)	
ACS				
AWMI	539(42.14)	370(25.3)	169(19.4)	
IWMI	477(37.29)	328(22.4)	149(17.1)	
NSTEMI	165(12.9)	108(7.4)	57(6.5)	
Unstable Angina	98(7.76)	54(3.7)	44(5.0)	
Diagnosis				
Normal	352(15.1)	157(10.7)	195(22.4)	<0.05
Mild coronary stenosis	189(8.1)	104(7.1)	85(9.7)	
Obstructive CAD	1794(76.8)	1202(82.2)	592(67.9)	
Obstructive CAD				
SVD	734(31.4)	489(33.4)	245(28.1)	
DVD	516(22.1)	347(23.7)	169(19.4)	
TVD	544(23.3)	366(25)	178(20.4)	
Multivessel CAD	1060(45.4)	713(48.7)	347(39.8)	
Left main disease	95(4.1)	65(4.4)	30(3.4)	0.23
Isolated LM disease	10 (0.4)	5(0.3)	5(0.6)	0.40
Risk Factors present	1680(71.9)	1171(80)	509(58.4)	<0.05
HTN	903(38.7)	569(38.9)	334(38.3)	0.77
DM	714(30.6)	468(32)	246(28.8)	0.05
Smoking	563(24.1)	441(30.1)	122(14)	
Tobacco	409(17.55)	363(24.8)	46(5.3)	<0.05
Alcohol	337(14.4)	292(20)	45(5.2)	
Dyslipidemia	171(7.3)	105(7.2)	66(7.6)	0.72

The most common indication for CAG both in gender was ACS. Among the patients with ACS, most were male 860(67.24%). Normal CAG was more common in females 195(55%). Obstructive CAD was more common among males 1202(67%). The presence of SVD, DVD, and TVD was more common in males 489 (66.6%), 347(67.2%), and 366(67.27%) respectively. Multi-vessel CAD was also more common in male 713 (67.2%). The left main disease was more in males 65(68.42%) but this was not statistically significant. Isolated left main was found equally in both sexes which were also not statistically significant. Risk factors were more prevalent in males (1,171 cases, 69.7%) compared to females. Specifically, diabetes mellitus (468 cases, 32%), smoking history (441 cases, 30%), tobacco use (363 cases, 24.8%), and alcohol consumption (292 cases, 20%) were notably higher in males, with these differences being statistically significant..

According to the ethnicity

Of the total angiographies performed, Brahmin and Chettri were 949(40.6%), Terai/Madhesi 340(14.6%), Dalit 226(9.7%), Newar 76(3.3%), Janajati 459(19.7%), Muslim 255(10.9%) and others 30(1.3%). The distribution of ethnicity is shown in table 2.

The results show that the most common indication of CAG was ACS in all ethnic groups. Obstructive CAD was found more among the Terai/ Madhesi, Dalits, and Muslims 280(82.4%), 186(82.3%), and 215(84.3%) respectively. Multivessel involvement was the most common in 1060(45.4%), more common in Muslims, Terai/Madhesi, and Dalits 145(56.9%), 181(53.2%), and 110(48.7%) respectively.

At least one risk factor was present in >70% of all ethnic groups except the other group had risk factors in 66.7%. Smoking was most common among Dalits 81(35.84%). Chewing tobacco was more common among the Muslims 88(34.5%) and Terai/ Madhesi 110(32.35%). HTN was more common among Brahmin/Chhetri, Newar, and in the "Other" subgroup.

Table 2: Distribution according to the ethnicity:

Ethnicity	Total(2335)	Brahmin/ Chhetri (949)	Terai/ Madhesi (340)	Dalit (226)	Newar (76)	Janajati (459)	Muslims (255)	Others (30)	p-value
Indications for CAG (%) Nonspecific chest pain Stable CAD ACS	632(27.1) 424(18.15) 1279(54.8)	267(28.1) 172(18.1) 510(53.7)	75(22.1) 58(17.1) 207(60.9)	53(23.5) 37(16.4) 136(60.2)	16(21.1) 15(19.7) 44(57.8)	150(32.7) 73(15.9) 237(51.6)	64(25.1) 61(23.9) 130(51)	7(23.3) 8(26.7) 15(50)	
ACS AWMI IWMI NSTEMI Unstable Angina	539(42.14) 477(37.29) 165(12.9) 98(7.76)	190(20) 227(23.9) 60(6.3) 33(3.5)	101(29.7) 62(18.2) 31(9.1) 13(3.8)	56(24.8) 50(22.1) 18(8) 12(5.3)	16(21.1) 15(19.7) 9(11.8) 5(6.6)	104(22.7) 76(16.6) 29(6.3) 27(5.9)	66(25.9) 40(15.7) 16(6.3) 8(3.2)	6(20) 7(23.3) 2(6.7) 0	<0.05
Diagnosis Normal Mild coronary stenosis Obstructive CAD	352(15.1) 189(8.1) 1794(76.8)	162(17.1) 83(8.7) 704(74.2)	38(11.2) 22(6.5) 280(82.4)	26(11.5) 14(6.2) 186(82.3)	8(10.5) 11(14.5) 57(75)	92(20) 40(8.7) 327(71.2)	24(9.4) 16(6.3) 215(84.3)	2(6.7) 3(10) 25(83.3)	
Obstructive CAD SVD DVD TVD	734(31.4) 516(22.1) 544(23.3)	314(33.1) 200(21.1) 190(20)	99(29.1) 81(23.8) 100(29.4)	76(33.6) 49(21.7) 61(27)	22(28.9) 21(27.6) 14(18.4)	147(32) 100(21.8) 80(17.4)	70(27.5) 60(23.5) 85(33.3)	6(20) 5(16.7) 14(46.7)	
Multivessel CAD	1060(45.4)	390(41.1)	181(53.2)	110(48.7)	35(46.1)	180(39.2)	145(56.9)	19(63.3)	
Left main disease	95(4.1)	33(3.5)	13(3.8)	9(4)	3(3.9)	20(4.4)	16(6.3)	1(3.3)	0.64
Isolated LM disease	10 (0.4)	1	3	2	0	4	0	0	0.18
Risk Factors present	1680(71.9)	678(71.4)	239(70.3)	179(79.2)	58(76.3)	323(70.4)	183(71.8)	20(66.7)	0.22
HTN	903(38.7)	407 (42.9)	108 (31.8)	88 (38.9)	37 (48.7)	163 (35.5)	86(33.7)	14(46.7)	
DM	714(30.6)	276 (29.1)	123 (36.2)	83 (36.7)	26 (34.2)	112 (24.4)	82 (32.2)	12(40)	
Smoking	563(24.1)	258 (27.2)	58 (17.1)	81 (35.8)	14 (18.4)	117 (25.5)	33 (12.9)	2(8.7)	<0.05
Tobacco	409(17.55)	81 (8.5)	110 (32.4)	51 (22.6)	5 (6.6)	71 (15.5)	88 (34.5)	3(10)	
Alcohol	337(14.4)	82 (8.6)	20 (5.9)	47 (20.8)	10 (13.2)	174 (37.9)	4 (1.6)	0	
Dyslipidemia	171(7.3)	73 (7.7)	21 (6.2)	21 (9.3)	8 (10.5)	27 (5.9)	18 (7.1)	3(10)	0.53

Table 2 shows the distribution and correlation of different parameters with ethnicity.

Discussions

Accurate diagnosis is of utmost importance in the evaluation of CAD. The diagnosis of stable CAD is best achieved nowadays by invasive CAG, a current gold standard.[8] Our study showed the most common indication for CAG was ACS 1279(54.8%). The ACC/AHA guideline also recommends CAG with the intent to perform PCI as a treatment of choice in STEMI as well as in patients with NSTEMI with high-risk features.[9]

CAG findings

Abnormal CAG was 1983(84.9%) and the normal was 352(15.1%). The presence of normal coronary is not uncommon in both chronic and acute coronary syndrome.[10] In a study done in Philipines[11] the normal coronaries were noted in 14% which is comparable to our study. According to a study done by Drabaa ZK et al., the incidence of normal coronary arteries observed during cardiac catheterization was 17.3%.[12] Meanwhile, a separate study by Bradley SM et al., reported that 21.4% of patients undergoing elective CAG had normal coronaries.[13]

The presence of obstructive CAD in our study was 1794(76.8%) mild coronary stenosis was 189(8.1%) and more in males 1202(67%). The result is similar to the study done in the Philippines where obstructive CAD was found in 75% of the patients.[11] The rate of obstructive CAD in another study by Ouellette ML et al was 55.5% but no gender differences in outcomes were observed.[14] In a study conducted at 691 U.S. hospitals, involving 565,504 patients without a history of myocardial infarction or revascularization who underwent elective CAG, the incidence of obstructive coronary disease was found to range from 23% to 100%.[15] In a study by Shaw et al, of the 375 886 patients, 58.7% had significant CAD.[16]

Among the obstructive coronary artery disease, the most common was SVD (40%). In a similar study, SVD was the most common finding (31%).[17] similar results were also seen in a study done in Iraq where SVD was 23.3%.[18] Left anterior descending artery (LAD) was the most frequently involved with 406 instances (55.31%), while RCA was affected in 222 cases (30.24%) and LCX in 106 cases (14.44%). A similar pattern was shown in other studies.[18,19]

Multivessel CAD

Multivessel CAD in our study was seen in 1060(45.4%). The findings are similar to the studies done in various other parts of the world. Meda JR et al 46%.[20] Baumann AA et al., reported a 42% prevalence of multivessel coronary artery disease in NSTEMI patients and about 40 to 50% prevalence observed in patients with STEMI.[21]

Left main disease

The prevalence of left main disease in our study was 4.1%, comparable to the 3.4% reported in a study by Ezhumalai B et al.[22]

Route of CAG

Femoral artery access is the time-tested method of performing percutaneous coronary interventions with some disadvantages like access site complications, and the need for recumbancy.[23] Majority of the CAG we performed was from the Radial artery 2000(85.7%). The findings are comparable to a study done by Lee Oh et al where the success rate of radial access was 83.3%.[24]

Risk factors

Coronary artery disease has been associated with various risk factors, including abnormal lipids, smoking, hypertension, diabetes, and alcohol consumption.[25] The most prevalent risk factors were HTN (38.7%). A 2014 study of residents aged 40-80 in Lamjung District, Nepal, reported a 42.9% prevalence of hypertension.[26] Similarly, research conducted in Iraq found hypertension to be the most common risk factor for CAD in patients undergoing CAG.[18]

Gender distribution

Among the total individuals who underwent CAG, male-dominated with 1463(62.7%) vs female 872 (37.3%). This shows gender differences in the utilization of the diagnostic procedure. Evidence suggests that women are less likely to undergo angiography and percutaneous coronary interventions, even in ACS situations.[27] Nonspecific chest pain, stable CAD, and ACS all were more common in males. STEMI NSTEMI and Unstable angina were more common in males (68.7%), (65.45%) and (55%) respectively. It has been shown in earlier studies that women are more likely to experience atypical chest pain than their male counterparts.[28] Among females, the common presentation of CAD was STEMI, in other studies the most common presentation was unstable angina or NSTEMI.[29] Normal coronaries was found mostly in females 195(55.4%) in our study. In a study done by Dave et al normal coronaries were found in 30.7%.[30] Obstructive CAD was more common in males (67% vs 33%). In a study done by Ezhumalai B et al[22] the prevalence of obstructive CAD was 45.4% in females. The study by Kim HL indicated that obstructive CAD was more prevalent in men (37%) compared to women (28.4%).[31] Similarly, Shaw et al., reported that the significant CAD affected 48.8% of women and 66.7% of men.[16] Almost 2/3rd of the females had obstructive CAD. In contrast to previous findings, which showed that nearly two-thirds of women undergoing elective CAG had non-obstructive CAD, this study presents a different outcome.[32] The reason could be the higher prevalence of increasing severe CAD among women of our population or early presentation at healthcare facilities. The presence of disease in a single, double, and triple vessel, is all significantly high among male SVD (66% vs 44%), DVD (67% vs 33%), and TVD (67% vs 33%). Similar presence of TVD among males was found in other studies.[33] The Multivessel CAD was high among the males (67% vs 33%). Studies conducted in the past have found multivessel disease and complex lesions are significantly less common in female patients compared to male patients.[33] Although the prevalence of left main disease was higher in males (68% vs 32%), the difference was not statistically significant. The findings align with a study by Kim et al., which also observed a higher prevalence of left main in men.[31]

Ethnic distribution

Ethnic variation in disease prevalence and presentation has been documented globally. According to cardiovascular registry data published by Shaw et al., there were notable variations in presentation and angiographic findings across different ethnic groups.[16] The proportion of CAG utilization differed significantly among the various ethnic groups. The majority of individuals undergoing CAG belonged to the Brahmin and Chhetri ethnic groups (949, 40.6%), while the lowest representation was from the 'other' category which primarily included individuals from the Marwari community. Ethnic differences in invasive cardiac procedure utilization have been documented in studies done across different parts of the world.[34] Studies have shown that cardiovascular disease presents differently among the different ethnic groups.[35,36] The most common indication for CAG was ACS across all ethnic groups. ACS was most common among Terai/Madhesi (60.9%) and Dalit (60.2%). There were wide variation in the findings of coronary angiograms across different ethnic groups. The study done by Shaw et al. revealed significant

variations in the likelihood of significant CAD at CAG and in-hospital mortality based on ethnicity and gender.[16] In the study conducted by Zaman MJ et al., there was a greater prevalence of CAD among South Asians.[37] This along with our study highlights the importance of doing further larger studies among the various ethnic groups. Obstructive CAD was highest among Muslims (84.3%), Terai/Madhesi (82.4%), Dalit (82.3%), and the individuals in the others category (83.3%). Of the total obstructive CAD, TVD was most common among Muslims (33.3%) and also in other categories (63.3%). The Multivessel CAD was highest among Muslims (56.9%) and others (63.3%).

The findings suggest that complex and severe CAD are common findings among Muslims, Dalits, and in the "other" category. One of the reasons could be the habit of chewing tobacco is quite prevalent in this part of Nepal and it was high among Muslims (34.50%) and Terai/Madhesi (32.35%). This association and other factors need to be studied in large randomized studies. The consumption of smokeless tobacco is prevalent in numerous regions globally, with WHO data highlighting South-East Asia as having the largest number of users.[38] In the case-control INTERHEART study, the odds ratio for non-fatal AMI was 2.23 (1.41-3.52) for chewing tobacco alone, while smokers who chewed tobacco had the highest increase in risk, with an OR of 4.09 (2.98-5.61).[39] A meta-analysis conducted in 2016 found that smokeless tobacco use was associated with an odds ratio (OR) of 1.40 (95%CI: 1.01-1.95) for non-fatal cardiac disease in Asia, but showed no significant effect in Europe (OR 0.91, 95% CI: 0.83-1.01). this association was confirmed by a 2018 study, which found a significant link between smokeless tobacco use and non-fatal cardiac disease in Southeast Asia (relative risk (RR) 1.30, 95%CI: 0.39-2.21), especially in Pakistan (RR 1.59, 95% CI: 1.34-1.83).[40] Similar associations with increased CAD risk in smokeless tobacco were also reported in the meta-analysis.[41]

A noteworthy observation was the occurrence of severe CAD among the "Other" groups. The majority of the group belonged to the Marwari community which is a strict vegetarian population. Studies have shown that a vegetarian diet is associated with an increased prevalence of hyperhomocysteinemia and decreased levels of serum vitamin B12.[42] Hyperhomocysteinemia has emerged as a significant risk factor for cardiovascular disease and atherosclerosis, with evidence showing that even mild levels can independently contribute to the risk of atherosclerosis and thromboembolic disorders.[43] In a Meta-analysis conducted by Sumit V. Unadkat et al, a significant association was found between higher homocysteine levels with CAD, although the certainty of the evidence was rated low. Additionally, the study noted that Asian and African populations had a stronger association compared to their European and American counterparts.[44] There is no direct causal relationship between homocysteine levels and cardiovascular outcomes, despite the evidence. Additionally, efforts to reduce plasma homocysteine through folate and vitamin B12 supplementation have not impacted cardiovascular outcomes.[45]

Study limitations

This study has several limitations that should be considered when interpreting the findings. First, the retrospective and observational nature of the study limits the ability to establish causal relationships between risk factors and outcomes. Data were collected from existing medical records, which may be subject to incomplete documentation, potential biases, and variability in diagnostic and treatment approaches over time. Second, as a single-center study, the findings may not be generalized to other institutions or populations with different demographic, geographic, or clinical characteristics. Third, the absence of randomization introduces the possibility of selection bias, as patients were not assigned to groups in a controlled manner. Finally, due to the limited sample size and non-prospective design, certain confounding factors may not have been adequately controlled.

Conclusions

The study highlights that ACS was the most frequent clinical indication prompting CAG, indicating its critical role in the early diagnosis and management of patients with suspected coronary artery disease. Among the angiographic findings, obstructive coronary artery disease emerged as the most common pathology. Notably, the prevalence of this condition was disproportionately higher among male patients and individuals belonging to the Terai/Madhesi, Dalit, and Muslim communities, suggesting potential sociodemographic and genetic predispositions. These findings underscore the importance of considering both clinical and population-based risk factors in cardiovascular assessment. However, to establish a definitive causal relationship between these risk factors and the angiographic outcomes—as well as to assess their impact on prognosis—larger, multicenter studies employing prospective, randomized methodologies are essential. Such studies would provide more robust evidence to guide risk stratification, prevention, and management strategies in diverse populations.

Conflict of Interest

The authors report no conflicts of interest.

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None

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Original Article

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Study of Incidence, Outcome and Relevant Factors of No Reflow and Slow Flow After Primary Percutaneous Coronary Intervention in Acute Myocardial Infarction

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Abstract

Background: Early primary percutaneous transluminal coronary angioplasty (PTCA) is a cornerstone therapy for patients with ST elevation myocardial infarction(STEMI). However, the no-reflow and slow flow phenomena occur in nearly one-third of primary PTCA cases. This study aims to investigate the incidence and outcome of no-reflow/slow flow and the clinical, angiographic, and interventional characteristics associated with these phenomena.

Methods: This retrospective study analyzed a prospectively maintained database from October 2022 to September 2023, enrolling 118 STEMI patients who underwent primary PTCA. We evaluated various clinical, angiographic, and interventional factors correlated with the occurrence of no-reflow phenomena.

Results: Among the 118 STEMI patients, no-reflow/slow flow was observed in 39 patients (33.1%). In the no-reflow/slow flow group, 66% had diabetes, and 77% were current smokers, compared to 40% and 54%, respectively, in the reflow group. The left anterior descending (LAD) artery was the culprit in 69% of the no-reflow/slow flow cases and was associated with longer target lesion lengths. Ventricular tachycardia (VT) occurred in 18% of the no-reflow group versus 3.7% of the reflow group.

Conclusion: There is a high incidence of no-reflow/slow flow in our study, likely due to late presentation to the emergency room. Refractory no-reflow during primary PTCA is associated with an increased risk of major adverse cardiovascular events, underscoring the need for prompt intervention.

Keywords: Cardiovascular events, No-reflow phenomena, Primary PTCA, STEMI

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Introduction

Acute myocardial infarction (MI) with ST-segment elevation is caused by plaque rupture or erosion of an atherosclerotic plaque that leads to thrombotic occlusion of the epicardial coronary artery[1]. Primary percutaneous transluminal coronary angioplasty (PTCA) of infarct related artery (IRA) is the best treatment modality to open the occluded coronary artery promptly[2]. Microvascular obstruction (MVO) and distal embolization reduce the beneficial effects of a successful recanalization of the infarct-related artery[1].

No-reflow phenomenon is a serious complication that occurs after opening of an infarct related artery and manifests as inadequate myocardial perfusion through a given segment of the coronary circulation without angiographic evidence of mechanical vessel obstruction[1,3]. It results in worse outcome of these patients; therefore no-reflow must be treated to avoid the adverse consequences[1].

Prevalence of no reflow is upto 32% in primary PTCA of ST elevation myocardial infarction (STEMI) patients and is associated with different clinical, angiographic and procedural risk factors[4]. Older age, comorbid status, prior MI, delayed presentation, and large thrombus burden are predominant risk factors[2]. It may occur due to incomplete stent expansion, vasospasm, use of multiple stents, longer stent length, dissection or in situ thrombosis[2].

Mechanism of no-reflow is multifactorial, but ischemia–reperfusion injury plays a key role[1,5]. Early detection, preventive measures, and treatment of no-reflow are crucial, and the drugs used for this purpose dilate the microcirculation, such as adenosine, glyceryl trinitrate, verapamil, and adrenaline[1,7,8].

In this study, we aimed to investigate the clinical, angiographic and procedural factors related with no reflow or slow flow in patients undergoing PTCA for acute STEMI.

Materials and Methods

This was a retrospective study of prospectively maintained database over a period of one year at the Department of Cardiology, Manmohan Cardio-thoracic Vascular and Transplant Center (MCVTC). A prior approval from Institutional Review Committee {IRC number: 337(6-11)E2} was gained. Keeping in consideration the inclusion and exclusion criteria in study protocol, one hundred and eighteen STEMI patients who had undergone primary PTCA in the cardiac catheterization lab of MCVTC from October 2022 to September 2023 were enrolled and evaluated:

Inclusion Criteria

- Acute STEMI patients who have undergone primary PCI

Exclusion Criteria

- Patients who underwent plain old balloon angioplasty (POBA)
- Patients with unsuccessful primary PCI and pretreatment with fibrinolysis before primary PCI
- Acute non ST elevation MI (NSETMI) patients who have indications for primary PCI were not included
- Patients with severe liver or renal disease, neoplasms

Diagnosis of STEMI was based on 2021 AHA/ACC/ASE/CHEST/SAEM/SCCT/SCMR guidelines for the evaluation and diagnosis of chest pain. Significant coronary artery disease was defined as the presence of at least 70% stenosis in at least one epicardial artery. No reflow and slow flow were graded according to the TIMI grades. No reflow was defined as TIMI flow 0 or 1 and slow flow was graded as TIMI flow 2. TIMI 3 flow was considered reflow group.[4]

Data collection was limited to existing records, as no face-to-face interactions were conducted with patients or their families. The information about demographic profile, risk factors, clinical characters and examination findings were collected from in-patient files obtained from medical record section. Details regarding angiographic information and intervention and final in-hospital outcome were obtained from procedural notes, in-patient files and video recordings that were accessed from cardiac catheterization lab.

All of the patients received 300 mg of aspirin, 600 mg of clopidogrel and 40 mg of rosuvastatin immediately at emergency room and 10,000 U of intravenous heparin before PTCA. PTCA was performed using standard radial or femoral artery approach and IRA was successfully revascularised after angiography. Intracoronary medications were used as adjunctive pharmacotherapy to alleviate no reflow/slow flow as per operator choice. Manual aspiration thrombectomy was performed as bail-out procedure and GpIIb/IIIa inhibitors were used in patients with TIMI flow less than or equal to one.

Patients were divided into two groups based on post-procedural TIMI flow grades. Patients with TIMI score of 2 or less were categorized as no reflow or slow flow group and those with TIMI flow 3 were categorized as reflow group. Collected data was analyzed using IBM SPSS (version 21). Distribution of baseline characteristics categorized as continuous variables and categorical variables were expressed as mean ± standard deviation (SD) as frequency percentages (%) respectively. Comparison of demographic profile, risk factors, clinical characters and angiographic profile between no-reflow/slow flow and reflow group was done by conducting appropriate independent sample t-test/ Chi-square and Fischer's exact test. P-value ≤0.05 was taken as criteria for statistical significance.

Results

During the period of study, total of 136 patients underwent primary PCI among which eight cases underwent POBA only. Similarly six NSTEMI patients and four chronic kidney disease (CKD) patients were also excluded from the study. After excluding these eighteen patients, a total of 118 patients were included for analysis among which 73 were men (61.9%) and rest were women (38.1%) with a mean age of 58±13. There were 39 cases in no reflow/slow flow group (33.1%) and 79 cases in reflow group (66.9%).

Table 1 shows the stratified data of baseline and presenting characteristics among no-reflow/slow flow versus reflow groups. No-reflow phenomena most commonly occurred in patients who were current smokers and who had underlying diabetes and the association was statistically significant with p-value <0.05.

In no-reflow/slow flow group diabetes was found in 66% of patients versus 40% in reflow group. Similarly, in no-reflow group 77% of patients were current smokers whereas in reflow group only 54% were current smokers. In addition, they were older in age, had co-existent hypertension and presented late in emergency room as compared to patients in reflow group. However statistically significant difference was noted only in patients with diabetes (p-value 0.011) and current smokers group (p-value 0.026).

Table 1: Baseline and presenting characteristics among study patients of no-reflow/slow flow and reflow groups

Variables	Reflow(n=79)	No reflow and slow flow(n=39)	P-value
Age	57.70+/-12.84	59.72+/-14.72	0.467***
Male	49	24	1.000*
Duration(hours)	19.06+/-25.66	23.59+/-22.28	0.326***
Co-morbidities			
Diabetes	32	26	0.011*
Hypertension	37	21	0.056*
Dyslipidemia	19	4	0.088*
Hypothyroidism	8	3	0.751*
Chronic Kidney Disease	2	0	1.000**
Chronic Obstructive Airway Disease	2	1	1.000**
Prior History			
Prior stroke	3	0	0.550**
Prior Myocardial Infarction	7	0	0.094**
Prior CABG	1	1	1.000**
Prior PTCA	5	0	0.169**
Risk factors			
Smoking	43	30	0.026*
Alcohol	24	18	0.105*
Chewing Tobacco	6	4	0.728**
Substance abuse	0	1	0.331**
Clinical characters			
Chest Pain	62	33	0.471*
Dyspnoea	19	18	0.020*
Syncope	9	3	0.748*
Systolic BP(mm Hg)	123.52+/-28.6	109.4+/-28.23	0.013***
Heart Rate(bpm)	79.78+/-21.15	90.51+/-20.78	0.010***
LVEF(%)	43.73+/-9.04	38.04+/-6.04	0.001***
Killip Class			
Class I	27	12	0.123*
Class II	34	11	
Class III	12	8	
Class IV	6	8	
Territory by ECG			
Anterior wall STEMI	35	26	0.099**
Inferior wall STEMI	36	12	
Posterior wall STEMI	4	1	
Antero-lateral wall STEMI	4	0	
In Hospital Complications and outcome			
Ventricular Tachy-cardia	3	7	0.015*
S/P DC shock	3	7	0.015**
S/P CPR	2	3	0.330**
Mortality	4	4	0.437**
Repeat Vascular-ization	2	2	0.598**
Stroke	2	0	1.000**
Complete Heart Block	10	3	0.541**
Heart Failure	14	9	0.622*
Vascular Compli-cations	6	3	1.000**

BP: Blood pressure; CABG: Coronary artery bypass graft; CPR: Cardio-pulmonary resuscitation; DC: Direct Current; LVEF: Left ventricular ejection fraction; PTCA: Percutaneous coronary intervention; STEMI: ST elevation myocardial infarction

*=Chi-square **= Fischer ***=T-test

Dyspnea was the presenting complaint in most of the patients in no-reflow/slow flow group and had tachycardia, low blood pressure and low ejection fraction at baseline compared to reflow group. Heart failure was observed in 23% of no reflow/slow flow group versus 17.7% in reflow group. In no-reflow group, 20.5% of patients presented in Killip class IV versus 7.5% in reflow group. No-reflow/slow flow mostly occurred in anterior wall STEMI however the association was not statistically significant (p-value 0.099).

In no-reflow group , GP IIb/IIIa was used in six cases along with other intracoronary medication like adrenaline, glyceryl trinitrate and verapamil. Check CAG was done before discharge of these six cases which revealed TIMI 3 flow in three cases, TIMI 2 flow in two cases and TIMI 1 flow in one case. Thrombus aspiration was also done in one case along with use of GP IIb/IIIa inhibitors.

None of the patients with history of prior MI and prior PTCA developed no-reflow phenomena. Patients in no-reflow/slow flow group developed sustained ventricular tachycardia requiring DC shock, which is significantly higher in comparison to reflow group (18% versus 3.4%) with p-value 0.015. Mortality rate was 10.2% in no-reflow/slow flow group compared to 5% in reflow group, however the difference was not statistically significant.

In reference to angiographic and interventional data depicted at Table 2; left anterior descending artery was the culprit IRA in majority of the patients exhibiting no-reflow phenomena and the association was statistically significant (p-value 0.03). No-reflow/slow flow was noted in many cases when the target lesion was more proximal , longer in length and had high thrombus burden but the results was statistically significant only for target lesion length (p-value 0.031). The lesion was located proximally in 59% of patients in no-reflow group versus 37% in reflow group. Similarly, two stents were used in 15.4% of patients in no-reflow group versus 7.6% in reflow group.

Table 2: Comparison of angiographic and interventional findings among no-reflow/slow flow and reflow groups

Variables	Reflow (n=79)	No reflow and slow flow (n=39)	P-value
Number of vessels			
Single vessel disease	33	18	0.692*
Double vessel disease	28	15	
Triple vessel disease	18	6	
Infarct related coronary artery			
LAD	32	27	0.030**
RCA	32	10	
LCx	10	1	
Major OM	3	0	
RI	1	1	
D1	1	0	
Initial TIMI flow grade			
0	44	23	0.964*
1	20	9	
2	15	7	
Target lesion location			
Proximal	29	23	0.078*
Mid	37	12	
Distal	13	4	
Thrombus Burden			
Low(Grade 0 and 1)	0	0	0.471*
Intermediate(Grade 2 and 3)	17	6	
High(Grade 4 and 5)	62	33	
Target lesion length(mm)	18.87+/-8.20	22.69+/-10.13	0.031***
Number of stents			
1	73	33	0.207**
2	6	6	
Stent Length(mm)	27.20+/-7.92	28.28+/-7.93	0.489***
Stent Diameter(mm)	2.99+/-0.41	3.06+/-0.37	0.348***
Pre-dilation	68	36	0.383**
Post-dilation	59	33	0.248*
Final TIMI			
1	0	15	<0.001*
2	0	24	
3	79	0	
Check CAG at discharge	0	6	<0.001**

CAG: Coronary angiography; D1: 1st diagonal; LAD: Left anterior descending; LCx: Left circumflex; OM: Obtuse marginal; RCA: Right coronary artery; RI: Ramus intermedius; TIMI: Thrombolysis in myocardial infarction

*=Chi-square **= Fischer ***=T-test

Multivariate logistic regression analysis was done with the variables that had significant statistical association between either of the groups. However, significant association was noted only with tachycardia at presentation (p-value 0.034) and in-hospital complication of ventricular tachycardia (p-value 0.018) as shown in Table 3.

Table 3: Independent associations for no-reflow/slow flow phenomena after primary PTCA

Variable	Odds ratio	Confidence Interval	P-value
Diabetes	2.520	0.987-6.42	0.053
Smoking	2.424	0.909-6.464	0.077
Dyspnoea	0.657	0.164-2.629	0.552
Systolic BP	0.992	0.973-1.011	0.40
Heart rate	1.028	1.002-1.054	0.034
LVEF(%)	0.940	0.854-1.034	0.200
Target lesion length	0.119	0.00-3.091	0.994
Ventricular tachycardia	5.542	1.347-22.793	0.018
S/P DC shock	2.091	0.387-11.288	0.391

BP: Blood pressure; DC: Direct current; LVEF: Left ventricular ejection fraction

Discussion

Incidence of no-reflow/slow flow phenomena during primary PTCA of STEMI patients in our study is 33.1 % and is significantly associated with older age, smoking habit, co-existent diabetes, decreased LVEF at presentation, longer target lesion length and LAD being the culprit artery. Similarly, patients presenting with dyspnea, tachycardia and hypotension were significantly predisposed to develop no-reflow. Complication like ventricular tachycardia, need of DC shock and cardio-pulmonary resuscitation were also higher in no-reflow group indicating the increased incidence of major adverse cardiovascular events associated with refractory no flow. The incidence of no-reflow/slow flow phenomena in our study is comparable to studies conducted by Shahin et al. and Rezkella et al with reported incidence of 32.8% and 32% respectively[2,5,8]. In the study done by Harrison R. et al and Goutam D. et al , the incidence of no-reflow was 2.3% and 7.75% respectively[2,5]. Variable incidence of no reflow phenomena among different studies is supposed to be only due to different sample sizes, difference in duration of presentation and inclusion/exclusion criteria for selection of study populations.

There was increased propensity of no-reflow phenomena in older patients, diabetics, current smokers and late presenting patients in our study and similar results have been observed in many studies done earlier[4,6,8]. The mean age of patients in no reflow group was 59.72± 14.72 years and in reflow group was 57.70±12.84 years and this consistent with study done by Kumar D. et al[1]. Diabetes and smoking which are the major factors responsible for endothelial and micro-vascular dysfunction has been associated with no-reflow phenomena in our study and likewise depicted in study by Goutam D. et al. Endothelial dysfunction, micro-thrombosis, chronic inflammation and platelet dysfunction occurred predominantly in patients with diabetes and also results from exposure to free radicals and various toxins in smokers that leads to micro-vascular dysfunction and subsequent no-reflow phenomena[2]. We also found that patients presenting with dyspnea, low LVEF, low systolic BP and increased heart rate had higher probability of developing no-reflow phenomena. As there are high chances of no-reflow phenomena in STEMI patients presenting with heart failure and severe LV dysfunction, post-dilation is preferably discouraged and use of intracoronary vasodilators and intravenous anti-platelets is contemplated in this subset of patients.

Among the angiographic and interventional correlates, incidence of no-reflow/slow flow was higher in left anterior descending artery and patients with longer target lesion length which was similar as reported in study by Alidoosti M. et al[4]. They tend to develop more complications during hospital stay like ventricular tachycardia, subsequent DC shock and cardio-pulmonary resuscitation.

We also found that patients with anterior wall STEMI, higher Killip class and those with target lesion located proximally had higher incidence of no-reflow/slow flow although not statistically significant. Alidoosti M. et al. reported significant association between no-reflow phenomena and lesser TIMI flow at presentation and higher TIMI thrombus grades but in our study there was no significant association which is only supposed to be due to low sample size in our study[4].

There is complex association of various mechanisms that results in occurrence of no-reflow after primary PTCA. Among the vessel related etiologies; endothelial and microvascular dysfunction, distal embolization of thrombus, vessel spasm, excess post-dilation and reperfusion injuries contributes for major causes[7].

In addition, types of stent, length and diameter of stents, length and diameter of balloon, and balloon inflation pressure has been associated with no reflow phenomena. Pre-dilation and post-dilation status has no significant association with no-reflow phenomena in our study similar to results of Alidoosti M. et al[4]. No-reflow phenomena was significantly higher in patients in whom stents of longer length and wider diameter were used as reported in study done by Babapour B. et al. and Alidoosti M. et al[4,6]. However in our study, although there was higher incidence of no-reflow in patients in whom stents of longer length and diameter were used, the results were not statistically significant which also could be due to small sample size of our study and association of confounding factors like diabetes, smoking, vascular territory, thrombus burden and duration of symptoms that intricate the result .

However there were few limitations in our study like small sample size, derivation of data only from medical records rather than face to face interview, and analysis of in-hospital outcome only.

Conclusion

This study depicts the higher risk groups that are not likely to benefit from primary PTCA. However, since the imaging modality in these acute conditions are not recommended before the procedure, the findings are best used to counsel the patients regarding the possible complications. Therefore, we need to be aware of the possible risk factors that are associated with the no-flow or slow-flow phenomenon.

Declaration of patient consent

The authors certify that they have obtained consent from the parent for publication of clinical information and investigation report.

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Conflicts of interest

There are no conflicts of interest.

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Original Article

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Hepatitis B Vaccination Status among Healthcare Workers in a Tertiary Cardiac Centre: A Descriptive Cross-sectional Study

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Abstract

Background: Healthcare Workers (HCWs) are at increased risk of occupational exposure to the Hepatitis B virus infection, making vaccination crucial for infection prevention. This study aims to assess vaccination coverage and identify factors influencing uptake among HCWs at a tertiary cardiac center.

Methods: We conducted a descriptive cross-sectional study at Shahid Gangalal National Heart Centre (SGNHC), involving 479 healthcare workers, including doctors, nurses, paramedical staffs, and support personnel. Data were collected using a structured electronic and paper-based questionnaire, ensuring comprehensive coverage of vaccination history and awareness.

Results: Participants had a mean age of 32.79 ± 9.0 years, with 43 (8.98%) males and 436 (91.02%) females. Of the 479 workers, 179 (37.36%) received complete vaccinations, while 215 (44.89%) received incomplete doses, and 85 (17.75%) had no record of vaccination. The primary reason for non-vaccination was a lack of awareness, reported by 58 (12.11%) of participants; knowledge of the required doses of the vaccination series was 74.11% and 19.62%, respectively.

Conclusion: In conclusion, the vaccination coverage among healthcare workers at this tertiary cardiac center is low, primarily attributable to inadequate knowledge and awareness. Institutional policies mandating HBV vaccination and education initiatives are recommended.

Keywords: Hepatitis B Vaccine, Infection control, Occupational health

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Introduction

Hepatitis B virus (HBV) infection is a public health concern, especially among frontline healthcare workers (HCWs). Primary strategy for its prevention is vaccination. It is effective and has been available since 1982.[1] Healthcare workers need special consideration for hepatitis B virus (HBV) vaccination, however, this is not widely implemented in low- and middle-income countries.[2] Different factors influence vaccination status, such as lack of knowledge and awareness, cost, availability, and hesitancy.[3]

Healthcare workers are exposed to various potential sources of bloodborne pathogens and play a pivotal role in patient care.[4] Despite advancements in infection control practices and the availability of safe and effective hepatitis B vaccines, a substantial proportion of healthcare workers globally remain susceptible to HBV infection.[5]

This study aimed to assess the hepatitis B vaccination coverage and identify factors that influence or hinder vaccination uptake among healthcare workers in a tertiary cardiac center. It will help to strengthen vaccination campaigns, propose evidence-based recommendations to boost immunization efforts, and mitigate the risk of hepatitis B transmission in healthcare settings.

Methods

A cross-sectional study was conducted at Shahid Gangalal National Heart Centre (SGNHC), a tertiary cardiac Centre in Nepal, after obtaining an ethical approval from the Institutional Review Committee, SGNHC (IRC No. 13-2023). Data were collected from 13 December 2023 to 18 April 2024 while maintaining participants' confidentiality. An enumerative sampling method, which included every eligible unit in the population, was employed. A total of 479 healthcare workers (HCWs) representing various job roles such as doctors, nurses, paramedical staffs, and support personnel were included. All current employees who provided consent to participate were included, while former employees and those on leave were excluded. Data were collected using a structured questionnaire via Kobo Toolbox; the web-based and paper-based questionnaire. The questionnaire covered demographic information, vaccination history, awareness, knowledge, barriers, facilitators, and prior hepatitis B infection. Validity of the questionnaire was ensured by infection prevention and control experts of the center. SPSS version 20 was used for data analysis. For continuous variables (age), mean ± Standard Deviation and for categorical values (education, gender etc.), median and inter quartile range was calculated. The association of categorical variables was determined by Chi-square test. A P-value of less than 0.05 was considered to be significant.

Results

Out of a total of 668 healthcare workers approached for participation in the study on hepatitis B infection, 479 individuals responded and completed the survey, resulting in a response rate of 71.74%. The mean age of the participants was 32.79 years with a standard deviation of ±9.0 years, indicating a relatively young workforce. The majority of participants were female (91.02%), while only 8.98% were male. Regarding educational background, the largest proportion had attained a bachelor's degree (59.5%), followed by higher secondary education (12.32%) and master's degree holders (10.02%). A small portion of the participants were either illiterate (4.18%) or had only completed primary education (4.59%). In terms of professional roles, three-fourths (75.16%) were medical personnel, whereas 24.84% were engaged in non-medical roles within the healthcare setting.

Table 1: Socio-demographic Characteristics

S. No.	Variables	Number (n=479)	Percent
1.	Age (mean)	32.79 ± 9.0 years	
2.	Gender		
	• Male	43	8.98
	• Female	436	91.02
3.	Educational status		
	• Illiterate	20	4.18
	• Primary Level	22	4.59
	• Secondary Level	45	9.39
	• Higher Secondary Level	59	12.32
	• Bachelor	285	59.50
	• Masters	48	10.02
4.	Designation		
	• Medical	360	75.16
	• Non-medical	119	24.84

Table 2 shows that 37.36% of workers had received the complete doses, 44.89% had received incomplete doses, and 17.75% had not received the hepatitis B vaccine. The main reason for not receiving the vaccine was a lack of awareness, reported by 12.11% workers.

Table 2. Hepatitis B vaccination status

S. No.	Variables	Number (n=479)	Percent
1.	Have you received the Hepatitis B vaccine?		
	• Yes		
	▫ Complete Dose	179	37.36
	▫ Incomplete Dose	215	44.89
	• No	85	17.75
2.	If you have not received the Hepatitis B vaccine, please specify the reasons:		
	• Concerns about vaccine safety.	11	2.30
	• Lack of awareness about the vaccine.	58	12.11
	• Medical reasons (e.g., allergies).	2	0.42
	• Others	14	2.92

Table 3 shows the knowledge and practices of the participants. Majority (77.45%) of respondents reported that they followed standard precautions during patient care, while others practicing them "often" (15.03%), "sometimes" (4.80%), "rarely" (1.46%), or "never" (1.26%). About 17.95% of participants had experienced an occupational exposure (e.g., needle-stick injury), but only 12.53% had had post-exposure prophylaxis after such incidents.

The knowledge assessment showed that 96.87% correctly identified the primary purpose of the HBsAg vaccine. However, 59.71% incorrectly believed that the vaccine provides lifelong immunity, highlighting a significant knowledge gap. Most participants (79.95%) recognized sexual contact as a major route of transmission, while a smaller group (15.87%) correctly identified close contact (horizontal transmission). A majority (74.11%) knew that three doses are required for a complete vaccination schedule, and 76.20% selected the recommended 0-, 1-, and 6-months schedule. In terms of additional preventive practices, 59.92% correctly noted that practicing safe sex, while 26.72% chose hand hygiene and 10.23% mentioned regular follow-up. Nearly all participants (98.96%) knew that hepatitis B can be prevented by the vaccine.

Table 3. Hepatitis B Knowledge and Practice

S. No.	Variables	Number (n=479)	Percent
1	Do you consistently practice standard precautions while providing patient care?		
	• Always	371	77.45
	• Often	72	15.03
	• Sometimes	23	4.80
	• Rarely	7	1.46
	• Never	6	1.26
2	Have you ever experienced an occupational exposure (e.g., needlestick injury) involving a potentially infected patient?		
	• Yes	86	17.95
	• No	393	82.05
3	Did you seek medical attention and follow the appropriate post-exposure protocols?		
	• Yes	60	12.53
	• No	26	5.42
4	What is the primary purpose of the HBsAg vaccine?		
	• To treat Hepatitis B infection	6	1.25
	• To screen for Hepatitis B infection	5	1.04
	• To prevent Hepatitis B infection*	464	96.87
	• To cure Hepatitis C infection	4	0.84
5	How is Hepatitis B primarily transmitted?		
	• Through the air	8	1.67
	• Through contaminated water	12	2.51
	• Through sexual contact	383	79.95
	• Through close contact (Horizontal Transmission) *	76	15.87
6	How many doses are typically required for a complete HBsAg vaccination series?		
	• 1 dose	20	4.18
	• 2 doses	10	2.09
	• 3 doses*	355	74.11
	• 4 doses	94	19.62
7	What is the recommended dosing schedule for the HBsAg vaccine?		
	• 0, 1, and 2 months	42	8.76
	• 0, 1, and 6 months*	365	76.20
	• 0, 2, and 12 months	20	4.18
	• 0, 6, and 12 months	52	10.86
8	Does HBsAg vaccine provide lifelong immunity after completion of the recommended doses?		
	• True	193	40.29
	• False*	286	59.71
9	In addition to vaccination, what other practice is important for preventing Hepatitis B transmission?		
	• Regular follow up	49	10.23
	• Sharing personal items	15	3.13
	• Practicing safe sex*	287	59.92
	• Effective hand hygiene	128	26.72
10	Which of the following diseases can be prevented by the HBsAg vaccine?		
	• Measles	1	0.21
	• Tuberculosis	4	0.84
	• Polio	0	0
	• Hepatitis B*	474	98.96
11	Are you aware of the proper protocols for handling sharps and disposing of them safely?		
	• Yes	457	95.41
	• No	22	4.59

*Indicates the correct response

Discussion

This study was conducted to assess the hepatitis B vaccination coverage, knowledge, and practices among healthcare workers (HCWs) at a tertiary cardiac center in Nepal. The findings point out the issues related to hepatitis B immunization status and associated awareness among frontline health professionals. The study population was predominantly young, with a mean age of 32.79 years, and had a notably high proportion of female workers (91.02%) as most of the responder are nursing staffs.

In a previous study done in Gandaki Province in Nepal, the study participant's mean age was 25.4 ± 5.6 with only half (51.7%) of the participants being completely vaccinated. The major reason for not getting vaccination was negligence.[6] In our study, 82.25% of the healthcare workers received at least one dose of the vaccine which is similar to the multi-site study conducted in China (80.8%).[7] Among the healthcare workers who were not vaccinated (17.75%), the main cause of non-vaccination was lack of awareness (12.11%). Studies have found that hepatitis B vaccination rates among healthcare workers vary due to factors like unavailable vaccines, busy work schedules, costs, and concerns about vaccine safety.[2] A multicenter cross-sectional study conducted in Bangladesh across 11 tertiary hospitals involving 2,046 healthcare workers reported an overall hepatitis B vaccination coverage of 66.6%. This finding was higher than the complete vaccination rate observed in our study. Majority of unvaccinated healthcare workers in that study expressed willingness to receive the vaccine if it were offered at no cost. This reflects a common barrier across resource-limited settings like ours.[8]

Although 95.41% of the healthcare workers were aware of proper protocols for handling and disposing of sharps, 17.95% of the healthcare workers have encountered an injury in our setting, which is high, indicating the need for proper monitoring of safe healthcare practices. A study done in a similar setting also showed inadequate knowledge of needle stick injuries among healthcare workers and a lack of appropriate precautions.[9] There is a need to update and implement protocols regarding needlestick injuries, especially considering challenges like busy schedules, costs, and vaccine safety concerns.[2]

In our study, participants showed fair knowledge of the hepatitis B vaccine, as 96.87% knew the primary aim of vaccination and 74.11% correctly answered the total number of doses for complete vaccination. These findings are similar to a recent study done among healthcare workers in Cambodia, which demonstrated adequate knowledge of the hepatitis B virus and vaccination with a mean knowledge score of 7.3 ± 1.6.[10] However, 40.29% still think that complete vaccination provides lifelong immunity, which is alarming because these individuals might not seek post-exposure prophylaxis, and contact transmission is fairly common due to occupational exposure. The majority of respondents, i.e., 383 (79.95%) participants in our study, marked sexual contact, and only 76 (15.87%) marked close contacts such as needle stick injury, tattooing, piercing, community shaving, or sharing of sharps at home or workplaces as the primary source of HBsAg transmission. This highlights the importance of awareness of post-exposure prophylaxis among healthcare workers.

Blood-borne diseases like Hepatitis B virus (HBV) in HCWs have been significantly found as a result of occupational exposure to contaminated sharps.[11] Transmission risk was found to be 2-40% for HBV through percutaneous injuries, as per previous studies.[12] So, assessing and emphasizing hepatitis B vaccination among HCWs holds increasing importance in medical practice. Studies also indicate an impact on the psychological well-being of the wounded HCWs, affecting their quality of life due to anxiety and concerns about contracting the sickness or infecting their family.[13]

As per a meta-analysis, measures on prevention to decrease the risk of HBV on HCWs which includes educational awareness, training HCWs on universal safety precautions, safe injection practices, sharp waste disposal, and delivery of engineered safety devices by the health care institution will contribute to reduce occupational exposure by 62%.[14]

Low cost of HBV vaccination and its effective prevention as stated by other studies will be an economical move for a country like Nepal.[15] Inadequate vaccination coverage not only puts healthcare workers at risk but also poses a potential threat to patient safety, as infected healthcare workers can inadvertently transmit the virus to patients. In addition, it can be used as an effective Post-Exposure Prophylaxis (PEP) due to its feasible exposure management.[11] So, efforts should be made to immunize the HCWs as early as possible in their career.

The strength of our study is that we have assessed knowledge and practices of HBV vaccination among the high-risk groups of occupational exposure. This study has a few limitations. Self-reporting of vaccination could introduce recall bias, potentially leading to both underestimation and overestimation of hepatitis B vaccination status which affect the accuracy of coverage estimates and actual awareness or adherence to safety protocols. The study was conducted at a single tertiary cardiac center in Nepal; therefore, the findings cannot be generalized to other healthcare institutions in Nepal or similar low-resource settings. The population in a cardiac center may differ significantly in terms of awareness, education, and access to vaccination compared to those in general or rural hospitals.

Based on our study findings, following recommendations can be proposed to improve hepatitis B vaccination coverage among healthcare workers. First hospitals should make vaccination mandatory for all new staff and offer the vaccines for free or at a low cost. Secondly regular training and awareness programs should be held to correct common misconceptions—like the belief that the vaccine gives lifelong protection. Lastly, hospitals should also keep a record of vaccination status of the staffs.

Conclusion

Although hepatitis B vaccination uptake among healthcare workers at our center is better than some previous reports, significant gaps in coverage and awareness persist, particularly the need for post-exposure prophylaxis and the misconception of lifelong immunity after complete vaccination. Despite good general knowledge, a considerable number of healthcare workers remain unvaccinated due to a lack of awareness.

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Conflicts of Interest

None

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Age and Defect Size as Predictors of Pulmonary Hypertension in Secundum Atrial Septal Defect: A Retrospective Study from the Himalayan Region

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Abstract

Background and aims: Atrial septal defect is a common congenital heart disease. Most patients are asymptomatic. The incidence and progression of pulmonary hypertension in these defects have important clinical implications. We sought to establish the role of age and defect size as predictors of pulmonary hypertension.

Methods: Hospital discharge summaries of patients who underwent surgical defect closure by a single unit of Shahid Gangalal National Heart Center between 2018 and 2023 were retrospectively reviewed. Baseline variables and echocardiography data were analyzed using SPSS. Pulmonary artery systolic pressure of > 50 mmHg in echocardiography was used to define pulmonary hypertension. A p-value of <.05 was considered significant.

Results: A total of 407 patients underwent atrial septal defect closure during that period, with a mean age being 22.1±12.5 (3-55) years and one-third (32.2%) being males. The majority (84.6%) were in NYHA I or II functional class. Mean pulmonary artery systolic pressure was 47.0±11.8 (24-113)mmHg. Mean indexed defect size was 2.2±0.8 (1.1-6.0) cm/m2. Age had a positive correlation of 0.38 with pulmonary artery systolic pressure (p <.001). Interestingly, indexed defect size had a negative correlation of .15 with pulmonary artery systolic pressure (p=.002). Multiple regression showed only age as the significant factor predicting pulmonary hypertension with a standardized beta of .357 (p<.001). Receiver operating characteristic curve analysis showed an area under the curve of. 733, p<.001 for age and pulmonary artery systolic pressure.

Conclusions: Patients' age and not the indexed size of the defect dictate the development of pulmonary artery hypertension in patients with secundum atrial septal defects.

Keywords: age, atrial septal defect, pulmonary artery hypertension

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Introduction

Atrial septal defect (ASD) is a common congenital heart disease accounting for 6–10% of all congenital heart diseases, and it has a prevalence of 2 to 3.89 per 1000 children.[1] Pulmonary arterial hypertension (PAH) is seen in 6% to 35% of patients with ASD secundum.[2-7] Pulmonary hypertension in ASD is due to the left-to-right shunt through the defect which results in right ventricular volume overload and pulmonary overcirculation.[8] Long standing pulmonary hypertension in a case of ASD might result into Eisenmenger's syndrome and no longer be operable. Moreover, we are not sure about the rate of progression of pulmonary hypertension; and there is clinical uncertainty regarding the relative influence of age versus defect size on the development of PAH. Our study aims to determine whether patient age or indexed atrial septal defect size is the primary predictor of pulmonary arterial hypertension in patients with secundum-type atrial septal defects.

Methods

We designed a retrospective cohort study analyzing hospital discharge summaries of patients who had undergone surgical ASD closure for secundum type ASD by a single team of Department of Cardiac Surgery at Shahid Gangalal National Heart Center between 2018 and 2023. There are two teams in the department, both would be operating on similar types of cases. Because of the ease of data availability, we included the cases from only one team. Patients with primum type of defect, sinus venosus type of defect, and patients with associated other cardiac anomalies were excluded. All patients who underwent secundum type ASD closure were included. None of the patients had to be excluded due to missing data. Baseline variables (age, sex, body surface area (BSA), New York Heart Association (NYHA) functional class) and echocardiographic variables (type of the defect, size of the defect as ASD diameter, and pulmonary artery systolic pressure (PASP)) were recorded. PASP of >50mmHg was defined as significant pulmonary hypertension. Primary outcome was the presence of pulmonary hypertension (PASP>50mmHg). Echocardiography was done for all patients by cardiologists preoperatively and PASP was calculated by calculating tricuspid regurgitation velocity in all patients.

All data were stored anonymously. Due to the retrospective nature of the study, consent for participation was not taken. Ethical approval was obtained from the Institutional Review Committee of our center (Ref no: SGNHC/IRC: 13-2024). Data were analyzed using SPSS version 29. Data were expressed as mean±SD (range), percentage; wherever appropriate. Pearson's correlation, multiple regressions, ROC curve analysis, and chi-square test were the statistical tests we applied during data analysis. Multiple regressions were done by putting PASP as dependent variable, and age and indexed defect size as independent variables. ROC curve was constructed by putting PASP >50mmHg as state variable and patient age as test variable. A p value of <.05 was considered as significant.

Results

A total of 407 patients underwent ASD closure for ASD secundum between 2018 and 2023. We operated on a small baby as small as 3 years old to an adult as old as 55 years old. Most of the patients were in NYHA I or II functional class. The mean absolute size of the defect was 2.5±0.6 (1.0-4.5)cm, and indexed size of the defect was 2.2±0.8 (1.1-6.0)cm/m2. Pulmonary artery systolic pressure was 47.0±11.8 (24-113)mmHg. Significant pulmonary hypertension (PASP >50mmHg) was present in 33.2 % (n=135). The results have been summarized in table 1.

We further looked on the same variables comparing patients with and without significant pulmonary hypertension. Patients with significant pulmonary hypertension tended to be older, increasingly females; and had larger BSA, larger absolute ASD diameter, and smaller indexed ASD diameter. However, both the groups had similar NYHA functional status. (Table 1).

Table 1: Baseline characteristics of patients.

Variables	Overall patients (n=407)	Patients with PASP >50mmHg (n=135)	Patients with PASP <50mmHg (n=272)	P value
Age (mean±SD, range), years	22.1±12.5 (3-55)	28.6±11.4	18.8±11.7	.000
Sex (male), n(%)	131 (32.7)	32 (23.4)	99 (36.4)	0.01
Body surface area (BSA), m2	1.22±0.32 (0.35-1.82)	1.38±0.19	1.15±0.35	.000
NYHA status n(%) I II III IV	 104 (25.6) 240 (59) 56 (13.8) 7 (1.7)	 40 (29.6) 71 (52.6) 21 (15.6) 3 (2.2)	 64 (23.5) 169 (62.1) 35 (12.9) 4 (1.5)	0.324
PASP (mean±SD, range), mmHg	47.0±11.8 (24-113)	59.9±11.1	40.6±5.0	.000
ASD diameter (mean±SD, range),cm	2.5±0.6 (1.0-4.5)	2.7±0.7	2.4±0.6	.000
Indexed ASD diameter(mean±SD, range), cm/m2	2.2±0.8 (1.1-6.0)	2.0±0.6	2.3±0.9	.000

Age had a positive correlation of 0.38 with PASP (p <.001), indicating that older age is associated with higher PASP (Figure 1). Indexed ASD size had a negative correlation of 0.15 with PASP (p=.002) (Figure 2). Multiple regression analysis showed only age as the factor which predicts PASP with standardized beta of .357 (p<.001). Indexed ASD size did not predict PASP and had standardized beta of -.016 (p=.799).

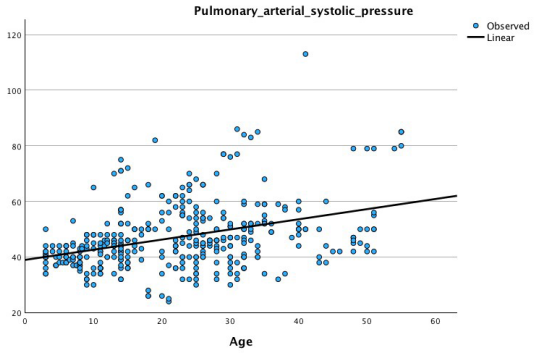

Figure 1. *Correlation between age of the patients and PASP. This has a positive correlation of 0.38 (p<.001).*

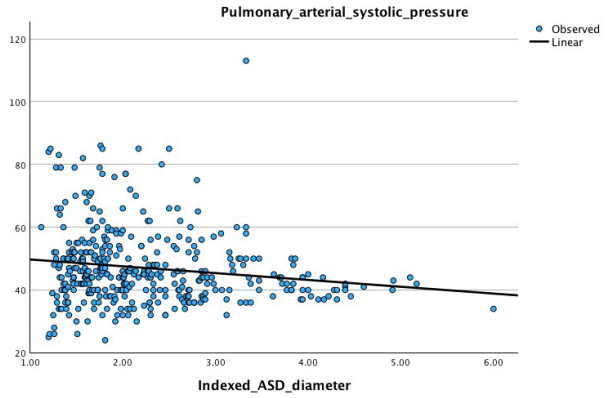

Figure 2. *Correlation between indexed ASD diameter and PASP. This has a negative correlation of 0.15 (p=.002).*

As we had defined PASP of >50mmHg as significant pulmonary artery hypertension, we further looked into the age and PASP by calculating ROC curve. ROC curve analysis showed area under the curve (AUC) of .733, p<.001 (Figure 3). Age cut off of 5.7 years revealed sensitivity of 99.3% with specificity of 9.02% predicting significant pulmonary artery hypertension. At the age of 13.5 years, it has sensitivity of 96.3% with specificity of 41.9%., and at the age of 15.5 years, it has sensitivity of 86.7% with specificity of 52.6%.

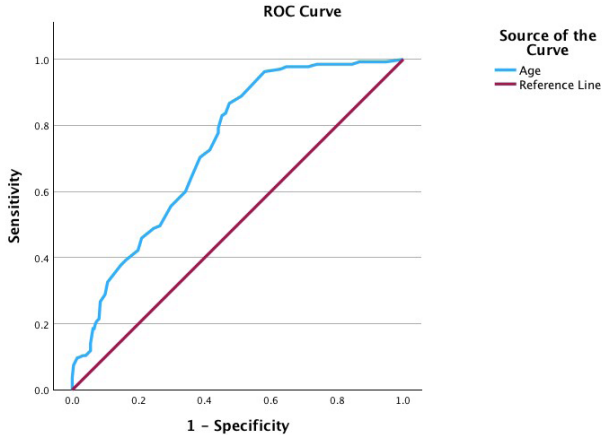

Figure 3. *ROC curve showing depicting the age and PASP. Area under the curve (AUC) was .733, p<.001.*

Discussion

Atrial septal defect closure is one of the most common surgical procedures in cardiac surgery, although a significant number of these patients undergo catheter based closure recently. When to operate after the initial diagnosis is a big concern for us. So, we aimed to find out if the age of the patients or the size of the defect predicts the development of pulmonary hypertension.

We showed that age is the only factor that predicts pulmonary hypertension; it had a positive correlation of 0.38. Indexed ASD size showed a weak negative correlation.

Our hypothesis was that the size of ASD has a role in predicting pulmonary artery hypertension. Because the size of the defect is an absolute number, we decided to index it by dividing by BSA for the purpose of analysis. Indexed ASD size did not predict the development of pulmonary artery hypertension, and to our surprise, it had a small degree of negative correlation with PASP. We are not exactly sure about this finding, however, one possible explanation would be that some of our cases we operated on were as small as 3 years old, and they had a large defect of 2cm, which resulted in a maximal indexed ASD size of 6cm/m2. However, those small kids had their PASP in the range of 40s. Also, we did not consider the geographical location of our patients. Because Nepal is a country where people live in plains, mountains, and the Himalayas, high altitude might have something to do with the development of pulmonary hypertension.

Similar to our findings, other authors have shown that the risk of PAH with ASD increases with age; however, the size of the defect has a loose association with the development of the PAH.[3,9] In adult patients, Vogel and colleagues[3] showed that patients with sinus venosus defect had pulmonary artery hypertension developed at an early age as opposed to patients with ASD secundum. Because our patients were only of secundum type and we included patients of all ages, we cannot compare our data with theirs as it is.

We used echocardiographic parameters to define pulmonary artery hypertension by measuring tricuspid regurgitation velocity, which gave us a clue about PASP. This method is non-invasive and easily reproducible, although some argue that cardiac catheterization is required to quantify PASP.[10]

Using age as a cutoff point to predict pulmonary artery hypertension, we showed that it has a sensitivity of 99.3% at the age of 5.7 years with a very low level of specificity; At the age of 13.5 years, it has a sensitivity of 96.3% with a specificity of 41.9%. To further increase the specificity of the test, age needs to be further increased to 15.5 years, at which point, it has a specificity of 52.6% but at the expense of sensitivity (86.7%). Because a good screening test should have very high sensitivity irrespective of specificity, an age cut-off of 5.7 years could be utilized to predict pulmonary hypertension. We believe that after the diagnosis, when a child is more than 5.7 years old, we could plan surgery to prevent further progression of pulmonary artery hypertension. Furthermore, if someone is diagnosed at an older age than this, at the age of 15 years, almost 86% of patients have already developed significant PAH, so intervention before this age is probably beneficial.

Limitations

Being a retrospective study, it has several limitations inherent to its design. However, this is a study from a Himalayan country, and due to its unique geographical location, this might be an interesting paper to begin with. Our focus was only on the age and size of the defect, so we did not analyze other variables further to see if they had a role to play. We defined pulmonary artery hypertension as systolic PA pressure of > 50 mmHg, which is an arguable value because some other authors would define pulmonary artery hypertension using the mean pulmonary artery pressure value. Also, the size of the defect was measured by different referring cardiologists, and their techniques of measuring the size of the defects might be different. We included patients with secundum-type defects only, so the results cannot be generalized for patients with sinus venosus and other types of atrial septal defects. However, our important message is that age is the factor that predicts pulmonary artery hypertension, and the size of the defect does not predict pulmonary artery hypertension, contrary to the perceived belief. Because we encounter a large number of patients with ASD in our cardiology OPD, carefully designed randomized studies could further be done to support/refute our findings in future studies.

Conclusion

Age of the patients predicts the development of significant pulmonary artery hypertension in patients with secundum-type atrial septal defects; however, indexed ASD size has a weak negative correlation with pulmonary artery hypertension.

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Original Artticle

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Prevalence of Mitral Annular Calcification in Nepalese Chronic Kidney Disease Patients Under Hemodialysis in A Tertiary Care Centre of Western Nepal

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Abstract

Background and aims: Mitral annular calcification (MAC) is a chronic process. Elderly patients have a higher prevalence of MAC. Chronic kidney disease(CKD) patients and cases with multiple cardiovascular risk factors have a higher chance of having MAC. MAC is associated with higher chances of having major adverse cardiovascular events (MACE). MAC is more common in CKD patients, probably because of abnormal calcium and phosphorus metabolism. The main aim of our study is to find out the prevalence of mitral annular calcification in chronic kidney disease patients under hemodialysis.

Methods: It was a prospective, observational, and single-centered study conducted in the department of internal medicine, Pokhara Academy of Health Sciences(POAHS), Nepal. This study was conducted over a period of a year between 9th November 2022 and 8th November 2023. Patients with CKD under maintenance hemodialysis(MHD) were enrolled. Data (Age, Sex, HD duration and frequency, presence of other risk factors like Hypertension, DM, smoking, history of coronary angiography and revascularization, electrocardiography for MAC, left ventricular systolic and diastolic functions (LVEF and LVDD), left ventricular hypertrophy) were collected after complete history taking followed physical examination, relevant laboratory investigations, and transthoracic echocardiography(TTE). Statistical analysis (descriptive analysis for proportion and percentage, and 2x2 contingency table for odds ratio and binary logistic) was performed using the latest version of SPSS.

Results: The total number of patients enrolled was 121. The mean age of the cases enrolled was 54.26 years (SD=15.25). The majority were male patients (67%). 111(91.74%) were hypertensives, and 40 (33%) were diabetics. MAC was found in 36 (29.75%) of patients enrolled. 6.6% patients had coronary artery disease(CAD) and 1.65% underwent coronary revascularization in past. Higher odds of having MAC were observed in CKD patients with smoking (OR=10.13), HD duration>12 months (OR=4.24), DM(OR=2.86), and HTN(OR=1.77). However, in binary regression analysis after adjusting for confounders, the AORs for age, HD duration, and DM were 9.8, 13.3, and 3.3, respectively.

Conclusion: There is a high prevalence of MAC in CKD patients under maintenance HD. Advanced age, CAD, longer duration of HD, DM, HTN, and smoking are important factors associated with MAC.TTE is an important tool to detect MAC in CKD patients.

Keywords: Coronary artery disease, Chronic kidney disease, Hemodialysis, Mitral annular calcification.

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Introduction

Mitral annular calcification (MAC) is basically a process of chronic degeneration with involvement of mitral valve's fibrous base[1-3]. Posterior mitral annulus is the area to be commonly involved[4,5].

Overall prevalence is about 10% as per various autopsy studies[6,7], but prevalence ranges between 8-15% and goes up significantly in elderly population and CKD patients[6,8-11].

It is linked with heightened risk of CVD and mortality and it increases the incidence of arrhythmia and mitral valve disease[2,12,13]. Transthoracic echocardiography (TTE) is a simple tool to identify MAC. MAC is demonstrated by TTE as an echo dense structure at an angle between left ventricular posterior free wall and posterior aspect of mitral leaflet.It has an irregular and lumpy appearance and has posterior acoustic shadowing.It is seen both in systole and diastole.TTE in SAX view at the level of mitral annulus can also help stratify the severity of MAC. It is mild when it is focal,moderate when 1/3rd to ½ of the total circumference is involved,and severe when more than ½ of the total circumference is involved[14].

Its prevalence is as high as 42% in elderly patients with cardiovascular diseases[15]. CKD cases have higher rates of aortic and mitral valvular calcifications which are said to independently predict cardiovascular events and overall mortality[16–21]. Calcification involving valves and coronary arteries have similar pathological features and hence share common risk factors[22–24].

Studies have revealed that patients with age less than 65 years who have MAC have higher prevelance of CAD[25].

Cardiovascular events are the main causes of mortality in CKD patients.ESRD patients under HD have higher risk of cardiovscular events and the prevalence of MAC is also quite high among them[16,19,26].

Younger patients with low risks for CV events, when not accompanied by typical symptoms of CAD are not advised to under go robust CV screening such as coronary angiography (CAG) to rule out significant CAD before renal transplantation but these patients if have MAC may be benefited or not by CV screening before renal transplantation is not clear.[27-29]

To the best of our knowledge,there are no studies on prevalence of mitral annular calcification in CKD patients on hemodialysis in our country till date,so our objective in this study is to determine prevalence of MAC in CKD patients under MHD along with their clinical profile.

Methods

It was a prospective, observational study conducted in a single centre between 9th november 2022 to 8th november 2023 in Pokhara academy of health sciences (POAHS), a government tertiary health care centre in western Nepal.

Inclusion criteria:All consecutive CKD stage V cases under MHD (maintainance hemodialysis for >/=3 months),with age between 16 to 85 years, in the department of internal medicine of POAHS were enrolled.

Exclusion criteria:Patients without consent, patients with severe medical illnesses like acute infections and active malignancies, were excluded.

All cases underwent TTE to identify and stratify MAC. MAC was stratified as mild,moderate and severe.Study variables were: Age, Sex, HD duration and frequency per week,presence of other risk factors like HTN,DM,smoking,history of coronary angiography and revascularization, electrocardiography, left ventricular systolic and diastolic functions (LVEF and LVDD),left ventricular hypertrophy. Data collection from patients were done using questionnaires, clinical examination, laboratory investigations, echocardiography. Data entry in an excel sheet was done and then subsequent analysis (descriptive analysis for proportion and percentage ,2x2 contingency table for odds ratio, binary logistic regression analysis) using SPSS latest version was performed.

Results

Total number of patients enrolled was 121. The mean age was 54.26 ± 15.25 years.Of total patients 81 (67%)were males and 40 (33%) were females.Mean HD duration was 32.45±27.21 months.All patients had a dialysis frequency of twice a week. 111(91.74%) were hypertensives and 40 (33%) were diabetics. 8 (6.6%) were patients with CAD and 2 (1.65%) gave history of coronary revacularization in the past. 16 (13.22%) were smokers.

MAC in this study was found in 36 (29.75%) of patients enrolled.

LVH (left ventricular hypertrophy) was observed in 77(63.64%). Grade I and II left ventricular diastolic dysfunction (LVDD) were found in 80(66.12%) and 19(15.7%) cases respectively. Eight (6.61%) patients had left ventricular systolic dysfunction (LVSD).

Table 1: Patient characteristics at baseline

Baseline characteristics	
Characteristics	Total(n=121)(%)
Number of patients	121(100%)
Mean age(years+/-SD)	54.26±15.25
Male	81 (67%)
Female	40 (33%)
HD duration	
(months+/-SD)	32.45±27.21
HD frequency	Twice a week
HTN	111(91.74%)
DM	40 (33%)
History of CAD	8 (6.6%)
History of coronary revasularization	2 (1.65%)
MAC	36(29.75%)
Smoking	16(13.22%)
LVH	77(63.64%)
LVDD1	80(66.12%)
LVDD2	19(15.7%)
LVSD	8(6.61%)

As in figure 1, of total cases with MAC, 22 (61.11%) cases had mild MAC, 10(27.78%) cases had moderate MAC and four(11.12%)

cases had severe MAC.

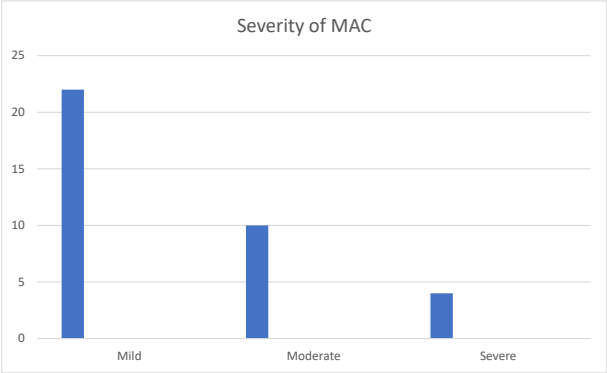

Figure 1: *Prevalence of different grades of MAC by TTE*

Table 2: Association of MAC with different risk factors (n=121)

Chi-square test was used to find the association between MAC and different risk factors taking p-value less than 0.05 as statistically significant.

Variables	Categories	MAC		p-value
		Present (%)	Absent (%)	
Age (years)	≤60	8 (22.2)	63 (74.1)	**<0.001**
	>60	28 (77.8)	22 (25.9)	
HD duration (in months)	≤12	6 (16.7)	39 (45.9)	**0.002**
	>12	30 (83.3)	46 (54.1)	
Smoking	Present	12 (33.3)	4 (4.7)	**<0.001**
	Absent	24 (66.7)	81 (95.3)	
Hypertension	Present	34 (94.4)	77 (90.6)	0.721
	Absent	2 (5.6)	8 (9.4)	
Diabetes	Present	18 (50.0)	22 (25.9)	**0.010**
	Absent	18 (50.0)	63 (74.1)	

Table 3: Unadjusted odds (OR) ratio for MAC and risk factors

First univariate analysis was done to find out the unadjusted odds ratio.

Risk factors	MAC	No MAC	95 % CI	Unadjusted OR
HTN	34	77	(0.36,8.76)	1.77
No HTN	2	8		
DM	18	22	(1.27,6.46)	2.86
No DM	18	63		
Smoking	12	4	(2.99,34.29)	10.13
No smoking	24	81		
HD duration			(1.6,11.24)	4.24
(>12 months)	30	46		
HD duration				
(</=12 months)	6	39		

MAC was present in six (16.67%) females and 30(83.33%) males. 34 (94.44%) hypertensive patients with CKD had MAC, (OR=1.77,CI=95%,0.36-8.76). 18 (50%) diabetic patients with CKD had MAC,(OR=2.86,CI=95%,1.27-6.46). Eight (22.22%) CAD patients with CKD had MAC. Six (16.66%) patients with LVSD with CKD had MAC. 12 (33.3%) smokers with CKD had MAC,(OR=10.13,CI=95%,2.99-34.29). Two (5.56%) male patients with CKD and age <45 years had MAC whereas none of the female CKD patients with age <55 years had MAC. The average duration of MHD in CKD patients with MAC was 43.56 months. 76 (62.8%) cases had the duration of HD >12 months,of which 30 (83.33% of total MAC patients) had MAC. For duration of HD>12 months,the odds of having MAC was 4.24 ,(OR=4.24,CI=95%,1.6-11.24).

Table 4: Binary logistic regression analysis to find out adjusted odds ratio (AOR)

Then to further explore the associations, binary logistic regression was applied using all risk factors found to have statistically significant association with MAC to find out the adjusted odds ratio (AOR) at p-value of less than 0.05 and 95% confidence interval. Smoking was not taken into consideration in the analysis as it had very wide CI because of small sample size.

Variables	Categories	β-coefficient	AOR	p-value	95% CI	
					Lower	Upper
Age (years)	≤60	*Ref.*				
	>60	2.290	**9.87**	**<0.001**	2.837	34.392
HD duration (months)	≤12	Ref.				
	>12	2.592	**13.351**	**0.003**	2.486	71.705
Diabetes	Absent	*Ref.*				
	Present	1.205	**3.336**	0.063	0.936	11.885

Discussion

As in many other studies in the past ,our study has found a higher prevalence (29.75%) of MAC in CKD patients who are under HD [16,27]. Likewise patients with longer duration of HD had a higher chance of having MAC in our study,similar to some previous studies[16,28]. To the surprise,all of our CKD patients with the history of CAD had MAC ,thus supporting significant association between MAC and CAD just as in past literatures.[28]

This study revealed a higher probability of getting MAC in CKD patients with smoking (OR=10.13), HD duration>12 months (OR=4.24), DM (OR=2.86), HTN(OR=1.77) in that descending order. However in binary regression analysis after adjusting for confounders, the AOR for age, HD duration and DM were 9.8, 13.3 and 3.3 respectively.These findings support the fact that one with multiple comorbidities has a higher chance of having MAC.[27]

The other important factor worth mentioning here is older age which is more associated with MAC probably because of age related valvular degeneration. 77.8% of patients with MAC had age of more than 60 years ($p< 0.001$).Our bulk of patients with MAC belonged to an advanced age group (the average age of MAC positive patients=63.91 years).[15]

Another important issue is with the younger CKD patients with MAC who are planned for renal transplantation. According to Scientific Statement From the AHA and the ACC Foundation, cardiovascular screening is indicated in high risk CKD patients, however the high risk features do not include MAC.When young CKD patients with

MAC (male <45 years and females<55 years) and without other high risk features like DM,history of CAD, abnormal ECG, left ventricular dysfunction, smoking and HD duration<2 years are planned for renal transplantation whether to subject them to cardiovascular screening (such as coronary angiography to rule out CAD) is not clear and as we know many studies in the past had demonstrated MAC as an independent predictor of CAD. This needs to be addressed in the future by guidelines[29].

MAC may signal towards a systemic vascular disease, so clinicians should focus on holistic cardiovascular care rather than focusing on management of MAC only.

Conclusion

This study shows a high prevalence of MAC in CKD patients under maintainance HD. It also highlights the association with certain cardiovascular risk factors. Advanced age,CAD,longer duration of HD,DM,HTN, and smoking are important factors associated with MAC.TTE is an important modality to detect MAC in such patients. Our findings also suggest that identifying and monitoring MAC in this population may lead to improved cardiovascular outcomes through timely interventions. Further studies are warranted to explore causal mechanisms and to validate these findings across diverse patient cohorts.

Limitations

- Small sample size and the short time period are important limitations of this study. So other well designed studies in future with large sample sizes are needed to establish strong association between risk factors and MAC.
- Intact parathyroid hormone, phosphorus and calcium were also not analysed which is one of the major limitations of this study.

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Original Article

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Sex Differences on Behavioural Risk Factors of Hypertension among Rural Community Dwellers, Nepal: A Cross-Sectional Survey

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Abstract

Background: The increase in hypertension in developing countries has been brought about by the increasing prevalence of risk factors, such as increased alcohol consumption, smoking, obesity, physical inactivity, and low fruit and vegetable intake. This study was conducted to assess gender differences in the prevalence of behavioural risk factors of hypertension.

Methods: Study design was cross-sectional survey. Adults residing in the Parsauni Rural Municipality, were the study population. In-person interview was done using WHO STEPs questionnaire among 596 samples selected via PPS technique. Height, weight, waist circumference, and hip circumference were measured by health personnel following standard technique. BMI and waist–hip ratio were calculated using standard formula. The data was analyzed using SPSS version 20 (IBM SPSS).

Results: Out of 596 respondents, a higher proportion of women were past smokers (13.9%), and a higher proportion of males were current tobacco users (14.2%). Only 38.5% of respondents attempted to quit smoking, of which 3.0% were female. Similarly, 29.0% were past and 20.1% were current alcohol users. Only 40.8% and 56.0% of respondents were involved in vigorous-intensity and moderate-intensity physical activity, respectively. Only 41.6% and 8.6% of respondents consumed vegetables and fruits daily, respectively. There was no association of alcohol consumption, physical activity, or fruit and vegetable consumption with respondents' sex. The odds of diagnosed hypertension were high among females (1.242, p = 0.034). Due to the cross-sectional design, causal relationships cannot be established.

Conclusions: Behaviour-related health risks such as physical inactivity, low fruit and vegetable consumption, tobacco and alcohol use, overweight and obesity, and high-risk waist-to-hip ratios are high in community people.

Key words: BMI; high blood pressure; NCD; obesity; waist- hip-ratio

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Introduction

It is estimated that 31.1% of adults are hypertensive.[1] The global prevalence of hypertension (HTN) is projected to decrease to 20.3% in 2040, with the highest prevalence in low-income countries.[2] National data of Nepal shows HTN among 18% female and 23% male.[3] The increase in chronic diseases in developing countries has been brought about by the increasing prevalence of risk factors, such as increased alcohol consumption, smoking, obesity, physical inactivity, and low fruit and vegetable intake.[4] WHO launched the Global Hearts Initiative in 2016 to reduce the prevalence of hypertension by 25% by 2025[5], while Nepal witnessed 14% of deaths attributable to high systolic blood pressure and 13% to smoking in the disease burden.[6]

By eliminating common risk factors, mainly tobacco use, unhealthy diet, physical inactivity, and the harmful use of alcohol, up to 80% of Non-communicable diseases, including HTN, can be prevented[7], and clustering of these risk factors increases his risk of heart problems.[8] Knowledge about risk factor distribution patterns among population cohorts is important for effective management. However, previous studies in Nepal focused on HTN prevalence, knowledge, and associated factors[9-11], while other studies focusing on risk factor distribution in community cohorts missed rural settings.[12-14] Thus, we undertook this study to assess gender differences in the prevalence of four major behavior risk factors, namely physical activity, fruit and vegetable consumption, tobacco and alcohol use, overweight and obesity, waist-to-hip ratio, and HTN-related information.

Methods

A cross-sectional survey design was used. Parsauni Rural Municipality of Province Two, Nepal was the study setting. This rural setting was selected because it reflects the socio-economic disparities and access challenges typical of underserved regions in Nepal. Males and females greater than 18 years old, available at the time of data collection, and physically able to communicate were the study population. The sample size was calculated applying the Cochran formula $Z^2(p\text{-}q)/L^2$, the PPS sampling technique was used to select 596 samples, and the sampling frame was the voter list. Their participation in this study was voluntary. Data was collected via in-person interview technique after obtaining consent from the respondents. Six staff nurses and health assistants working in the Parsa district were enrolled as data collectors and trained before data collection. The interviews were in the Bhojpuri language using the WHO STEP questionnaire, and colorful show cards were used as needed.

Height was measured with the removal of shoes, hat, and hair tie and standing with feet together, knees straight and with the back against the wall and heels touching the ground, arms on the side, and eyes in front parallel to the ground (facing the interviewer). The reading coinciding with the occipital edge was noted in centimeters. The weighting machine was placed on a firm flat surface and the weight of all participants was taken with minimum clothes on the body & was recorded in kilograms with the help of a standard digital weighing machine, which was adjusted to 'zero' weight while measuring it. Participants were requested to remove shoes and extra clothes, stand on the scale with one foot on each side of the scale, face forward, and wait until asked to step off. The waist circumference was measured by placing the measuring tape midway between the top of the hip bone (iliac crest) and the bottom of the last rib. Measurement was taken in a room of the house (private area) with light clothing. Hip circumference was measured around the maximum circumference of the buttocks. Participants were requested to wrap the tape around the buttocks. Measurement was read at the level of tape to the 0.1 cm. The BMI was calculated as weight in kilograms divided by the square of the height in meters (kg/m2) [weight (kg)/height (m2)]. The waist-hip ratio was calculated by dividing waist circumference by hip circumference.

The data was analyzed using SPSS version 20 (IBM SPSS). Researchers conducted descriptive statistical analyses, such as frequency distributions, measures of central tendency, and dispersion. The odds ratio for risk factors was estimated using a 2/2 table, and the confidential interval (CI) was set at a 95% level of significance. The Ethical Review Board of the Nepal Health Research Council reviewed the proposal and provided ethical clearance (ref. 381).

Findings

A total of 600 respondents were surveyed, four were excluded from the analysis due to incomplete data. Among the respondents, 13.9% of women reported being former smokers, while 14.2% of men were current tobacco users (figure 1) and their ages ranged from 18 to 80 years.

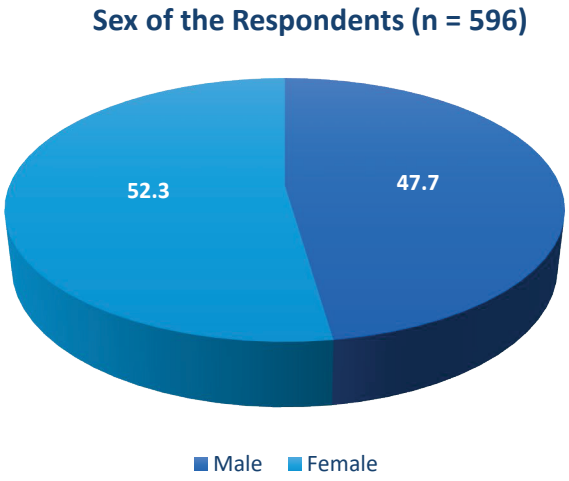

Figure 1: *Sex distribution of the respondents*

Regarding salt intake, 49.2% of the respondents sometimes added extra salt to their food, while 10.7% often and 4.7% always did (figure 2).

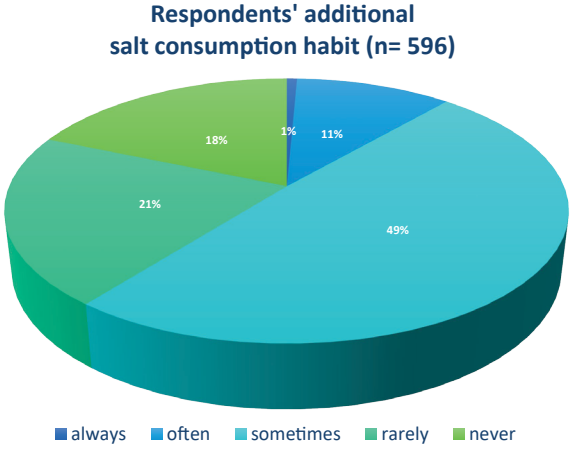

Figure: *2 Respondents' additional salt consumption habit*

Respondents consumed different types of alcoholic drinks, of which local spirit was the most frequently (57.5%) used. (figure 3)

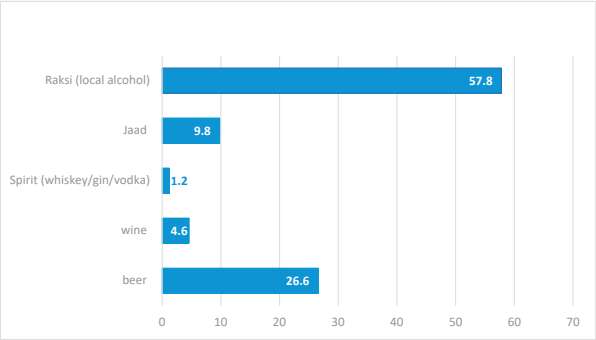

Figure 3: *Respondents' usual alcohol types (n=173)*

Apart from 596 respondents, a higher proportion of women were smokeless tobacco users (16.4%) and past smokers (13.9%) compared to male and their odds were 1.124. However, a higher proportion of males were current tobacco users (14.2%) and the odds were 1.125. An equal proportion of males and females were daily smokers (12.4%). Out of 76.5% daily smokeless tobacco users, a greater portion of males (40.1%) were male. Out of 38.5% of respondents who tried to quit smoking, a greater proportion of females who tried to quit both smoked (23.0%) and smoked less tobacco (23.4%) use in comparison to males. The odds of smoking quit were 1.384 for females (table 1).

Table1: Gender differences in smoking habits

Variables	Male (n 284)	Female (n 312)	Total (n 596)	$\chi 2$	p	OR	CI
	No. (%)	No. (%)	No. (%)				
Past Smokers	41 (10.0)	57 (13.9)	98 (23.8)	1.230	.267	1.124, F	.921-1.37
Past smokeless tobacco users	53 (11.3)	77 (16.4)	130 (27.7)	1.948	.267	1.124, F	.921-1.37
Current tobacco users	84 (14.2)	78 (13.1)	162 (27.2)	1.574	.210	1.125, M	.940-1.34
Daily smokers	74 (12.4)	74 (12.4)	148 (24.8)	.436	.509	1.067, M	.883-1.28
Daily smokeless tobacco users	65 (40.1)	59 (36.4)	124 (76.5)	.068	.794	1.048, M	.532- 2.27
Attempted to quit smoking session	23 (15.5)	34 (23.0)	57 (38.5)	3.452	.063	1.357, F	.990- 1.09
Attempted to quit smokeless tobacco use	22 (17.7)	29 (23.4)	51 (41.1)	2.993	.084	1.384, F	.961- 1.99
Passive smoking exposure	114 (19.1)	116 (19.5)	230 (38.6)	.550	.458	1.067, M	.900-1.26

M= odds of male, F= odds of female

In comparison to males, a higher proportion of females were alcohol users. Out of 29.0% of past alcohol users, 16.4% were women, and out of 20.1% of current alcohol users, 11.7% were female. Regarding physical activity, 40.8% of respondents were involved in vigorous-intensity physical activity, and 22.0% were female.

Table 2: Gender differences in alcohol consumption, physical activity and food habits

Variables	Male (n 284)	Female (n 312)	Total (n 596)	χ2	p	OR	CI
	No. (%)	No. (%)	No. (%)				
Past alcohol consumer	75 (12.6)	98 (16.4)	173 (29.0)	1.085	.179	1.120, F	.953- 1.31
Current alcohol users	50 (8.4)	70 (11.7)	120 (20.1)	2.157	.142	1.147, F	.963- 1.36
Vigorous intensity activity	112 (18.8)	131 (22.0)	243 (40.8)	.401	.527	1.052, F	.901- 1.22
Moderate physical intensity	164 (27.5)	170 (28.5)	334 (56.0)	.641	.423	1.072, M	.903 -1.27
Daily fruits consumption	23 (4.4)	22 (4.2)	45 (8.7)	.332	.564	1.096, M	.811- 1.48
Daily vegetables consumption	110 (20.1)	117 (21.4)	227 (41.6)	.035	.852	1.017, M	.735- 1.45
Median days of fruit consumption in a week 2.5 (Q1=2,Q3=4)							
Median of fruit servings in a week 1 (Q1=1, Q3=2)							
Median days of vegetable consumption in a week 5 (Q1=3.5, Q3=7)							
Median of vegetable servings in a day 2, (Q1=1, (Q3=2)							

M= odds of male, F= odds of female

Similarly, out of 56.0% of respondents involved in moderate-intensity physical activities, 28.5% were female. Only 41.6% of respondents consumed vegetables daily, while 8.7% of respondents consumed fruits daily. There is no such difference in the proportion of males and females in fruit and vegetable consumption. Respondents' median days of fruit consumption in a week was 2.5 with 2-4 IQR and their median days of vegetable consumption was 5 with 3.5- 7 IQR (table 2). Among 61.4% of respondents, who measured their BP, 39.6% were said to have HTN. Among those proportion of females was higher (22.7%), and the odds of females was 1.242 which was significant statistically. Of those diagnosed with HTN, only 87.6% took the prescribed medicine and the proportion and odds of females were higher (48.3% & 1.516) in this regard. Among the moderate to high health risk waist-to-hip ratio of the respondents, 55.0% were female and their odds were 1.179. Similarly, among the 20.8% of respondents who were overweight and obese, an almost equal proportion was male and female. However, odds ratio was higher among females (1.102) (table 3).

Table 3: Gender differences in anthropometric measurement and blood pressure related information

Variables	Male (n 284)	Female (n 312)	Total (n 596)	χ2	p	OR	CI
	No. (%)	No. (%)	No. (%)				
Ever measured BP	181 (30.4)	185 (31.0)	366 (61.4)	1.232	.266	1.104, M	.925- 1.31
Ever diagnosed HTN (n= 336)	62 (16.9)	83 (22.7)	145 (39.6)	4.306	.038	1.242, F	1.01-1.51
Have taken medicine (n= 89)	35 (39.3)	43 (48.3)	78 (87.6)	1.362	.243	1.516, F	.676- 3.39
Waist to hip ratio							
Low health risk	16 (2.7)	25 (4.2)	41 (6.9)	1.314	.252	.179, F	.358- 1.31
Moderate to high health risk	268 (45.0)	287 (55.0)	555 (93.1)				
BMI							
Normal	220 (36.9)	252 (53.4)	472 (79.2)	.985	.321	1.102, F	.903- 1.34
Overweight and obese	64 (10.7)	60 (10.1)	124 (20.8)				

M= odds of male, F= odds of female

Discussion

Out of 596 respondents, 52.3% were female and 47.7% were male. Their age ranged from 18 to 80 years. In this study, it was found that the four established behavioral risk factors of HTN: tobacco consumption, passive smoking, alcohol consumption, inadequate fruit and vegetable consumption, and physical inactivity are upright in the rural community residents. Moreover, other risk behaviors of HTN such as high health risk waist-to hip ratio, overweight and obesity, and discontinuation of HTN medication were also prevalent in the study.

Respondents consumed different types of smoke and smokeless tobacco products. Overall, 27.2% of respondents in this study were current tobacco users, of which a higher proportion (14.2%) was male with odds of 1.125 compared to females (13.1%). The proportion of women consuming any type of tobacco in this study (13.1%) was higher than the National average (5.0%), while the proportion of tobacco consumption among males was lower than (28.0%) of the National data.[3] Overall tobacco consumption in this study was lower than the slum population of Kathmandu (35.6%)[12] and the same as the rural population of Myanmar (27.0%).[15] In comparison to males, a higher proportion of females were past smokers (13.9%) with an odds ratio of 1.124, however, a higher proportion of males were current tobacco users (14.2%) with an odds ratio of 1.125 in this study. In line with our findings, a study has reported that being male increased the odds of current tobacco use.[16] Differing from the previous results, Majic and their friend reported a higher prevalence of smoking (both current and past) among females.[17] While, among the Indian population, most of the men were both current and past smokers compared to females.[18] On top of that out of 38.5% of respondents who tried to quit smoking, a greater proportion of females who tried to quit both smoked (23.0%) and smoked less tobacco (23.4%) use in comparison to males. It is clinically significant that the odds ratio to quit smoking for females was 1.384. This gender difference might be due to stigma among marginalized groups, and those groups have higher smoking session attempts.[19]

The prevalence of alcohol use and smoking among community residents has been increasing in trends in a span of 20 years.[20] We found a higher proportion of female alcohol users than males. Out of 29.0% of past alcohol users, 16.4% were women, and out of 20.1% of current alcohol users, 11.7% were female, indicating a smaller difference between genders. However, the proportion of alcohol use in this study is significantly lower than in a study of Chitwan of Nepal, where 53.7% of males consumed alcohol.[21] A study in Myanmar reported that 19.9% rural population was currently drinking alcohol[15], and a higher proportion of males consume alcohol than females and hazardous alcohol use is more pronounced in the male population.[16-18] In this study local spirit was the most frequently (57.5%) used alcohol types.

Previous studies have reported low physical activity, overweight and obesity increased over time among the rural population.[20] Regarding physical activity, in this study, females were more physically active than males. Out of 40.8% of respondents involved in vigorous-intensity physical activity, 22.0% were female. Similarly, out of 56.0% of respondents involved in moderate-intensity physical activities, 28.5% were female. Similar trends were reported by Pengpid and Peltzer, where low odds of physical activity (OR 0.48, CI 0.39 to 0.58), and high sedentary lifestyle (OR 1.35, CI 0.96 to 1.83) among the male population.[16] Disagreeing with these findings, Majic and friends[17] reported a higher proportion of males (72.9%) involved in physical activities compared to females. While Rajkumar and Romate equalize males and females (32.5-32.8%) of being physically inactive in the Indian population.[18] In this study female population tends to have a health high-risk waist-to-hip ratio (55.0% out of 93.1%). Disagreeing with our finding, Prabhakaran et al[22] demonstrated higher mean hip circumference among males (0.99) compared to the female (0.83) population. Similarly, among the 20.8% respondents who were overweight and obese, almost equal proportions were male and female. However, the odds ratio was higher among females (1.102). However, the literature shows a lower tendency of overweight and obesity among males in comparison to females.[16] While the tendency of overweight and obesity was high among the male population of Bosnia and Herzegovina[17] and of India.[18]

WHO recommends more than five servings of fruits and vegetables for healthy living. However, in this study, the median days of fruit consumption was 2.5 in a week with 2-4 IQR and their median days of vegetable consumption was 5 with 3.5- 7 IQR in a week. Similar to this finding a study among the Nepali population reported <2 days per week of the mean fruit consumption while comparable higher mean days (6) of vegetable consumption in a week.[12] Only 41.6% of respondents in this study were daily vegetable consumers, while only 8.7% were daily fruit consumers. The difference between the male and female population regarding fruit and vegetable consumption was smaller. However, the literature supported a higher proportion of females (48.5%) consuming high fruits and vegetables compared to the male (36.0%) population.[17] In line with this, a study among Indian nationals, females consumed fewer fruits and vegetables than males (P 0.07).[18] Contradicting previous findings, Pingpit and Peltzer reported higher odds of (1.13, CI 0.92 to 1.39) consuming low fruits and vegetables among the male population.[16] Regarding salt intake, 49.2% of the respondents sometimes added extra salt to their food, while 10.7% often and 4.7% always did. Supporting our finding, Ali et al reported that 14% of people residing in the urban area of Kathmandu, Nepal, take high salt-containing foods every day.[12]

Out of 61.4% of respondents, who measured their BP, 39.6% were said to have HTN. Among those proportion of females was higher (22.7%), and the odds of female was higher (OR 1.242, CI 1.01 – 1.51) which was significant statistically. A previous study in Nepal reported that 49% of the male and 34.7% of the female population have undiagnosed HTN[12], while Rajkumar and Romate reported a higher prevalence of HTN among males (51.5%) in the Indian population.[18] Additionally, Majic et al, reported a higher proportion of males (18.2%) having hypertension compared to females (15.5%).[17] Of whom diagnose with HTN, only 87.6% in this study took the prescribed medicine and the proportion and odds of female were higher (48.3% & 1.516) in this regard. Literature reported that female tends to do more frequent BP monitoring in comparison to males.[17] This suggests a need for early risk stratification among community people. However, it should be considered that the cross-sectional design allows us to capture associations, it limits the ability to establish causal relationships. Self-reporting bias in alcohol and tobacco use data might have impacted the findings.

Conclusion

Many adults in Nepal exhibit high rates of behaviour-related health risks such as physical inactivity, low fruit and vegetable consumption, tobacco and alcohol use, overweight and obesity, and high-risk waist-to-hip ratios. Current smoking is more prevalent among

men, while more women are former smokers. A larger proportion of women attempt to quit smoking compared to men. Women also tend to consume alcohol more than men. Physical activity levels are low across the population, with no significant gender difference. The average daily intake of fruits and vegetables is very low, with no notable disparity between men and women. A significant portion of the population has moderate to high health risk waist-to-hip ratio, and overweight and obesity with no observable gender difference. Few people monitor their blood pressure regularly, and there's no disparity in this practice between genders. There is a trend of non-adherence to prescribed antihypertensive medication, with women more likely to adhere than men. Hypertension is a growing public health concern in Nepal, therefore, ongoing surveillance of its risk factors in different population cohorts would be helpful. In this regard, Community-level interventions or partnerships with local healthcare providers would strengthen the risk factor target program. The results suggest the need for gender-sensitive public health programs focusing on smoking cessation, increased fruit and vegetable intake, and physical activity promotion. Future research should focus on reducing associated risk factors and preventing hypertension.

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COI: none

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Case Report

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Hypertrophic Obstructive Cardiomyopathy with Severe Aortic Valve Stenosis – A Case Report of a Commonly Overlooked Dual Pathology

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Abstract

We report acase of coexisting hypertrophic obstructive cardiomyopathy and aortic stenosis in a 69-year-old female who presented with exertional breathlessness and palpitations. Trans thoracic echocardiogram revealed severe valvular aortic stenosis and asymmetric septal hypertrophy with obstruction and mild to moderate mitral valve stenosis. The patient underwent concurrent aortic valve replacement with a tissue valve and extended septal myectomy. Post-surgery, the patient experienced significant symptom relief and improved functional status with no residual obstruction in the left ventricular outflow tract. This case highlights the necessity of assessing for sub-valvar obstruction while assessing valvular aortic stenosis.

Keywords: Aortic Valve Stenosis, Extended Septal Myectomy, Hypertrophic Obstructive Cardiomyopathy

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Introduction

Primary hypertrophic cardiomyopathy (HCM) co-existing with aortic valve stenosis (AVS) is rare.[1,3] Asymmetric septal hypertrophy is known to occur in patients with AVS, with some authors having reported the incidence to be up to 10%.[1–3] HCM and AVS cause left ventricular outflow obstruction with the prior causing dynamic while the latter causing fixed obstruction. Appropriate treatment of combined dual pathology significantly lowers mortality and improves long-term survival similar to regular age sex-matched individuals.[4] The management of HCM or AVS in isolation may be straightforward, however, when these entities occur together, it poses a challenge, more so in the era of increasing Transcutaneous Aortic Valve Implantation.[4,5] Herein, we present such a case and discuss its management.

Case report

A 69-year-old female presented with progressive exertional shortness of breath and palpitation for 6 months. She had been diagnosed with hypertension for 23 years, diabetes mellitus for 20 years, dyslipidemia for 15 years, and peripheral vascular disease with absent pulses in the right side below the popliteal arteries. Clinical evaluation revealed an audible ejection systolic murmur radiating bilaterally to the anterior neck. Her ECG showed sinus rhythm with right bundle branch block and features of left ventricular hypertrophy seen in HOCM, transthoracic echocardiography was significant for aortic valve stenosis with a peak pressure gradient of 75.7 mmHg and a mean gradient of 42.3 mmHg and an aortic valve area of 0.9 cm2, and a separate gradient across the left ventricle outflow tract (LVOT) of 90.7 mmHg (Figure 1), and a sigmoid-shaped interventricular

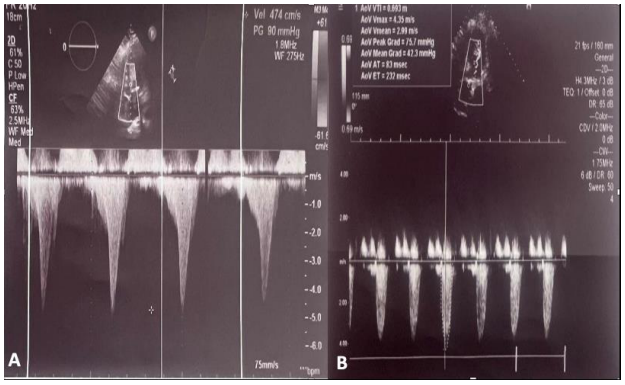

Figure 1. *2-Dimensional Transthoracic Echocardiogram showing gradients across (A) Left Ventricular Outflow Tract and (B) Aortic valve*

septum giving a shape of a dagger and asymmetric hypertrophy with a septal thickness of 1.64 cm in diastole and 1.82 cm in systole. (Figure 2) The mitral valve was found to be thickened with a mean gradient of 6 mm Hg and an area of 1.63 cm2 with a normal heart function. Pre-operative coronary angiography revealed a non-significant mid-LAD lesion which was documented to be 40%. She also had poor pulmonary reserve (FEV1 of 46%) and peripheral vascular disease with absent pulses on the right side below the popliteal arteries.

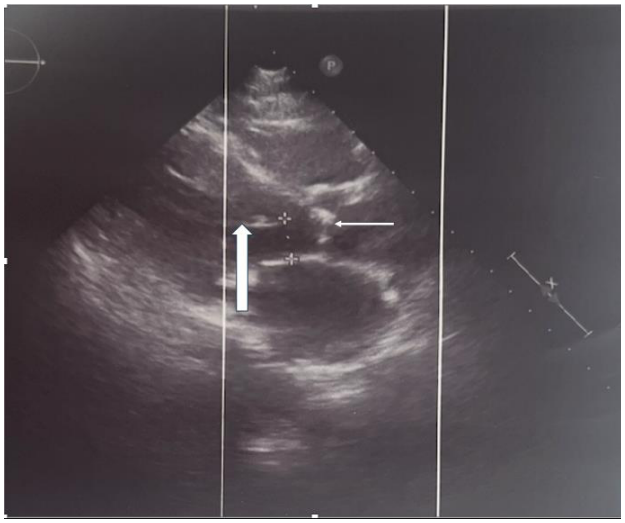

Figure 2. *Two-dimension Transthoracic Echocardiogram in parasternal long axis view showing hypertrophied IVS (thick arrow) causing obstruction to LVOT. Thickened and calcified aortic valve leaflets are also visualized. (thin arrow)*

She underwent aortic valve replacement with a 19-mm Edwards Inspiris Resilia bioprosthetic valve (Edwards Lifesciences, Irvine, CA, USA) and extended septal myectomy; with a total aortic cross-clamp time of 79 minutes and a total cardiopulmonary bypass time of 135 mins. Mitral valve leaflets were thickened but mobile with less than moderate obstruction on transesophageal echocardiogram and an intra-operative decision to not repair the valve was taken.

She was extubated on the day after surgery. She had complete atrioventricular dissociation post-operatively and was placed on epicardial pacing which was converted to a transvenous dual chamber pacemaker on the 7th postoperative day. She required a prolonged ICU stay of 10 days due to pulmonary issues and was discharged from the hospital on the 20th day.

She continues her regular follow-up and is in NYHA Class I status. Her follow-up transthoracic echocardiogram at 6 months showed a normal heart function with a normally functioning prosthetic aortic valve with a mean gradient of 8.2 mm Hg and no gradient across the LVOT.

Discussion

We present a case of combined HCM and AVS causing a fixed and dynamic obstruction to LVOT who underwent a concurrent procedure and improved clinically. Concentric left ventricular hypertrophy is a part of severe AVS, asymmetric hypertrophy of the ventricular septum can be an adaptation to chronically raised afterload or occur as a co-existent disorder of HCM.[6] Although symptomatic severe AVS is managed with surgical or transcatheter aortic valve replacement depending on the level of surgical risk[6], its occurrence with HCM in a patient poses diagnostic challenges. The detection of sub-valvular obstruction or abnormal anatomical variation in patients with AVS needs a high index of suspicion and a cautious echocardiography.[3]

HCM alone can be managed with surgical septal myectomy with excellent results,[7] however, when co-existent with severe AVS, valve replacement alone can lead to residual LV outflow obstruction and therefore needs to be combined with septal myectomy.[8] Correction of valvular stenosis without addressing septal hypertrophy may result in major postoperative morbidities and mortality.[3] To minimize or avoid residual obstruction, asymmetric septal hypertrophy with a sub valvular gradient above 30 mm Hg at rest or 50 mm Hg on exertion in a patient with symptomatic aortic stenosis, aortic valve replacement is recommended in addition to myectomy.[8] In the era of increasing transcutaneous aortic valve implantation (TAVI), the role of identifying the anatomy of sub-valvar structures and appropriate corrections is mandatory. There are case reports where patients have required emergency alcohol septal ablation following TAVR to minimize the effects of subvalvar obstruction.[9]

Preoperative right bundle branch block (RBBB) is a significant risk factor for the development of complete heart block (CHB), as LBBB is common after septal myectomy.[9] A large study by Cui and Schaff found that 34.8% of HOCM patients with preoperative RBBB who underwent transaortic septal myectomy developed CHB postoperatively. Our case had preoperative RBBB and developed CHB postoperatively necessitating insertion of a dual-chamber pacemaker.

Conclusion

This case highlights the importance of meticulously looking for sub-valvular obstruction in patients with aortic stenosis. It is important to address both valvular and septal pathology simultaneously to prevent or minimize post-operative morbidity and mortality from residual obstruction in patients with coexisting hypertrophic obstructive cardiomyopathy and aortic stenosis.

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