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Original Article

An Observational Study of Transesophageal Echocardiography in Patients Presenting with Ischemic Stroke

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Abstract

Background

Transesophageal echocardiography is a valuable tool for identifying stroke causes, particularly left atrial clots and cardiac abnormalities undetectable by other methods. However, studies on transesophageal echocardiography in resource-limited settings like Nepal are limited. This study aims to examine the demographics, clinical features, and transesophageal echocardiography findings of ischemic stroke patients.

Materials and Methods

An observational study was done in patients with ischemic stroke undergoing transesophageal echocardiography in a tertiary care center from April 1, 2022 to December 31, 2023. All the patients undergoing transesophageal echocardiography were included in the study after getting the ethical approval from the institutional review board with IRC-KUSMS Approval No. 54/24. Total population sampling was done. Descriptive statistics was used to analyze data.

Results

The mean age of the patients was 57.35±12.36 years. Smoking was seen in 40 (66.67%), hypertension in 37 (61.67%), dyslipidemia in 31 (51.67%), and diabetes mellitus in 30 (50.00%). Other risk factors included contraceptive use in 14 (23.30%) and rheumatic heart disease in 5 (8.30%). Left atrial clots were observed in 9 (15.00%), while left atrial (LA) enlargement (≥40 mm) was found in 57 (95.00%). The study shows that TEE is superior to detecting left atrial clots those missed by Transesophageal echocardiography. Among these, 7 males had a left atrial size <41 mm, and 1 female had a left atrial size <39 mm. There is also significant difference in left atrial size between the different age groups (p=0.001) with older age groups having larger Left Atrial size. Additionally, atrial septal defect was found in 3 (5.00%), patent foramen ovale in 1 (1.67%), and valvular heart disease in 18 (30.00%)

Conclusion

Transesophageal echocardiography detected crucial cardiac abnormalities in ischemic stroke patients, including left atrial thrombi and valvular dysfunction in our study.

Keywords: *Echocardiography, Ischemic stroke, Transesophageal*

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Introduction

Transesophageal echocardiography is the non-invasive procedure whereby echocardiography is performed by passing a transducer into the esophagus and imaging the heart. The evolving technology associated with the transducer provided with advanced techniques and resolution of the imaging with varied implications [1]. Transesophageal echocardiography (TEE) is the powerful tool to detect potential causes of stroke [2].

TEE may be adequate and the preferred technique while diagnosing conditions like left ventricular thrombi, ventricular aneurysms, mitral annulus calcifications, mitral valve prolapse, aortic calcifications, and intracardiac device linked thrombi as a possible cause of cardioembolic stroke [2]. TEE has diagnostic yield of more than 50% when used for stroke [3]. TEE is especially important in detecting left atrial clots and other abnormalities not visible on Transesophageal echocardiography (TTE) [4]. Still, there is scarcity of literature of transesophageal echocardiography in resource-limited settings like Nepal.

This study aims to study the demographic profile, clinical features and TEE findings of the patients undergoing transesophageal echocardiography in patients of ischemic stroke in a tertiary care center of Nepal.

Materials and Methods

An observational cross-sectional study was conducted in the cardiology unit of the Department of Internal Medicine of Dhulikhel Hospital from April 1, 2022 to December 31, 2023. The ethical approval was obtained from the institutional review committee with IRC-KUSMS Approval No. 54/24. Total population sampling was done. All the patients with ischemic stroke presenting with focal neurological deficit who underwent TEE were enrolled in the study. All the patients presented with ischemic stroke and underwent transesophageal echocardiography were included in the study. The patient in whom the transthoracic echocardiography revealed clod on left atrial thrombus, and had contraindications to the transesophageal echocardiography were excluded from the study. Patients having unsuccessful TTE and/or missing data were also excluded from the study.

Data was collected and reviewed for completeness in Microsoft Excel and descriptive analysis including mean, median, frequency, percentage and standard deviation were done with IBM Statistical Program for Social Sciences (IBM SPSS Version 25.0).

Results

There was a total of 60 cases who was undergone transesophageal echocardiography (TEE) during the study period. Among them, 33 (55.00%) were male and 27 (45.00%) were female with the male to female ratio of 1.22:1. The mean age of the patients was 57.35±12.36 years. The distribution of patients by age category is as follows: less than 40 years 5(8.33%), 40-60 years was 27 (45.00%), more than 60 years was 28(46.67%).

Out of total sample population enrolled, Smoking was seen in 40 (66.67%) persons and among patients who smoke, 25(65.79%) consumed more than 20 pack years of cigarettes. Hypertension was found in 37 (61.67%) followed by dyslipidemia in 31 (51.67%) and Diabetes mellitus in 30 (50.00%). Other risk factors like use of contraceptives were seen among 14 (23.30%) individuals and Rheumatic Heart Disease (RHD) was seen in 5(8.30%) of individuals. Among 60 patients undergoing TEE, Left Atrial Clots were seen in 9(15.00%) patients, left atrial (LA) size (>=40 mm) was found in 57(95.00%) of the patients. Among them, male with LA size less than 41 mm were 7 out of 33 males and female with LA size less than 39 mm were only 1 out of 27 females. ASD was found in 3(5.00%), PFO was found in 1 (1.67%) and valvular heart disease was found in 18 (30.00%) of the patients.

Among the patient presented with ischemic stroke, 53 were hypotonic (88.30%),10(16.66) cases had only a flicker of contraction while 50 cases had detectable power only after excluding gravity by postural adjustment, 54(90.00%) of cases had a very brisk response while 3(5.00%) cases had normal brisk response and rest 3(5.00%) cases had clonus. Plantar was bilateral flexor in 100% of cases and facial nerve involvement was seen in 6 (10.00%) of cases.

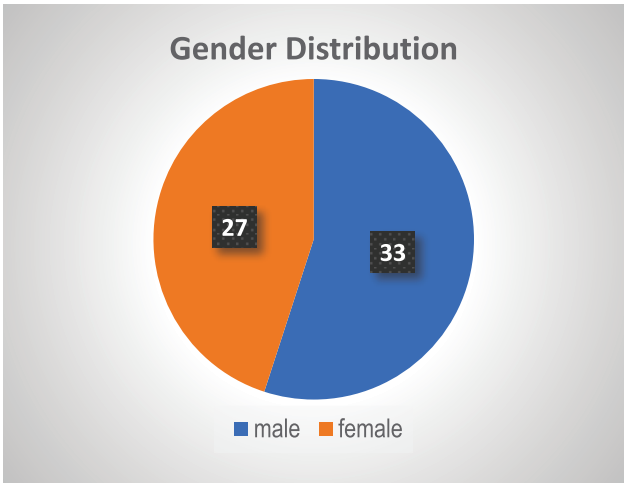

Figure 1: Gender Distribution

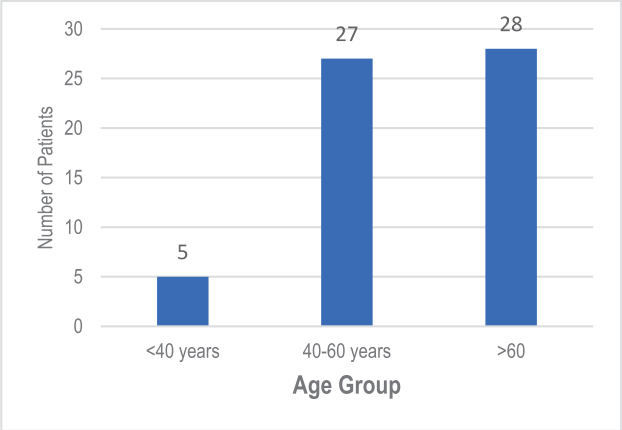

Figure 2: Age group distribution of patients

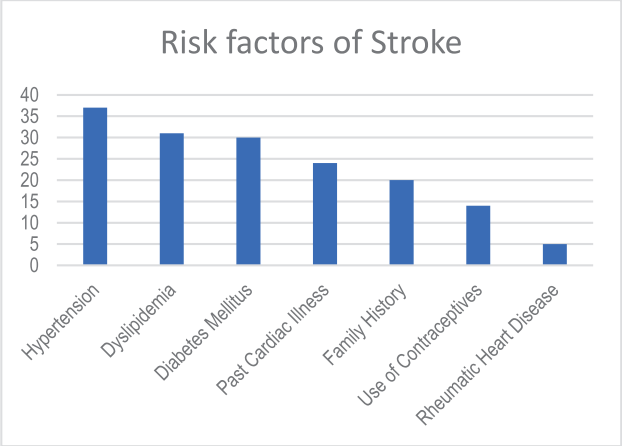

Figure 3: Risk factors for Stroke

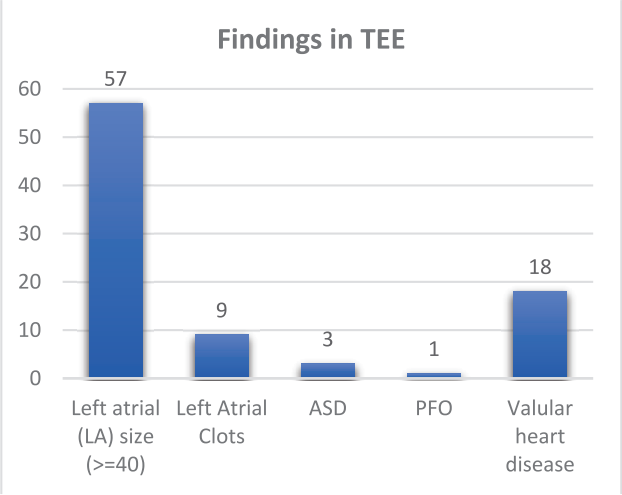

Figure 4: Findings in TEE

Discussion

Among patients undergoing TEE, there was higher number of male than female which aligns with the evidence that stroke is higher in males [5]. This gender disparity may be due to higher rate of smoking, hypertension, and other cardiovascular risk factors among men [6]. There is high prevalence of modifiable risk factors like smoking (66.67%), hypertension(61.67%) and dyslipidemia (51.67%) suggesting the cardiac risk factors causing higher rate of stroke [7]. Among smokers, 65.79% had consumed more than 20 pack-years, emphasizing the importance of smoking cessation in stroke prevention –[8]. Also, diabetes was seen in 50% of our patients which is a well-established factor for stroke [9]. Among the patients undergoing transesophageal echocardiography, left atrial enlargement (LA size> 40mm) was seen in 95% of the patients which is related to the association of left atrial enlargement with ischemic stroke [10]. Furthermore, there was a significant difference in LA size between different age groups (p=0.00), with older age groups having larger Left Atrial size. Studies have also shown that ageing is associated with LA enlargement which can increase the risk of thrombus formation [11, 12].

Also, Left atrial clots was seen in 15% of the patients which is often missed in transthoracic echocardiography (TTE) highlights the importance of TEE –[13]. Valvular heart disease was found in 30% of patients, emphasizing its significance as a possible source of embolism which is consistent with earlier research demonstrating that valvular heart disease is one of the leading causes of embolic strokes [14]. Rheumatic heart disease, which is still common in low-income countries, continues to contribute significantly to valve pathology, particularly mitral stenosis and regurgitation, both of which predispose individuals to thrombus formation and systemic embolization [15]. These findings highlight the need of early detection and treatment of valvular heart disease, especially in resource-constrained areas where access to sophisticated cardiac procedures may be limited. In our study also, ASD was found in 5.00% of the study population. ASDs provide a pathway for paradoxical embolism, in which thrombi originated from the venous system can bypass the lungs and enter systemic circulation, potentially leading to stroke [16]. Neurological findings among the study population were consistent with ischemic stroke presentations. Hypotonia was found in 88.3% of patients, while facial nerve involvement was seen in 10%. These findings are consistent with the pyramidal tract involvement often seen in ischemic strokes, confirming the clinical diagnosis of stroke [17].

This study emphasizes the advantages of TEE over TTE in detecting cardiac causes of embolism. Also, the study shows that TEE is superior to TTE (p=0.0479) in detecting LA clots. While TTE is frequently used as the first-line imaging modal-

ity because to its non-invasiveness and widespread availability, its sensitivity in identifying intracardiac thrombi, left atrial appendage abnormalities, and minor structural defects is limited [18]. Also, one study showed similar diagnostic yield of echocardiography and cardiovascular MRI [19]. So, TEE is important in resource limited settings like Nepal where the access to advanced imaging modalities like MRI may not be easily available and affordable. This study has few limitations. As the study was done in a single tertiary care center, this study may not reflect large geographic area. Also, since it is a descriptive cross-sectional study, it lacks the ability to establish causality or temporal relationships.

This study contributes to the expanding body of research on the use of TEE in stroke assessment, particularly in low and middle-income countries. Future research should include prospective trials with larger sample numbers to verify these findings and investigate the long-term influence of TEE-guided treatment on clinical outcomes. TEE inclusion into routine clinical practice at tertiary care institutions may also aid in risk assessment and subsequent stroke prevention [20].

Conclusion

Our study concluded that the incidence of left atrial thrombus detected by transesophageal echocardiography is higher than that of the transthoracic echocardiography. Our study also showed high prevalence of left atrial enlargement and significant findings among patients of ischemic stroke like atrial septal defects, patent foramen ovale and valvular heart diseases which was identified by the use of TEE.

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