Original Article

RELATION OF LOW LEFT ATRIAL APPENDAGE VELOCITY WITH THROMBUS FORMATION IN PATIENTS WITH SIGNIFICANT RHEUMATIC MITRAL STENOSIS

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ABSTRACT:
OBJECTIVE: To study low left atrial appendage velocity and its relation with thrombus formation in patients with significant rheumatic mitral stenosis.
MATERIAL AND METHOD: A cross sectional study was conducted at a tertiary care hospital from February 2014 to December 2015. Sixty patients with significant mitral stenosis as diagnosed by a 2D ECHO were included in the study. Patient variables and ECHO data was recorded for each patient. Significant mitral valve stenosis classified as severe Mitral Stenosis (MVA) ≤ 1.5 cm2 and very severe Mitral Stenosis (MVA) ≤ 1.0 cm2. Patients were divided into two groups based on values of left atrial appendage velocity (LAAV). Group1 (LAAV< 20cm/sec) Group 2 (LAAV > 50 cm/sec). Data was entered and analyzed in SPSS version: 21.0. p-value less than 0.05 was considered statistically significant.
RESULTS: A total of 60 patients were included in the study and divided into two groups. In Group I (LAAV< 20cm/sec), mean age was 26.84 ± 8.531 years, out of which 25 % were male and 75.0% were females. In Group II (LAAV> 50cm/sec), mean age of subjects was 26.18 ± 8.120 years and 50.0% were male and 50.0% were female (X2= 4.019, P< 0.045). Left Atrial Appendage (LAA) clot formation occurred in 34.4% patients in Group I and in 7.1% in Group II (X2= 6.255, P < 0.01). Spontaneous ECHO Contrast (SEC) formation in Group I was 62.5% and in Group II it was 21.4% (P <0.001). Mean Mitral Valve Pressure gradient in Group I was 15.88 ± 2.637 mmHg and in Group II was 12.25 ± 1.076 mmHg. (t=6.792, P =.000). Mean Mitral Valve area in Group I was 0.828 ± 0.0772 cm^2 and in Group II was 1.293 ± 0. 1086 cm^2. (t= -19.280, P =.000)
CONCLUSION: Our study concluded that low left atrial appendage velocity is associated with Left Atrial thrombus formation in patient with significant rheumatic mitral stenosis.
KEY WORDS: Left Atrial Appendage Velocity, Thrombus, Rheumatic Mitral Stenosis.

INTRODUCTION:

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For a long time, it was considered that the left atrial appendage (LAA) was a structure which apparently did not have any important function in the heart and could be easily resected during cardiac surgery without hazardous effects on the human body. But with advancements of echocardiographic techniques, it is now proved that the LAA is an actively contracting structure which likely plays an important role in cardiac function. Particularly, the dysfunction of LAA leads to thrombus formation that can result in potentially devastating complications like embolization[1]. Therefore a detailed assessment of LAA structure and function is now regularly performed to guide therapeutic decision-making in important cardiac diseases[2].

In the modern era of Echocardiography, Transesophageal echocardiography (TEE) is the modality of choice for the detailed study of the LAA. TEE not only permits complete assessment of its anatomical function but also allows a detailed study of function in almost all patients [3].

TEE is a highly accurate method and according to some studies its sensitivity and specificity is as high as 100% and 99% respectively [4].But in reality, TEE as a diagnostic modality may not be so highly accurate due to false-positives (pectinate muscles/ Coumadrin ridge diagnosed as thrombi) and false-negatives (thrombi hidden in one of the lobes missed) studies[5]. So for this purpose a meticulous scanning of the LAA from different imaging planes is essential to reduce the incidence of wrong diagnosis. But despite these advancements in echocardiography, it may be sometimes difficult

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to differentiate a thrombus from the pectinate muscles or artifact shadows. In those cases the Doppler echocardiographic studies can be helpful for differentiation[6].

TEE is not only helpful in the detection of thrombus but also demonstrate the presence of LAA spontaneous echo contrast (SEC). SEC has been shown to be the precursor of thrombus formation which eventually leads to thromboembolism [7].

LAA flow velocity has generally been measured by TEE more accurately. But it can also be measured by transthoracic echocardiography. According to recent studies low LAA emptying velocity leads to thrombus in LAA in patients with significant rheumatic mitral stenosis[8].

Current advancements in echocardiography allow us to measure left atrial appendage flow velocity by transthoracic echocardiography to some extent.Several studies inthe western societies have shown relationship between low left atrial appendage velocity and thrombus formation in patient with significant rheumatic mitral stenosis. Our study aimed to address this problem in Pakistani population.

MATERIAL AND METHODS:

A cross sectional study was carried out including 60 patients with significant mitral valve stenosis classified as severe Mitral Stenosis (MVA) ≤ 1.5 cm^2 and very severe Mitral Stenosis (MVA) ≤ 1.0 cm^2. All the patients underwent trans-esophageal echocardiography on GE Vivid 7 dimension machine. All patients were having atrial fibrillation at the time of study. Baseline demographic characters like age, sex and mitral valve mean pressure gradient (MVPG) was measured in all patients. We made 2 groups for comparison baesd on values of left atrial appendage late diastolic velocity (LAAV). Emptying velocity of left atrial appendage (LAA-E) was measured which infect is a LAA contraction velocity and a marker of LAA contractile function. Group1 (LAAV< 20cm/sec) and Group 2 had (LAAV > 50 cm/sec). Variables compared in groups were age, gender, LAA clot formation, Spontaneous Echogenic Contrast, Mitral valve area and Mean Pressure Gradient. Data was entered and analyzed in SPSS version: 21.0. Chi-square test was used for nominal variables like age, LAA clot formation and spontaneous echo contract and independent t test was used to compare Mitral valve area and mean pressure gradient with $p < 0.05$ as statistically significant.

RESULTS:

Sixty patients with atrial fibrillation who underwent Transesophageal echocardiography were divided into two groups (table 1). In Group I (LAAV< 20cm/sec), mean age was 26.84 ± 8.531 years, 8 patients (25 %) were male and 24 (75.0%) were females. In Group II (LAAV> 50cm/sec), mean age of patients was 26.18 ± 8.120 years, 24 (50.0%) were male and 14 (50.0%) were female (X2= 4.019,P<0.045) . LAA clot formation occurred in 11 patients (34.4%) in Group I and in 2 patients (7.1%) in Group II (X2= 6.255,P <0.01). SEC formation in Group I was in 20 patients (62.5%) and in Group II 6 (21.4%) (P <0.001). Mean Mitral Valve Pressure gradient in Group I was 15.88 ± 2.637 mmHg and in Group II was 12.25 ± 1.076 mmHg. (t=6.792, P =.000). Mean Mitral Valve area in Group I was 0.828 ±0.077 cm^2 and in Group II was 1.293 ± 0. 1086 cm^2 (t= -19.280, P =.000)

Table 1: Results and main findings.

		Group I n=32 (LAAV< 20cm/sec)	Group II n=28 (LAAV> 50cm/sec)	P VALUE
Age (Mean) (Years)		26.84 ± 8.531	26.18 ± 8.120	NS
Gender	Male	8 (25.0%)	14 (50.0%)	X^2= .4.019
	Female	24 (75.0%)	14 (50.0%)	P = 0.045
LAA clot Formation		11 (34.4%)	2 (7.1%)	X^2= 6.259 P = 0.011
SEC Formation		20 (62.5%)	6 (21.4%)	X^2= 10.259 P = 0.001
Mean Mitral Valve Pressure gradient mmHg		15.88 ± 2.637	12.25 ± 1.076	t= 6.792 P = .000
Mitral Valve Area cm^2		0.828 ± 0.0772	1.293 ± 0.1086	t= -19.280 P =.000

DISCUSSION:

Epidemiologists and cardiologists have acknowledged that LAA dysfunction is a strong precursor of thrombus formation and eventually embolic events, even in those patients who do not have clot in LA on initial study[9,10]. In the subset of Stroke Prevention in Atrial Fibrillation III study which included patients with AF, the rate of thrombus formation was 17% in patients with LAA emptying velocities ≤20 cm/s when compared to those patients with higher LAA emptying velocities where it was 5%.[9] The rate of SEC was also higher in patients with low LAA emptying velocities (75% vs 58%). Moreover, the incidence of ischemic stroke was 2.6 times greater in patients with lower velocities than in those with higher velocities. Many other studies also showed same findings[9,1].Güler et al also found SEC and

thrombus were more frequent in patients of mitral stenosis with low LAA velocity (LAAV< 46cm/sec) [11].In a recent study conducted by Fazlinezhad et al done on patients with severe rheumatic mitral stenosis showed that patients with LA clot had more LA appendage dysfunction, frequent atrial fibrillation rhythm, and smaller mitral valve area but there was statistically insignificant difference between patients with or without LA clot regarding the presence or absence of SEC (P = 0.072) [8].

Golbasi Z et al found that LAA dysfunction may occur in patients with mitral stenosis in sinus rhythm which leads to more SEC and clot formation in left atrium[12]. In a similar study by Kaya et al showed that SEC is the precursor of thrombus formation which eventually leads to thromboembolism in patients with mitral stenosis [7].

In the setting of mitral stenosis, the LAA dysfunction is a strong precursor of SEC and thrombus formation in LA. Successful percutaneous balloon mitral valvuloplasty (PBMV) improves the LAA function which also leads to reduced incidence of the stroke in those patients. Reddy et al, demonstrated the effect of BMV on LAA function in patients with significant mitral stenosis while in sinus rhythm. A noteworthy improvement in LAA flow and tissue velocities on TEE performed after BMV was found. This leads to almost complete disappearance of SEC in all the patients who had SEC before the procedure was performed[13].So based on the strong association between LAA dysfunction and the risk of thrombus formation, an echocardiographic assessment of the LAA function after BMV may be an imperative goal with significant therapeutic effects. Another study by Vijayvergiya et al, had followed those patients who underwent BMV for longer time and had shown sustained enhancement in LAA function over this period[14].Our study suggested that mitral valve area (MVA) was significantly smaller in patients with lower LAAV which eventually had more LA clot and SEC formation. A study by Manjunath et al, showed MVA did not have significant relation with thrombus formation[2].

The significant relationship between low left atrial appendage velocity with thrombus formation in patient with significant rheumatic mitral stenosis as demonstrated by our study as well other studies. Research work demands much larger studies for the assessment. The actual scale of this problem as mitral stenosis is quite prevalent in our country. Moreover educational programs for public awareness on rheumatic mitral stenosis should be conducted to avoid these complications by early management.

CONCLUSION:

Our study concluded that low left atrial appendage velocity is associated with Left Atrial thrombus formation in patient with significant rheumatic mitral stenosis.

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