ORIGINAL ARTICLE

Incidence of Left Atrial Thrombus in Patients with Rheumatic Mitral Stenosis in Sinus Rhythm & to Find out the Factor Responsible for Clot Formation: A Transesophageal Echocardiographic Study

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Abstract

Rheumatic mitral stenosis (MS) predisposes to left atrial (LA) Thrombus formation. The reported incidence of LA clot formation in sinus rhythm (SR) is 2.4 to 13.5% in various studies. Aim: To determine the incidence of LA thrombus in MS in SR in a group of patients and to determine the factors that predict its development. Method: Total of 110 consecutive patients with MS in SR who were being evaluated for percutaneous transverse mitral commisurotomy or CMV were included in the study. Both transthoracic (TTE) and transesophageal echocardiogram (TEE) were performed to identify clot and other hemodynamic parameters. Result: The mean age of the study population was 35.15+10.34 years and the mitral orifice area was 0.75+0.22 cm2.. Out of 110 patients, 9 patients (8.1%) had LA thrombus on TEE. On univariate analysis there was a trend toward thrombus formation in individual with age >45 years, LA inferosuperior dimension > 6.8 cm, mean mitral gradient >18 mHg and dense spontaneous echo contrast (SEC). On multivariate analysis none of factor predicted clot formation. Conclusion: The incidence of LA thrombus in MS in SR (8.1%). TEE is warranted in MS Patients in SR When they are >40 years, LA inferosuperior dimension >6.8cm and mean mitral gradient >18 mmHg. When SEC is absent on TEE, Thrombus formation is unlikely.

Key Words

Mitral Stenosis, Thrombus, Sinus Rhythm, SEC, TEE

Introduction

Rheumatic mitral stenosis with left atrial Thrombus is a predisposing condition which can lead to serious complications of systemic embolism with economic burden in many patients. Thrombus within the left atrium and its appendages is well visualised by transesophgeal echocardiography (TEE) (1) and is usually detected in association with atrial fibrillation (AF). Thrombus formation is seen in about 33% of patients with rheumatic mitral stenosis in AF (2). The reported incidence of LA Thrombus in the presence of sinus rhythm (SR) is 0.1% out of 20643 TEE examination in general population (3). Left Atrial clot formation is reported in about 2.4- 13.5% of patients with mitral stenosis in SR in various studies (4-9). The present study was conducted with the objective to determine the incidence of LA clot in patients with rheumatic mitral stenosis who were in SR and to find out and establish the factors that play determining role in this process.

Material and Methods

The present study was conducted in the Department of Cardiology of Government Medical College Jammu. A Prospective cohort study was conducted for a period of two years ranging from December 2013 to December 2015. A total of 110 consecutive patients of rheumatic

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moderate to severe mitral stenosis who were more than 18 years of age were included in the study. Their inclusion criteria were having patients in sinus rhythm which was determined by electrocardiogram(ECG) done at the first out patients visit, ECG monitoring during TEE and ECG done after one month in the outpatient department. If the ECG showed sinus rhythm during all three stages, then these patients were included in the study. All those patients who were excluded from study; (a) Patients in atrial fibrillation (b) Patients not willing for TEE(c) Patients who had contraindications for TEE (d) Patients did not come for follow up at the end of 1 month. A total of 110 patients who were included in the study fulfilling above mentioned inclusion criteria, comprising both males and females with a mean age of 35.15 +_ 10.34 years (range 18 to 58 years).

Two Dimensional Echocardiography and Doppler study- All patients underwent both Transthorcic and Transesophageal two dimensional Echocardiograms using Siemens Colour Doppler machine. TEE Doppler studies were performed by using a Omniplane transducer. LAA clot was diagnosed by the presence of clearly defined echogenic intra-cavitary mass with an echo texture different from that of underlying endocardium and not due to pectinate muscle(10). Spontaneous echo contrast(SEC) was diagnosed by the presence of dynamic smoke like echoes in the LA with characteristics swirling motion distinct from white noice artifacts after properly adjusting the gain settings .SEC was scored by the method described by fatkin et al(11).and accordingly was graded as 0=no echogenicity,1 +=mild(minimal echogenicity only, transiently detectable with optimal gain settings),2+=mild to moderate (transient echogenicity without increased gain settings and more dense pattern than grade 1),3+=moderate(dense swirling pattern through-out cardiac cycle),and 4+= severe(intense echogenicity and very slow swirling pattern in the LA appendage ,usually with similar density in LA body). The inferosuperior and transverse LA dimension were measured in the apical four chamber view.

Statistical Analysis

Mean values and standard deviations were computed for continuous variables. Evaluations of changes over time were made with a students paired t- test. Differences were considered significant at $p< 0.05$. Values were expressed as mean values + standard deviation. All statistical analysis was performed using SPSS 15.0 statistical software.

Results

A total 110 patients included in the study as per the inclusion criteria. Out of 110 patients, 73 were females and rest 37 were males with a mean age of 35.15 + 10.34 years (range 18 to 58 years). The baseline characteristics of the study population are shown in *Table 1*. The mean mitral valve orifice area(MVOA) and mean mitral valve gradients were 0.75 + 0.22 cm2 15.75 +6.68 mmHg, respectively. The atrial size was 4.53+ 0.57 cm. SEC was seen within the atrial cavity in 84 patients (76.36%) on transesophgeal echo. Mitral regurgitation of grade II was present in only 4 patients (3.63%). About 4 patients(3.63%) showed presence of thrombus in LA on transthoracic echo, whereas on transesophageal echo 9 patients (8.1%) were found to have thrombi. The LA thrombus was classified according to the scheme proposed by Manjunath *et al* (12)..The common sites of thrombus formation were the LA appendage (Type Ia) 7 patients (6.36%), LA appendage with protrusion to LA cavity (Type Ib) 1 patients (0.90-%),(fig1b), LA roof clot limited to plane above fossa ovalis (Type IIa) 1 patients (0.90%) . Clot types Type 11b,III, IV and V were not seen in patients with SR in our study. The mean left atrial appendage emptying velocity and filling velocities were 16.8 + 9.6 cm/s and 21.3 + 13.2cm/s in patients with thrombus compared to 22.5 + 9.7 cm/s and 23.7+10.4 cm/s in those without thrombus. Though the LA appendages emptying and filling velocities were lower in the group with thrombus, this did not assume statistical significance. On univariate analysis there was a trend toward thrombus formation in SR with increasing age. (*Table 2*).however, on multivariate analysis none of the factor predicted the development of thrombus.

Discussion

Currently there are only few studies available wherein they have studied the incidence of left atrial thrombus in patient with mitral stenosis in sinus rhythm while as lot many work have done where they have studied the incidence of thrombus in patient with mitral stenosis and atrial fibrillation

In our study thrombus was found in 8.1% of all patients with moderate to severe mitral stenosis in sinus rhythm who underwent TEE .This finding of our study is well consistent with findings of other studies which have reported an incidence of about 2.4 to 13.5%(6-9) .A similar

Table 1.The Baseline Characteristics

Variables	Mean+ Standard Deviation
Age(years)	35.15 + 10.34
MVOA(cm^2)	0.75 + 0.22
Mean MVG(mmhg)	15.75 +6.68
Wilkins score	8.21 + 1.61
LA SEC on TEE	2.8 + 1.20
LA AP (cm)	4.53 + 0.57
LAA EV (cm/s)	18.26 +11.55
LAA FV (cm/s)	23.26 + 12.19s

MVOA= mitral valve orifice area; MVG = mitral valve gradient; LA AP = left atrial anteroposterior dimension; LAA EV= left atrial appendage emptying velocity LAA FV =left atrial appendages filling velocity.

Table 2. Univariate predictors of Thrombus Formation

Variables	Thrombus present	Thrombus Absent	p-value
Age (years)	45.5+8.9	34.5 +9.1	0.007*
LA AP(cm)	4.6±0.6	4.3 ± 0.7	0.272
LA IS (cm)	6.8+0.7	6.1 +0.7	0.022*
LA Trans (cm)	5.2± 0.5	5.1 ± 0.7	0.691
LA ESV (ml)	94.2+24.1	81.5+33.3	0.296
LA EDV (ml)	137+41.3	118 +41.1	0.271
MVOA (cm)	0.75+0.22	0.77+ 0.22	0.825
Mean MVG(mmHg)	18.4±6.0	14.0 ± 5.0	0.064*
Wilkins score	9.0+1.3	8.8+1.9	0.766
TEE LA SEC	3.2±1.2	2.2± 1.2	0.053*
LAA EV (cm/sec)	16.8+9.6	22.5+ 9.7	0.162
LAA FV (cm/sec)	21.3±13.2	23.7± 10.4	0.625

*LA AP=left atrium anteroposterior diamension;LA IS =left atrium inferosuperior diamension; LA Trans = left atrium transverse diamension;LA ESV=left atrium end systolic volume; LA EDV=left atrium end diastolic volume ;MVOA =mitral valve orifice area;MVG =mitral valve mean gradient ;LA SEC =left atrium spontaneous echo contast; LAA EV=left atrium appendage emptying velocity ; LAA FV =left atrium appendage filling velocity. *statistically significant*

study was conducted by Manjunath *et al* (12) in 845 patients where they have found the incidence of thrombus in sinus rhythm about 6.6 %.Another similar study conducted by Saidi *et al* (7) where in the incidence of clot in patients with mitral stenosis and Sinus rhythm was found to be 13.5%.In their study the mean age of the study population was 44.8 years as compared to 35.15 years in our study and this could have contributed to the increased incidence of clot in that study.

Factor responsible for thrombus formation in sinus rhythm: On univariate analysis the, the parameters that appeared to relate the development of thrombus in patients with moderate to severe mitral stenosis were age , LA inferosuperior diamension,mean mitral valve gradient and dense Spontaneous Echo Contast(SEC).However,on multivariate analysis these parameters of our study doesnot found to have any relation with thrombus formation .These results of our study were consistent with the study conducted by Saidi et al and Manjunath et al where inspite of incidence of clot being 13.5% and 6.6%,none of the echocardiographic parameters predicted the development of thrombus.

In the some earlier studies conducted by Li *et al* (13)., Agarwal *et al* (14) and Gonzalez-Torrcella *et al* (15) mitral valve orfice emerged as the single most predictor of LA clot formation.Although the MVOA did not show any correlation with clot formation in our study while as Mean mitral valve gradient showed a trend toward clot formation but was statistically insignificant.In our study the LA inferosuperior diamension was found to be correlate with thrombus formation on univariate analysis while as LA diamension in other planes did not .

The LA appendage emptying and filling velocity were consistently lower in patients with clot compared to those without;yet it did not reach to statistical significance. This suggest that though the LA appendage function is reduced in mitral moderate to severe stenosis,this alone does not promote thrombus formation in Sinus Rhythm

Unlike earlier studies that had found the incidence of SEC in Sinus Rhythm to be 62% (6), nearly 73.6% in our study had SEC .In our study all the 9 patients with clot had SEC(100%).There is an insignificant trend toward thrombus formation in all patients with sinus rhythm with SEC.

Possibility of intermittent Atrial fibrilition canot be ruled out .However, in our study patients have been

evaluated on three different occasions for the underlying rhythm as described in methods mentioned above.

Conclusion

Despite the facts that left atrial clot is usually seen in mitral stenosis patients with Atrial fibrillation, mitral stenosis patients in sinus rhythm are also at the risk for clot formation .In patients with sinus rhythm ,there is trend toward thrombus formation with increasing age , inferosoperior LA dimension, mean mitral valve gradient and dense SEC. Hence we recommend TEE in mitral stenosis patients in sinus rhythm when they are >45 years ,inferosuperior dimension is > 6.8cm and when the mean mitral valve gradient is > 18 mmHg. when SEC is absent on TEE thrombus formation is unlikely.

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