

# Detection of Thrombi in Left Atrial chamber by Transoesophageal Echocardiography in patients suffer from Non-rheumatic Atrial Fibrillation

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## ABSTRACT

**Background:** Background : Patients with non-rheumatic atrial fibrillation have high risk of thromboembolism especially ischemic stroke usually arising from left atrial appendage .Transoesophageal echocardiography provides useful information for risk stratification in these patients as it detects thrombus in the left atrial or left atrial appendage.

**Objective :** This study was conducted at Al-Kadhimiya Teaching Hospital to assess the prevalence of left atrial chamber thrombi in patients with chronic non-rheumatic atrial fibrillation using transoesophageal echocardiography and its clinical significance as well as to verify the superiority of transoesophageal over transthoracic echocardiography in the detection of these abnormalities.

**Type of the study:** Cross sectional study.

**Patients and Methods :** Forty (40) consecutive patients (11 female and 29 male), at a mean age of  $46 \pm 9$  years (range 28-60) with chronic non-rheumatic Atrial fibrillation were enrolled to this prospective study between March 2006 and December 2006. Transthoracic and transoesophageal two dimensional , M- mode , Doppler, and color- flow echocardiography were obtained with a kretz diagnostic ultrasound system.

**Results :** The prevalence of Left atrium thrombus was 12.5%, 5 patients from the total number which was 40 patients. All of them seen bytransoesophagealechocardiography and non are detected byTansthoracic echocardiography . All the left atrial thrombi were confined to the left atrial appendage (100%). Left atrial spontaneous echo contrast was detected in 10 patients 25% by transoesophageal

echocardiography, but was not observed in patient bytransthoracic echocardiography. All the 5 thrombi were found in left atria were significantly associated with spontaneous echo contrast 100% (P-value  $<0.001$ ), reduced left ventricle ejection fraction (p-value  $<0.05$ ) , large left atrium diameter ( p-value  $<0.05$ ) and low LAAV  $<20$  cm/s (p-value  $<0.001$ ) compared to those without thrombus .

**Conclusions :** The study showed that the prevalence of left atrial thrombus and appendage is not uncommon in patients with non-rheumatic atrial fibrillation and is exclusively seen in patients with left atrial SEC. Low Left ventricle ejection fraction , large Left atrium diameter , and low Left atrial appendages velocity are significantly associated with subsequent thrombus formation , and is more sensitive in the detection of these abnormalities compared with transthoracic echocardiography .

**Key words:** non-rheumatic atrialfibrillation, Transoesophageal echocardiography,large LA diameter Baghdad College of Medicine - Baghdad University ,Baghdad Teaching Hospital ,Baghdad Teaching Hospital

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**A**trial fibrillation is a supraventricular arrhythmia characterized by complete absence of coordinated atrial contractions. On the electrocardiogram (ECG) P waves are absent and are replaced by fibrillatory waves (1) .Atrial fibrillation is the most common arrhythmia that requires treatment (2) , occurs in 2 to 4 percent of the population aged 60 years and older (3-5) . The prevalence of AF increases with age, affecting more than 10 percent of people older than age 80 years (3-6) . Although rheumatic valvular disease remains the most common cause in developing countries, most patients develop atrial fibrillation against a background of systemic hypertension and coronary artery disease (non-rheumatic or non-valvular AF). Clinically important causes for AF are as follow: • Binge drinking • Cardiac and non-cardiac surgery • Myocarditis or pericarditis • Hyperthyroidism • Sympathomimetic medications • The consequences of AF include : Palpitation , Impaired haemodynamics due to low cardiac output if there is very fast ventricular response , (7) .

Types of AF :.Paroxysmal (i.e., self-terminating) AF in which the episodes of AF generally last less than seven days, usually less than 24 hours, and may be recurrent. • Persistent AF fails to self-terminate and lasts for longer than seven days. Persistent AF may also be paroxysmal if it recurs after reversion. AF is considered recurrent when the patient experiences two or more episodes. • Permanent AF is considered to be present if the arrhythmia lasts for more than one year and cardioversion either has not been attempted or has failed. • "Lone" AF describes paroxysmal, persistent, or permanent AF in individuals without structural heart disease(8).

Patients treated with rhythm control likely remain at risk for embolization even when in sinus rhythm for two main reasons: recurrent episodes of AF are common and asymptomatic in up to 90 percent (9,10)

The mechanisms leading to an increased risk of stroke, thrombus, and embolism in AF are multiple, complex, and closely interact with each other (11) ; this may be due to its shape and the presence of trabeculations (12)

Spontaneous echo contrast (SEC) – one of the initial events occurring in a fibrillating left atrium (LA) is increased erythrocyte aggregation caused by low shear rate due to altered LAA flow dynamics and uncoordinated LA systole (13, 14). The resultant smoke-like echoes swirling slowly in the LA are referred to as spontaneous echo contrast (SEC), an echo phenomenon, or "smoke". SEC is a strong risk factor for and may be the preceding stage to thrombus formation (15,16,17). Its occurrence is independently related to the hematocrit and fibrinogen concentrations and may be associated with a hypercoagulable state (14, 18). Because of the higher transducer frequencies used in TEE probes, spontaneous echoes in the left atrium can be identified more frequently by TEE than by TTE (19,20,21). Spontaneous echoes in the left atrium are found most often in patients with mitral valve stenosis, mitral prostheses, or atrial fibrillation (20). Spontaneous echoes in the left atrium also indicate an increased risk of thrombus formation and embolism in patients with nonvalvular AF (20,22,23). Therefore, this phenomenon is usually searched for as a sign of a potential source of embolism (24). Once it occurs, SEC is a stable phenomenon that cannot be resolved by either warfarin or aspirin therapy (20,26). However, anticoagulation can reduce subsequent thrombus formation and thromboembolic events. SEC semi quantitatively graded as follows (on the basis of the system described by Fatkin et al) (27-28). The LAA peak outflow velocity One of the most important determinants of stasis in the LAA is the degree of LAA peak outflow Velocity as detected by TEE (29); LAAV among patients with sinus rhythm is (71±16 cm/s) (30). -The thrombin-antithrombin III complex, a marker of thrombin generation, and D-dimers, released as a substrate of fibrin by activity of plasmin, are significantly elevated in patients with AF compared with those in sinus rhythm (31,32).

**Aim of the study :**

To assess the prevalence of left atrial and left appendage thrombi in patients with chronic non-rheumatic atrial fibrillation using transoesophageal echocardiography and its clinical significance as well as to verify the superiority of transoesophageal over transthoracic echocardiography in the detection of these abnormalities

**Patients & Methods :** Forty (40) consecutive patients (11 female and 29 male), at a mean age of 46 ± 9 years (range 28-60) with chronic non-rheumatic AF were enrolled to this prospective study between March 2006 and December 2006. The majority of those patients were seen in the outpatient clinic for echocardiographic assessment in the Echocardiographic Unit of Al-Kadhimiya Teaching Hospital and the rest are patients admitted to the same hospital for different presentations and comorbid conditions. **Inclusion Criteria:** • AF rhythm which was chronic as documented by serial ECGs **Exclusion Criteria:** • Patients known to have Oesophageal disease • Patients unable to tolerate TEE study • Acute AF rhythm • History, physical and /or echocardiographic evidence of rheumatic mitral stenosis.

At the time of TEE study, seven (7) patients (17.5%) were receiving anticoagulant therapy, twenty (20) patients (50%) were receiving anti-platelets and Thirteen (13) patients (32.5%) on no treatment (neither aspirin nor warfarin).

**Echocardiographic evaluation :** Transthoracic and transesophageal two dimensional, M-mode, doppler,

and color-flow echocardiography were obtained with a kretz diagnostic ultrasound system. TTE study: Conventional echocardiographic examination were obtained using 2-4 MHz probe. In each patient Transthoracic echo study was performed routinely, immediately before the transesophageal examination.

**Preparation and premedication for TEE study.** Before the examination patients had fasted for a minimum of four hours and had given their consent.

Most of our patients were sedated either with diazepam (5-10 mg), midazolam (1-4 mg), or pethidine (50-100 mg) IV. Antiemetic was given to the majority of our patients. A cannula was always inserted into a peripheral vein for administration of medications. The patient lies in a left lateral decubitus position with gentle neck flexion. A cardiac rhythm strip, continuously displayed on the echocardiography screen, was monitored regularly; the oropharynx was anaesthetized with xylocain 10% spray. The patient was observed for a time while the effect of sedative drugs wore off.

**Statistical Analysis** Results are expressed as means ± standard deviation (SD) and continuous variables between groups were compared by unpaired student's t-test, and categorical variables were compared using Chi-square test. All P-value are two-sided, < 0.05 considered statistically significant and > 0.05 considered not significant, and if <0.001 considered to be highly significant statistically

**Results ;** All the cases were studied prospectively from March 2006-December 2006. The total number of patients in this study was 40 patients. Age was ranged between 28-60 years, mean 46±9. Regarding sex, male patients were more than females in this study, 29 male patients (72.5%) and 11 female patients (27.5%). (Fig 1). Regarding etiology of AF, it was found that: -45% had HT (18 patients). -10% had CAD (4 patients). -12.5% had IDCM (5 patients)- 5% had hyperthyroidism (2 patients). -7.5% had COPD (3 patients). -2.5% had SSS (1 patient). -17.5% had lone AF (7 patients). (fig 2)

Regarding echocardiographic parameters (see table 1) The prevalence of LA thrombus was 12.5%, 5 patients from the total number which was 40 patients. All of them seen by TEE and non are detected by TTE. All the left atrial thrombi were confined to the left atrial appendage (100%). (see fig 3). Left atrial SEC was detected in 10 patients 25% by TEE, but was not observed in patient by TTE. (see Fig 4 a & b). All the 5 thrombi were found in left atria were associated with SEC 100%, and 5 patients in those without thrombus in their atria 14%. so it is highly significant P-value <0.001. LVEF was significantly lower in patients with than without left atrial thrombus (44±3 vs. 58±4) p-value <0.05. LA dilation which detected by TTE is significantly associated with thrombus formation than those without (45±1 vs. 32±3) p-value <0.05. 4 patients with thrombus formation 80% had LAAV <20 cm/s. compared to those without thrombus only 5 of them had LAAV <20 cm/s. 14%, p-value <0.001 which is considered to be highly significant. (Fig 6). Regarding age, sex and LVEDD were not significantly different between the studied groups. 7 patients 17.5% were receiving anticoagulant, 20 patients 50% were receiving anti-platelets and 13 patients 32.5% were on no treatment (neither aspirin or warfarine), 2 patients with left atrial thrombus were on aspirin 40% and 3 patients were on no medication 60%.

	LA Thrombus Present	LA Thrombus Absent	P-value
Age (years)	43 ± 9	47 ± 9	NS
Women	2 (40%)	9 (22.5%)	NS
LAD (mm)	45 ± 1	32 ± 3	<0.05
LVEDD (mm)	54 ± 3	53 ± 2	NS
LVEF (%)	44 ± 3	58 ± 4	<0.05
SEC	5 (100%)	5 (14%)	<0.001
LA AV	4 (80%)	5 (14%)	<0.001

NS: not significant

Table 1: Clinical and echocardiographic variables in patients with and without left atrial thrombus

*Sex Ratio*

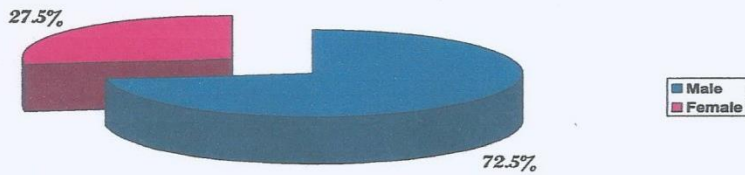


Figure 2-Distribution of patients according to the causes of atrial fibrillation

*Aetiology of AF*

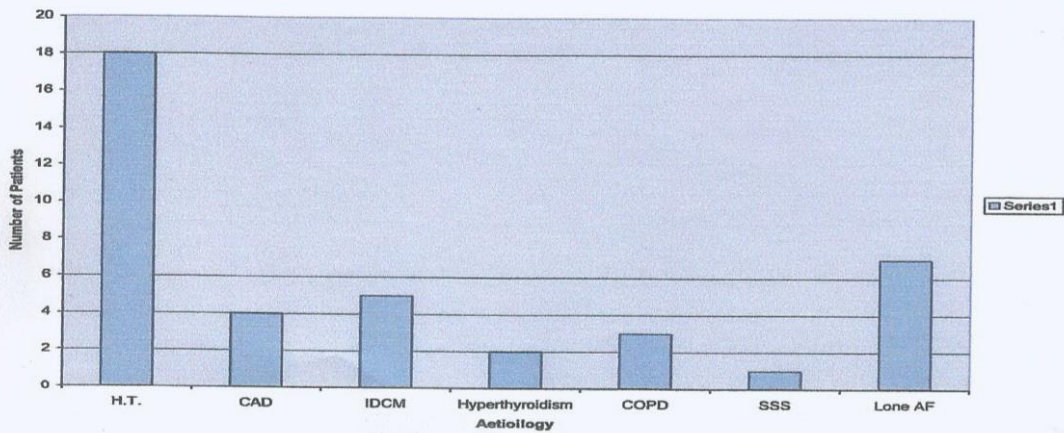
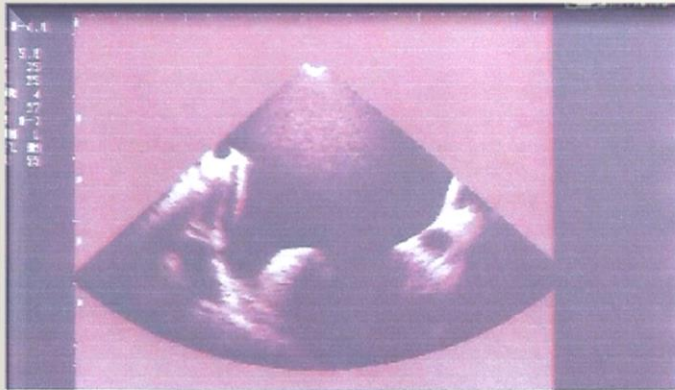


Fig.3 Distribution of patients according to gender



**Fig 3** – Left atrial appendage thrombus as detected by TEE  
(LA= Left atrium ; LV= Left ventricle ; TH.= Thrombus)



**Fig 4a** – A mild spontaneous echo contrast in the left atrium as seen by TEE



**Fig 4b**- An intense (thick) SEC in the left atrium as seen by TEE

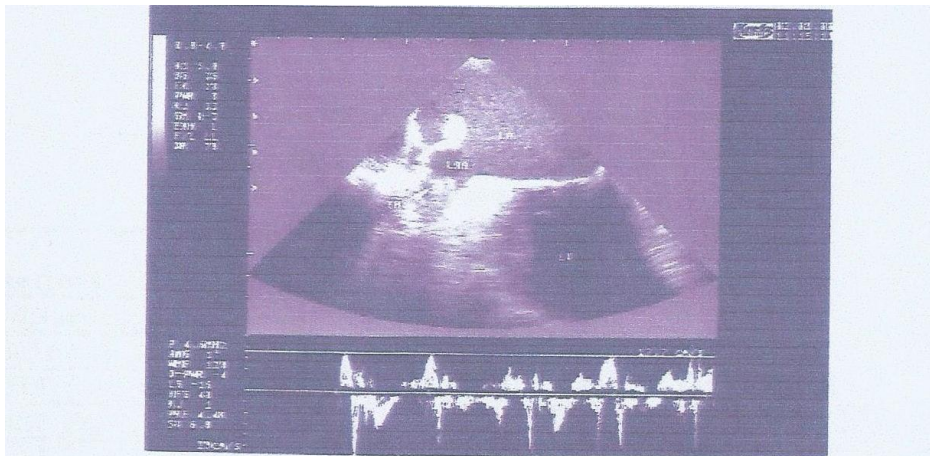


Fig 5- Low LAAV (< 20cm/sec) is associated with left atrial appendage thrombus (LA= Left atrium ; LV= Left ventricle ; LAA=Left Atrial Appendage ; TH.= Thrombus)

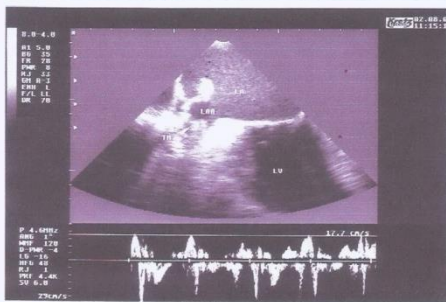


Fig 6- Low LAAV (< 20cm/sec) is associated with left atrial appendage thrombus (LA= Left atrium ; LV= Left ventricle ; LAA=Left Atrial Appendage ; TH.= Thrombus)

## Discussion

Patients with non-rheumatic AF have approximately five folds the risk of systemic embolisation compared with those without this dysrhythmia (33). It is believed that the increased thromboembolic incidence is due to thrombus formation in the left atrium (43,35). Previous studies using TTE were unable to document an increased prevalence of left atrial thrombus (36,37), partly due to less sensitivity of the transthoracic approach for the detection of left atrial thrombus. In the present prospective study using TEE, we found 12.5% prevalence of left atrial thrombus in a forty consecutive and unselected patient population with non-rheumatic AF. We found in this study, the superiority of TEE for the detection of atrial thrombi in comparison to TTE. The prevalence of TEE-detected LA thrombus in our study is lower than that of Brown et al (38) who observed LA thrombus in 13 of 48 (27%) patients with non-rheumatic AF; However only hospitalized patients were included in that study. On the other hand, Leung et al (39) found LA thrombus in 19 of 272 (7%) in non-valvular AF patients. Our

finding is in close agreement with the results of previous studies (40,41,42), who found LA thrombus in 13% of patients with non-valvular chronic AF, the difference of the reported prevalence is probably due to different patient selection.

LA SEC was observed in 25% of our patients. Although the pathogenesis of SEC remains controversial, it is usually observed under conditions favoring blood stasis in the left atrium. The previously reported prevalence of TEE-detected LA SEC ranged from 25% - 68% in patients with rheumatic mitral stenosis (43), and from 24%-59% in patients with non-rheumatic atrial fibrillation (44). In the present study, all the LA thrombi were observed in patients with LA SEC. The finding suggests that SEC is likely a precursor of LA thrombus in patients with non-rheumatic AF. Since not all patients can tolerate TEE procedure, it is important to identify a subgroup of patients who are likely to have TEE-detected LA thrombus or SEC, based on clinical and TTE data. Consistent with the result of Brown et al (39) and Manning et al (45), our patients with LA thrombus had significantly lower LVEF than those without. The finding suggests that reduced left ventricular contractility could precipitate blood stasis as well as thrombus formation in left atria of patients with non-rheumatic AF. LAD is significantly associated with thrombus formation that might be due to large atrium in a fibrillating heart which is predisposing for stasis and subsequent clot formation especially in reduced left ventricular function. The same is applied for reduced LAAV which could be considered as a risk factor for stagnation and subsequent thrombus formation. Two patients from the total five patients who had a thrombus in their left atria were on aspirin and the other three were on no treatment (neither aspirin nor warfarin), so the indication for anticoagulation should be assessed well and not to be underestimated to avoid preventable and reversible devastating events like thromboembolism and its sequelae. CHADS2 (Cardiac Failure, Hypertension,

Age, Diabetes, Stroke [Doubled]), another stroke risk stratification, scores 1 for heart failure, hypertension, ages over 75, and diabetes and scores 2 for a previous history of a stroke or transient ischemic attack and adds the scores, and then classifies score 0 as a low risk group, scores 1 as a moderate risk group and scores over 2 as a high risk group. Aspirin is used for the low risk group, aspirin or warfarin is selectively used for the moderate risk group, and the high risk group with scores over 2 should be performed with anticoagulant therapy (46,47)

A relatively common complication of TEE is minor throat irritation, which was reported in 71% of patients in the Mayo clinic series (48). Fortunately, none of our patients had such complications, but they may occur as the number of patients undergoing TEE increases.

### Conclusions

The study showed that the prevalence of left atrial thrombus and appendage is not uncommon in patients with non-rheumatic atrial fibrillation and is exclusively seen in patients with left atrial SEC. Low LVEF, large LA diameter, and low LAA velocity are significantly associated with subsequent thrombus formation. TEE is more sensitive in the detection of these abnormalities compared with TTE.

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