



The Prevalence of Left Ventricular Thrombus among Heart Failure Patients Admitted to Kuwait Teaching Hospital in Sana'a City between January 2014 -2017

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Abstract

Background: Heart failure is a major Public Health problem due to its high morbidity and mortality rates .The Left Ventricular Thrombus (LVT) is more frequently seen in acute heart failure as a complication of Left Ventricular (LV) systolic dysfunction.

Objectives: The objective of this study was to determine the prevalence of LVT and its outcome among Yemeni patients presented with heart failure to Kuwait teaching hospital in Sana'a. This cross sectional retrospective study made during the period of January 2014-January 2017 study for all patients admitted to the hospital with Heart Failure (HF).

Results: During study period 1856 patients with cardiac diseases were admitted to the hospital. Of this 217 were in (F. Among patient which 61(28.1%) had LVT. The mean age of patient presented with LVT was 51 years \pm 8.1 Most cases were male (90%) while only (10%), were females. Ischemic Heart Disease (IHD), Dilated Cardiac Myopathy (DCMP) and Hypertension, found to be an associated risk factors of LVT represented (51%, 34.2% and 34.2%) respectively. However 8 (13%) of patients with LVT had embolic complications. The mortality rate during hospitalization was 4 (6.6%).

Conclusion: The Ischemic heart disease was the leading cause of left ventricular thrombus.

Keywords: Left ventricular thrombus, Heart failure, Yemeni patients.

Abbreviations: LVT-Left Ventricular Thrombus, LV-Left Ventricular, HF-Heart failure, IHD-Ischemic Heart Disease, DCMP-Dilated Cardiac Myopathy, AMI-Acute Myocardial Infarction, PCI-Percutaneous Intervention, TTE-Transthoracic Echocardiography, ACE-Angiotensin Converting Enzymes, SEC-Spontaneous Echo Contrast, LVEF-Left Ventricular Ejection Fraction, ASE-American Society of Echo, MI-Myocardial Infarction, HHD-Hypertensive Heart Disease, RHD-Rheumatic Heart Disease, LVEDD-Left Ventricular End Diastolic Dimensions, EF-Ejection Fraction, DM-Diabetes Mellitus, LBBB-Left Bundle Branch Block, RBBB-Right Bundle Branch Block, SVT-Supra Ventricular Tachycardia, AF-Atrial Fibrillation, HTN-Hypertension.

Introduction

Heart failure represents a major and growing public health problem because of its prevalence, incidence, morbidity, mortality and economic costs. The prevalence of HF is 2% to 3% of general population [1]. Five million Americans are affected, with more than 530000 cases diagnosed each year [2]. The mortality rate from severe HF remains >60% within 5 years of diagnosis and that of 50% of hospitalized patients with HF required readmission to hospital within 6 months of discharge. The estimated costs of HF amounted to >35 billion \$ per year in the USA [3]. The development of LVT is a well-known complication in various cardiac conditions with the highest rate observed in acute anterior myocardial infarction and congestive HF reached to 10-30% [4,5]. As a result of severe left ventricular systolic dysfunction [6,7]. Rabbani et al found that the incidence of LVT remain persistently high reached to (35%) for Acute Myocardial

Infarction (AMI) involving the anterior wall [8]. The prevalence of LVT, especially in early Percutaneous Intervention (PCI) facilities are found to be reduced with estimation ranging between 5% and 15% [9,10]. Solheim et al, reported an incidence of LVT within 3 months of AMI in selected patients managed with primary PCI was 15% [7]. The constellation of endothelial injury, hypercoagulability and blood stagnation, which are well described previously as Virchow's triad, for formation of the thrombus [11,12]. In AMI, other predisposing factors also play a role in the development of LVT such as large infarct size, severe apical a synergy, LV aneurysm and anteroposterior myocardial infarction. The early recognition of LVT is vital to prevent the unwanted sequel of systemic thromboembolic events [6,11,12]. Currently in Yemen the well-known diagnostic system applied in majority health center and hospitals is Transthoracic Echocardiography (TTE) which is easily accessible and believed to have over 85% accuracy in proper imaging results [13-15].

However, care must be taken to exclude false positive results which occasionally may occurred [16,17]. Improved LV cavity assessment and thrombi detection using TTE contrast studies were noted to be better than non-contrast TTE, especially for mural (Laminar) and

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smaller thrombus [18]. Although several therapies as B-blockers, Angiotensin Converting Enzymes (ACE) inhibitors and cardiac resynchronization therapy have been proven effective in improving HF outcomes, many questions about optimal treatment remain yet unanswered. The magnitudes of heart failure and left ventricular thrombus have not been yet studied in Yemen. We carried out this study to determine the prevalence of heart failure with LVT among Yemeni patients admitted into Kuwait Teaching Hospital in Sana'a City.

Methodology

We reviewed all files of patients admitted to the hospital between January 2014 to 2017 whom had heart failure based on Framingham clinical major and minor criteria for the diagnosis of HF [19].

Major criteria include the following:

- Paroxysmal nocturnal dyspnea.
- Weight loss of 4.5 kg in 5 days in response to treatment.
- Neck vein distention.
- Rales.
- Acute pulmonary edema.
- Hepatojugular reflux.
- S3 gallop.
- Central venous pressure greater than 16 cm water.
- Circulation time of 25 seconds.
- Radiographic cardiomegaly.
- Pulmonary edema, visceral congestion, or cardiomegaly at autopsy.

Minor criteria are as follows:

- Nocturnal cough
- Dyspnea on ordinary exertion
- A decrease in vital capacity by one third the maximal value recorded
- Pleural effusion
- Tachycardia (rate of 120 bpm)
- Bilateral ankle edema

The diagnosis of HF was by 2 major or 1 major and 2 minor criteria.

Special form was designed to record demographic data clinical presentation and all investigations including echocardiogram, chest X-ray and ECG. The Echo procedure was performed using vivid 3 GE machine with adult prop transducer with frequency from 1.5-5 to ensure adequate imaging analysis. The diagnosis of LVT was made using the following criteria (20):

- A distinct echogenic mass within the left ventricle cavity (may be sessile/layered or protruding/mobile) that is contiguous with, but acoustically distinct from the underlying endocardial surface [20].
- It is seen throughout the cardiac cycle and visualized on at least 2 orthogonal views, an associated underlying region of severe wall motion abnormality, usually severe hypokinesis, akinesis, dyskinesis, or aneurysmal dilatation [14].
- Rarely, LVT forms in regions of stunned myocardium that has recovered normal wall motion at the time of detection [21].
- Spontaneous Echo Contrast (SEC) or "smoke" is commonly seen within the left ventricle of patients with Intracardiac thrombi and is believed to be due to the interaction of red cells and plasma proteins in situations of low, stagnant flow [22].
- The presence of SEC in association with marked wall motion abnormalities should warrant a high suspicion for the presence of left ventricle thrombus [21].

- Given the propensity for thrombi to form at the apex of the left ventricle, the best imaging planes to visualize left ventricle thrombus are the apical views, where the transducer is closest to the region of interest [21].
- Certain normal anatomic structures (papillary muscles, false tendons, and trabeculations) and technical artifacts (reverberations, near-field artifacts) will result in false positive diagnoses of left ventricle thrombus [23].
- The use of higher frequency transducers has been shown to overcome some of these limitations due to higher spatial resolution and reduced artifacts [21].

Left ventricular dimensions were determined by the leading edge to leading edge method [6,16]. Left Ventricular Ejection Fraction (LVEF) was determined based on the recommendation of American Society of Echo (ASE) and European Society of Echo [24]. Dilated cardiomyopathy was diagnosed in the presence of globular LV dilatation with LVDD>56 mm and EF <40% [25]. Diagnosis of Myocardial Infarction (MI) was based on combination of documented history of chest pain, ECG abnormalities and segmental wall motion abnormalities [26]. Peripartum cardiomyopathy was diagnosed on the basis of temporal relation of HF to last pregnancy and delivery as proposed in ESC guideline [27]. Hypertensive Heart Disease (HHD) was diagnosed in hypertensive patients documented by history and the presence to concentric or eccentric LV hypertrophy or concentric LV remodeling, left atrial dilatation and/or systolic and/or diastolic dysfunction [28]. Diagnosis of Rheumatic Heart Disease (RHD) was made using the World Heart Federation criteria [29].

Data analysis

Data was verified and Interred to PC, and analyzed using SPSS V16.0, AP. Variables were presented as proportions, and the differences were tested using Pearson's chi-square test. P value of ≤ 0.05 was considered significant.

Results

The total numbers of patients admitted into the medical wards with heart diseases during the study period were 1856 patients. Of them 217 patients (11.7%) were suffering from heart failure. Among those patients of heart failure there were 61 (28.1%) patients had left ventricular thrombosis. Distribution of patients with heart failure according to age and sex is shown in **table 1**. There were significance differences between age and sex of both groups of patients with LVT and those without LVT. The mean age of patients with LVT was 51 ± 8.1 years and that without LVT was 60 ± 2.3 . In there were only 7 (11.4%) below 30 years old and 30 (49%) were >50 years in heart failure with LVT. Heart failure was more frequent in male's patients than in females in both groups (HF with LVT and HF without LVT).

Characters	HF with LVT	HF Without LVT	P. value
Age			
Mean age	51 ± 8.2	60 ± 2.3	0.002
<30	7 (12%)	4 (2.5%)	
30-50	24 (39%)	37 (23.5)	
>50	30 (49%)	115 (74%)	
Sex			
Female	06(10%)	54 (33%)	<0.001
Male	55 (90%)	102 (65%)	

Table 1: Distribution of patients with heart failure according to age and sex in both groups (with LVT and without LVT).

We analyzed several risk factors that may play significant role in the development of left ventricular thrombus among patients with heart failure, we found that Ischemic heart diseases is the significant risk factor for development LVT with Value of (<0.0001) see **table 2**.

Risk factors	With LVT	Without	P. value
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		LVT	
Smoker	43 (70%)	107 (69%)	0.785
Kat chewer	46 (75%)	117 (75%)	0.95
DM	08 (13%)	36 (23%)	0.101
Causes of HF			
IHD	31 (51.0%)	85 (54%)	<0.0001
DCMP	21 (34.2%)	16 (10%)	-
HTN	07 (11.5%)	24 (15.5%)	-
RHD	02 (03.0)	12 (8%)	-
Presence of embolic complication	8 (13%)	11 (7%)	0.078
Mortality rate	4 (6.6%)	4 (2.6%)	0.161

DM-Diabetes Mellitus, IHD-Ischemic Heart Disease, DCMP-Dilated Cardiomyopathy, HTN-Hypertension, RHD-Rheumatic Heart Disease.

Table 2: Characteristic manifestation and Risk factors among heart failure patients with LVT and those without LVT.

Further work -up of ischemic heart diseases and DCMP on both groups of patients we found that Antero-lateral ischemia presented in equal percentage in both group ,while dilated cardiomyopathy was found in HF with LVT more than HF without LVT accounted for (34.2% and 10%) respectively **table 3** and **figure 1**.

Cause of HF	HF with LVT	HF without LVT	P value
Antero-lateral ischemia	30 (49.8%)	77 (49.5%)	0.981
Lower-septal ischemia	1 (1.5%)	8 (5%)	0.435
DCMP	21 (34.2%)	16 (10%)	0.004
Hypertensive cardiomyopathy	7 (11.5%)	24 (15.5%)	0.459
RHD	2 (3%)	12 (8%)	0.378
Cor-pulmonale	0	19 (12%)	0.004

RHD-Rheumatic Heart Disease, DCMP-Dilated Cardiomyopathy.

Table 3: Shows the causes of HF in patients with and without LVT.

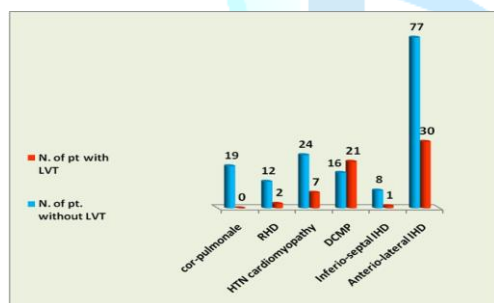


Figure 1: Shows (the causes of HF in patients with and without LVT).

The internal dimensions of LV was measured using echocardiography revealed that, the Left Ventricular End Diastolic Dimensions (LVEDD) among HF patients with LVT was higher than that with HF without LVT with a mean value of (67.18mm versus 55mm). Similarly the mean Ejection Fraction (EF) of HF with LVT was 32.39% while the mean EF in patients with HF without LVT was 47.97% with significant P value <0.0001, see **table 4** and **figure 2**.

Echocardiogram finding	HF with LVT	HF without LVT	P.value
LVEDD	2 (3%)	32 (20%)	<0.0001
<45mm	6 (10%)	52 (33%)	
45-55mm >55mm	53 (87%)	72 (47%)	
Total	61	159	
EF	25 (40%)	16 (20%)	<0.0001

<30%	33 (55%)	80 (52%)	
30-50% >50%	3 (5%)	60 (38%)	
Total	61	159	

LVEDD-Left Ventricular End Diastolic Dimensions, EF-Ejection Fraction.

Table 4: Echocardiogram finding in HF patients with and without LVT.

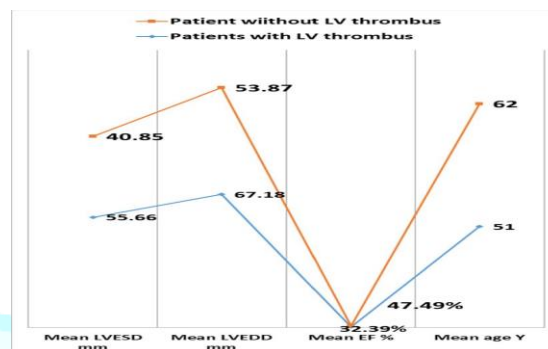


Figure 2: Shows (mean age, EF, LVEDD, LVESD in patients with and without LVT).

There were 34 patients who had arrhythmia in both groups of patients; however the frequency was more among HF with LVT than HF without LVT (21% versus 13%). The most common ECG findings were Left Bundle Branch Block (LBBB) in both HF patients with and without LVT, see **table 5** and **figure 3**.

ECG Finding	HF with LVT	HF without LVT	P value
AF	0	5 (3.2%)	0.362
Ventricular extrasystoles	2 (3%)	4 (3%)	1
Atrial extra systoles	0	1 (0.05%)	1
AV block	0	1 (0.05%)	1
LBBB	9 (15%)	8 (5.1%)	0.037
RBBB	2 (3%)	1 (0.05%)	0.396
SVT	0	1 (0.05%)	1
Total	13 (21%)	21 (13.5%)	0.153

LBBB-Left Bundle Branch Block, RBBB-Right Bundle Branch Block, *SVT-Supra Ventricular Tachycardia, AF-Atrial Fibrillation.

Table 5: ECG finding in the two groups of HF patients (with and without LVT).

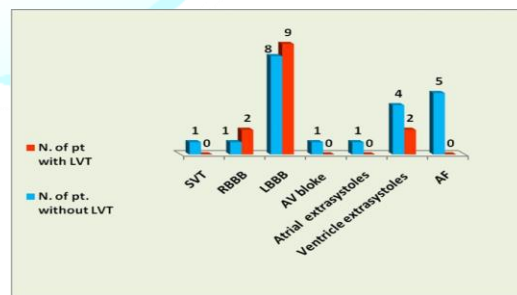


Figure 3: Shows the relationship between left ventricle thrombus and the electrocardiography finding.

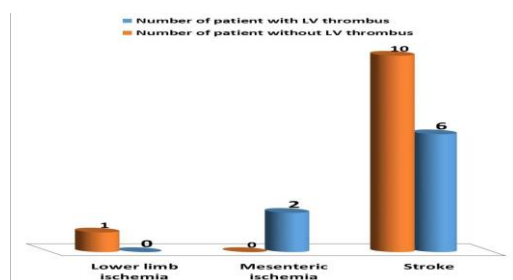
The complications were recorded in 19 patients, ischemic stroke found in 6 patients (10%) in HF with LVT and in 10 patients (6.4%) in patients with HF without LVT. Other complications such as mesenteric ischemia and lower limb ischemia were less frequent in both groups **table 6** and **figure 4**.

Embolic Complications	HF with LVT	HF without LVT	P.value
Stroke	6 (10%)	10 (6.4%)	0.562

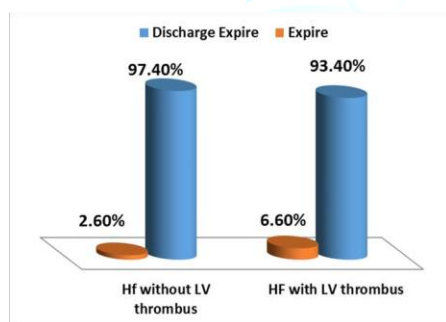
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Mesenteric ischemia	2 (3%)	0	0.138
Lower limb ischemia	0	1 (0.005%)	1
Total	8 (13%)	11 (6.5%)	0.155

Table 6: Embolic complications in patients with HF with and without LVT.**Figure 4:** Shows the embolic complication in patients with and without LVT.

The outcome of patients in this study was divided into 2 groups, patients improved & discharged with acceptable condition without surgical interventions were 209 patients (93.4%), 57 (93.4%) with HF and LVT and 152 (97.4%) with HF without LVT. 8 patients died during hospitalization in both groups HF with LVT 4 (6.6%) and HF without LVT 4 patients (2.6%) this did not reach to statistic significant P. value 0.161 see **figure 5**.

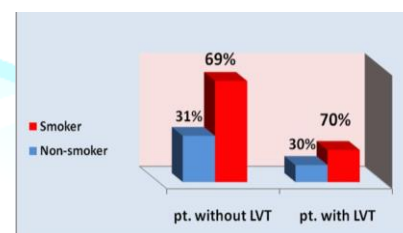
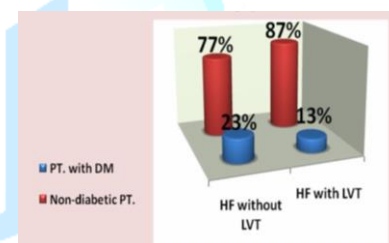
**Figure 5:** Shows the outcome of patients with heart failure and left ventricle thrombus.

Discussion

The prevalence of LVT among patients with heart failure in this study was 28.1%. This prevalence is higher than that was reported from Pakistan, USA which found the prevalence ranged between 11%-20% [30-33]. But coincide with prevalence rate from Egypt [34]. This is because most of our cases were cardiomyopathy and ischemic cases and they attended hospital late, also because of poverty most of our cases did not receive thrombolytic therapy or underwent primary PCI. In our study the mean age of HF patients with LVT was 51 years and considered to be less than the mean age reported from Egypt and Pakistan which reported 57 and 54 respectively [34,35]. These differences may be related to life expectancy, the average age of life expectancy in Yemen is 55 years while life expectancy in other countries is more than 60 years.

In our study most cases with HF and LVT were males, this phenomena was reported from Egypt, Pakistan and USA **table7** we know that ischemic heart diseases and cardiomyopathy which are the risk factors for (LVT) are more prevalence in males than females. Risk factors such as Smoking, Diabetes mellitus had no significant role in HF with LFT in our study see **figure 6** and **figure 7**. This result contradicts with other studies reported from Egypt and Pakistan. In this regard a separate study may be required to enable us to highlight these differences.

Items	Our study	USA	Pakistan	Egypt
Mean age of HF with LVT	51	50	54	57.6
Mean age of HF without LVT P. value	62 0.001	54 0.19	-	53.3
Male/female% in HF with LVT P. value	90/10 <0.001	78/2 0.26	80/20 -	85/15 >0.05
Smoking in HF with LVT	70%	30%	80%	63%
Nonsmoking in HF with LVT P. value	30% 0.785	70% 0.36	20% 0.03	37% 0.05
DM in HF with LVT	13%	25%	66%	21%
HF with LVT without DM P. value	87% 0.101	75% 1	34% <0.001	79% >0.05

Table 7: Our finding compared to other similar studies of HF with LVT.**Figure 6:** Shows the prevalence of LVT between smokers and non-smokers.**Figure 7:** Shows the prevalence of LVT among diabetic & non-diabetic patients.

We found the highest prevalence of HF with LVT in Ischemic heart diseases 31 (51%) most of them with anterolateral infarction. This result goes in line with results reported from other countries [34-36]. Left ventricular thrombus is well documented as a complication of MI with a prevalence varying from 60% in prethrombotic era to between 5%-15% in the setting where PCI is instituted [7,9]. Most of the patients with LVT in our study had anterolateral involvement with dilated LV and reduced EF. Higher prevalence of LVT following anterolateral MI compared to non-anterior MI was reported from other studies too [7]. Dilated Cardiomyopathy accounted for the second highest prevalence among HF with LVT in this study accounted for (34.2%). This in keeping with other reports [38,39].

DCMP is associated with dilatation of both right and left ventricles with reduced overall LV systolic function, the resultant biventricular stasis promotes the formation of the thrombus, most frequently in the LV, possible explanation is at chewing habit in our country which is known to induce tachycardia and possible tachycardia induced myopathy. Hypertensive heart disease is regarded to be an important cause of HF all over the world. In our study it was the 3rd cause of HF with LVT associated with impaired LV systolic function this can be explained by drug noncompliance where we found that most of our patients had uncontrolled hypertension [40]. Overwhelming majority of our cases had high LVDD and low EF. Previous studies reported increased LVDD and low EF to be independent predictors of LVT Formation [19,25].

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Information on LVT complicating hypertensive heart disease without MI or DCMP is scarce. The role of hypertension in enhancing prothrombotic or hypercoagulable state by impacting on all components of the Virchow's triad termed the thrombotic paradox of hypertension or Birmingham paradox was reported by Lip [41]. In the study of Framingham offspring study, Poli and colleagues reported an association between blood pressure and plasma PA-1 and tPA antigen levels suggesting impaired fibrinolysis with increasing blood pressure [42].

Rheumatic heart disease in general, is still one of the causes of HF and hospital admission in our country, but in this study it was an uncommon cause of LVT, two patients were observed they have severe chronic Rheumatic Mitral incompetence with dilated and poorly contractile LV. We speculate that LVT observed in these patients is a result of increased LVDD and low EF rather than the rheumatic etiology of the valve lesion in comparing the echocardiography findings in our patients we found significant difference between HF patients with LVT and those without LVT which including (EF,LVEDD,LVESD). This observation goes with results seen in other literature in Egypt, Pakistan and USA [33-38].

In this study thromboembolic complication of HF with LVT is 13.1% similar to the study conducted in Nigeria in which the thromboembolic complications at the time of presentation were 13% [43]. Mortality during hospitalization reached to (3.6%) and no differences found between HF with LVT OR HF without LVT. This result is not compared to other studies because of limitation of retrospective study in our situation and the causes of death may be not related to presence of thrombus in LV and the information available may be not adequate to explain the mortality.

Conclusion

Heart failure is still one of the important causes of admission in our hospital and LV thrombus as a complication of HF is higher when comparing with developed countries.

Recommendation

Prospective study is needed to recognized risk factors and long term complication of heart failure with left ventricular thrombus.

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