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 ± 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]. Rabbaniet 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, hypercoagubility 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
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.
- Hepatopatugular 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 global 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).

<table>
<thead>
<tr>
<th>Characters</th>
<th>HF with LVT</th>
<th>HF Without LVT</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age</td>
<td>51 ± 8.2</td>
<td>60 ± 2.3</td>
<td>0.002</td>
</tr>
<tr>
<td>&lt;30</td>
<td>7 (12%)</td>
<td>4 (2.5%)</td>
<td></td>
</tr>
<tr>
<td>30-50</td>
<td>24 (39%)</td>
<td>37 (23.5)</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>30 (49%)</td>
<td>115 (74.5%)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>06(10%)</td>
<td>54 (33%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Male</td>
<td>55 (90%)</td>
<td>102 (65%)</td>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>With LVT</th>
<th>Without LVT</th>
<th>P. value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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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 3.2%) respectively table 3 and figure 1.

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.

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 LV. Other complications such as mesenteric ischemia and lower limb ischemia were less frequent in both groups table 6 and figure 4.

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.

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

<table>
<thead>
<tr>
<th>Causes of HF</th>
<th>LVT</th>
<th>Non-LVT</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>IHD</td>
<td>31 (51.0%)</td>
<td>85 (54%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>DCMP</td>
<td>21 (34.2%)</td>
<td>16 (10%)</td>
<td>-</td>
</tr>
<tr>
<td>HTN</td>
<td>17 (11.3%)</td>
<td>24 (15.3%)</td>
<td>-</td>
</tr>
<tr>
<td>RHD</td>
<td>02 (03.0)</td>
<td>12 (8%)</td>
<td>-</td>
</tr>
<tr>
<td>Presence of embolic complication</td>
<td>8 (13%)</td>
<td>11 (7%)</td>
<td>0.078</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Cause of HF</th>
<th>HF with LVT</th>
<th>HF without LVT</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antero-lateral ischemia</td>
<td>30 (49.8%)</td>
<td>77 (49.5%)</td>
<td>0.981</td>
</tr>
<tr>
<td>Lower-septal ischemia</td>
<td>1 (1.5%)</td>
<td>8 (5%)</td>
<td>0.435</td>
</tr>
<tr>
<td>Hypertensive cardiomyopathy</td>
<td>7 (11.3%)</td>
<td>24 (15.3%)</td>
<td>0.459</td>
</tr>
<tr>
<td>RHD</td>
<td>2 (3%)</td>
<td>12 (8%)</td>
<td>0.378</td>
</tr>
<tr>
<td>Cor-pulmonale</td>
<td>0</td>
<td>19 (12%)</td>
<td>0.004</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Echocardiogram finding</th>
<th>HF with LVT</th>
<th>HF without LVT</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEDD</td>
<td>2 (3%)</td>
<td>32 (20%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>&lt;45mm</td>
<td>6 (10%)</td>
<td>52 (33%)</td>
<td></td>
</tr>
<tr>
<td>45-55mm &gt;55mm</td>
<td>53 (87%)</td>
<td>72 (47%)</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>61</td>
<td>159</td>
<td></td>
</tr>
</tbody>
</table>

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

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

**Figure 4**: Shows (mean age, EF, LVEDD, LVESD in patients with and without LVT).

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

<table>
<thead>
<tr>
<th>ECG finding</th>
<th>HF with LVT</th>
<th>HF without LVT</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AF</td>
<td>0</td>
<td>5 (3.2%)</td>
<td>0.362</td>
</tr>
<tr>
<td>Ventricular extrasystoles</td>
<td>2 (3%)</td>
<td>4 (3%)</td>
<td>1</td>
</tr>
<tr>
<td>Atrial extra systoles</td>
<td>0</td>
<td>1 (0.05%)</td>
<td>1</td>
</tr>
<tr>
<td>AV block</td>
<td>0</td>
<td>1 (0.05%)</td>
<td>1</td>
</tr>
<tr>
<td>LBBB</td>
<td>9 (15%)</td>
<td>8 (5.1%)</td>
<td>0.037</td>
</tr>
<tr>
<td>RBBB</td>
<td>2 (3%)</td>
<td>1 (0.05)</td>
<td>0.396</td>
</tr>
<tr>
<td>SVT</td>
<td>0</td>
<td>1 (0.05)</td>
<td>1</td>
</tr>
</tbody>
</table>

**Table 6**: Complications in heart failure patients.

<table>
<thead>
<tr>
<th>Complications</th>
<th>HF with LVT</th>
<th>HF without LVT</th>
<th>P.value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>6 (10%)</td>
<td>10 (6.4%)</td>
<td>0.562</td>
</tr>
</tbody>
</table>

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The outcome of patients in this study was divided into 2 groups, patients improved & discharged without surgery, and patients who required surgical interventions were 209 patients (93.4%), 57 cases with HF and LVT and 152 cases (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.

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, table 7 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 LVT 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.

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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, LVEF). This phenomenon 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 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.

Acknowledgment
We express our deep thanks to Esmaeel Gahaf and Arab Board carrier for the contribution in assisting data analysis.

Reference


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