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Left ventricular pseudoaneurisms: A series of case reports on left ventricular pseudoaneurisms following inferior wall myocardial infractions

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Abstract

Left Ventricular Pseudoaneurysm (LVP) is an uncommon, but a life threatening complication of acute myocardial infarction. This clinical phenomenon carries significant cardiac mortality due to the increased potential risk of cardiac rupture. However, the clinical presentations of these patients are generally non-specific, making the timely diagnosis challenging. 2D and 3D trans-thoracic and trans-oesophageal echocardiography, cardiac Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) have emerged as valuable non-invasive diagnostic tools in the diagnosis of this condition, in contrast to classical left ventricular angiography. As this cardiac condition is mostly fatal, speedy diagnosis and well-timed management is utmost important. Here we present three cases of LVPs to illustrate the importance of echocardiography, cardiac CT and Cardiac MRI in the diagnosis and management of these patients.

Keywords

left ventricular pseudo-aneurism; left ventricular aneurysm; cardiac computed tomography; cardiac magnetic resonance imaging; inferior myocardial infarction

Introduction

Left Ventricular Pseudoaneurysm (LVP) is a rare, but a grave complication of acute Myocardial Infarction (MI), and the reported incident is found to be less than 0.1% of all patients with MI [1].

The pseudoaneurysm happens as a result of the ischaemic cardiac rupture, which is enclosed by the parietal pericardium and is characterized by the absence of myocardium in its capsule, contrasting true ventricular aneurysm which involves full thickness of the myocardium. It also has a greater tendency to rupture in comparison with a true Left Ventricular (LV) aneurysm. Thus, it is essential to recognize and make a prompt diagnosis of this condition to provide an appropriate care in a timely manner.

Invasive left ventricular angiography, also known as ventriculography is the classical diagnostic approach, however, echocardiography, cardiac Computed Tomography (CT) and cardiac Magnetic Resonance Imaging (MRI) can be highlighted as valuable non-invasive diagnostic tools that can be used to diagnose this condition.

Here we report the value of these non-invasive diagnostic modalities in the evaluation LV pseudoaneurysm, and the challenges that were encountered in the diagnosis and management of this complex cardiac scenario.

Case Series

Case number - 01

A 67-year-old male patient presented with progressive exertional dyspnoea for over six months duration. Precordial examination showed displaced and forceful apical impulse without any murmurs. He had a past history of late presentation of inferior MI complicated with re-infarction, about three years ago. Though the re-infarction was managed with medical thrombolysis, he had not undergone any coronary interventions. Echocardiography on discharge showed impaired LV function with inferior wall hypokinesia. Nearly three years later from the initial event, he was presented with symptoms of heart failure and the Trans Thoracic (TT) 2D echocardiography showed dilated LV with 2D biplane ejection fraction of 34%. There was a large LV pseudoaneurysm in relation to inferior wall with a large in situ thrombus and spontaneous echo contrast in the LV chamber (Figure-1.1).

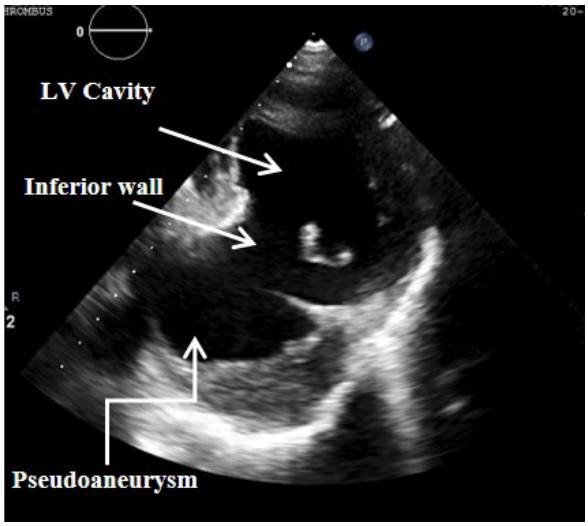

Figure 1.1: 2D TT echocardiography showing the LV pseudoaneurysm in relation to inferior wall

The LV Pseudoaneurysm had a communication through a wide neck with poorly supported margins in the infero-lateral wall of the LV. Color Doppler echocardiography revealed flow turbulence across the pseudoaneurysm neck and a bidirectional flow pattern between the pseudoaneurysm and the LV cavity. Trans-oesophageal 3D echocardiography further elaborated the anatomy of the neck of the sac and the dimensions of the pseudoaneurysm and details of the thrombus extension (Figure-1.2). 3D echocardiographic navigation demonstrated the thrombus demarcating the pseudoaneurysm which is becoming deficient towards the antero-lateral aspect of the expanded cavity.

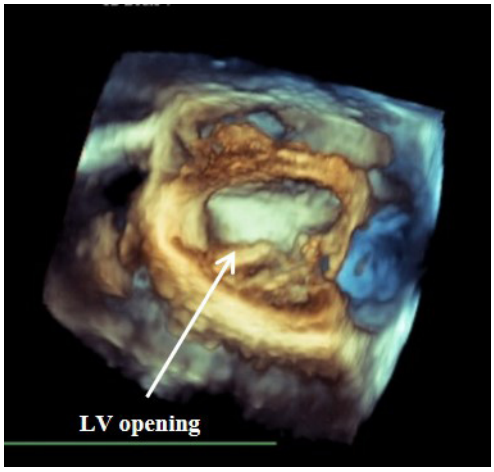

Figure 1.2: 3D transesophageal echocardiography showing the LV opening of the pseudoaneurysm.

Cardiac CT with 3D reconstruction confirmed the location, structural integrity of the fibrous cap and the extension of the thrombus confirming the 2D and 3D echocardiographic findings.

As the definitive management, the option of surgical resection and LV repair was suggested. However, after explaining the risk and the benefits of the surgical procedure, the patient took the decision towards the conservative management approach. Medical management of his heart failure was established with addition of dual antiplatelet therapy. During one year follow-up, he remained with NYHA class II symptoms and had no progression of the dimensions of the LV pseudoaneurysm.

Case number - 02

A 79-year-old gentleman presented with NYHA class III symptoms for six month duration with recent worsening of his heart failure symptoms. He had a history of diabetes mellitus for more than ten years and hypertension for fifteen years. His medical documents revealed that he had a past history of inferior MI about one year ago for which he did not receive thrombolytic therapy owing to the delayed presentation and was treated with heparin only. His precordial examination was normal.

2D echocardiogram showed the evidence of LV pseudoaneurysm in relation to the inferior wall with poor LV systolic function. Subsequently he was subjected to a cardiac CT. It showed a large pseudoaneurysm involving lower part of the inferior septum (Figure2.1).

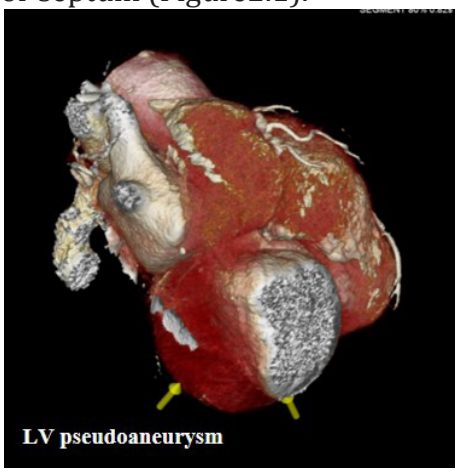

Figure 2.1: 3D reconstruction of the cardiac CT demonstrating the location of the LV pseudoaneurysm.

It had poorly defined margins with wide mouth opening and a thin layer of thrombus covering the aneurysm (Figure 2.2).

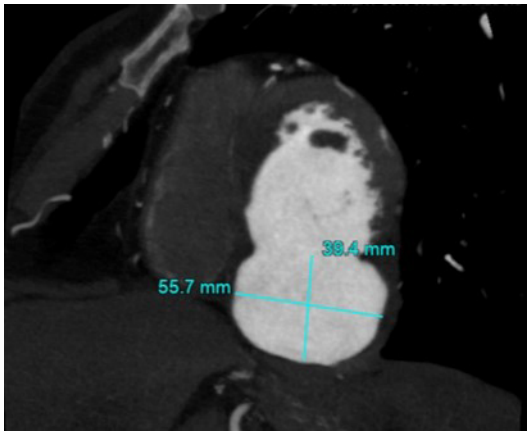

Figure 2.2: Cardiac CT demonstrating the dimensions and the mouth of the LV pseudoaneurysm.

However, in the antero-posterior orientation there was a large thrombus without having a fibrous cap. The pseudoaneurysm was mostly sealed by the pericardium. CT coronary angiography showed moderate disease of the left anterior descending artery and left circumflex artery. The dominant right coronary artery was totally occluded from the middle segment (Figure-2.3).

The conservative management approach was established after heart team discussion and also considering patient's willingness for non-operative treatment. Heart failure management was optimized with antiplatelet therapy. He continued his drug treatment with NYHA class II symptoms after one year follow-up.

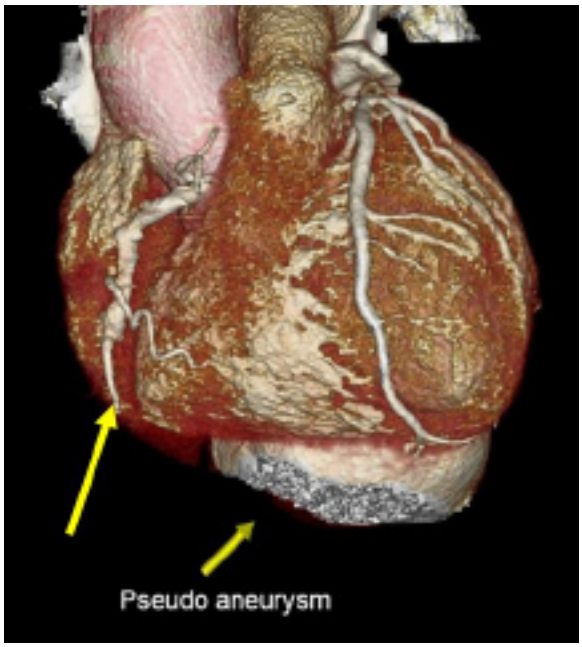

Figure 2.3: Cardiac CT coronary angiogram eliciting the coronary anatomy.

Case number - 03

A 57 year-old-male presented with progressive symptoms of heart failure for one year duration and he had a past history of late presentation of inferior MI, which was about four years ago. He had defaulted regular medical follow-up and had poor glycaemic control as well.

His 2D echocardiogram showed a dilated LV with 2D biplane ejection fraction of 30%, severe functional Mitral Regurgitation (MR) and a LV pseudoaneurysm related to the inferior wall. Invasive coronary angiogram showed normal left coronary system with Chronic Total Occlusion (CTO) of the right coronary artery from the mid segment onwards. Since he had impaired LV function, inferior wall pseudoaneurysm and MR as a result of severe papillary muscle dysfunction, a cardiac MRI was planned for further evaluation. It showed a rupture of the inferior wall of LV leading to a very large LV pseudoaneurysm, measuring 110 mm x 80 mm with a LV opening of 45 mm (Figure 3.1).

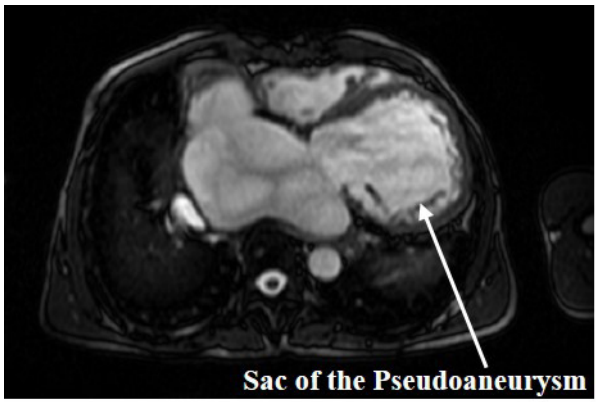

Figure 3.1: Cardiac MRI showing the LV pseudoaneurysm in relation to inferior wall

Three dimensional reconstruction of the cardiac MRI accurately located the anatomy of the lesion and its relationship to the surrounding structures (Figure 3.2).

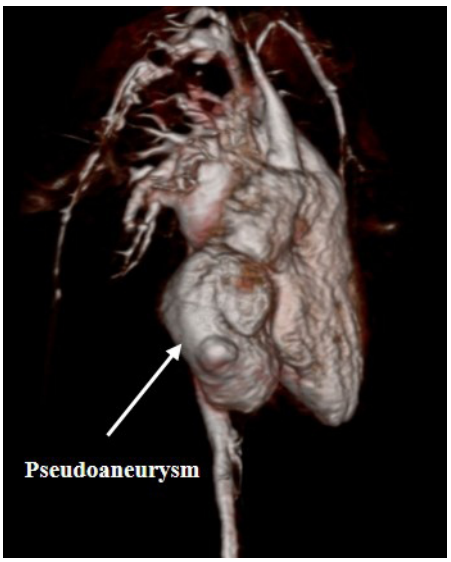

Figure 3.2: 3D reconstruction of the cardiac MRI demonstrating the LV pseudoaneurysm.

Furthermore, it showed that the basal inferior septum and the base to apex of the whole inferior septum of LV having late Gadolinium enhancement indicating myocardial segments which were infracted and scarred. However, the MRI confirmed the viability of the rest of the myocardial segments, the severity of the MR and the normal Right Ventricular (RV) function.

The surgical management was carried out with the exploration of the pseudoaneurysm (Figure 3.3) followed by the resection of the pseudoaneurysm, LV repair and mitral ring annuloplasty.

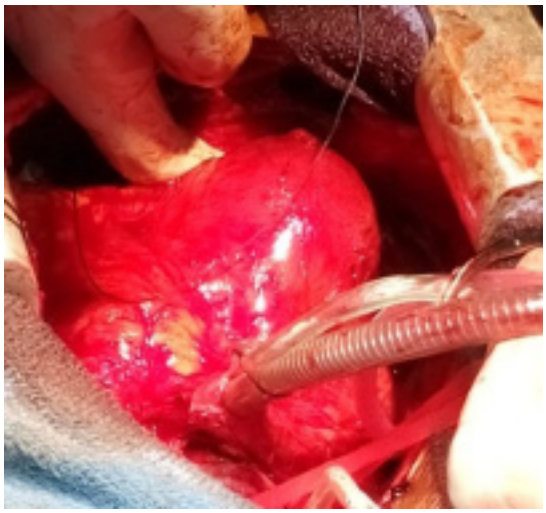

Figure 3.3: Surgical exploration of the LV pseudoaneurysm.

However, the patient was not able to regain his LV function in the post-operative period and had persistent irreversible cardiogenic shock.

Discussion

Left Ventricular Pseudoaneurysm (LVP) occurs as a result of slowly progressive cardiac rupture, which is controlled by the pericardium and is characterized by the absence of myocardium in its outer boundary. Those are most commonly produced by MI secondary to atherosclerotic coronary artery disease. However, some of the other uncommon aetiologies for this phenomena includes cardiac trauma, [2] infective endocarditis, [3] inflammation [4] and post cardiac surgery [5]. In contrast to true LV aneurysms, which are typically situated in the anterior and apical walls [6-8] the LVPs are located in postero-lateral aspect of the LV as evident in our patients. Most importantly, complications of LVPs are catastrophic causing cardiac mortality in nearly half of the patients who had no treatment with mechanical intervention [9]. Therefore, a prompt diagnosis is essential as LV pseudoaneurysm is associated with high cardiac rupture risk. Out of all diagnostic modalities, cardiac imaging plays a very substantial role in the diagnosis of this unusual condition and rational use of each cardiac imaging modality is important in making an accurate diagnosis and achieving correct therapeutic decisions.

Diagnostic value of echocardiography

Echocardiography plays a valuable role in the diagnosis and management of LVPs pre-operatively, intra-operatively and even after the surgical intervention as a follow up modality. Trans Thoracic Echocardiography (TTE) is useful to differentiate true aneurysm from pseudoaneurysm by tracing the continuity of the myocardium. However, TTE has its own limitations as a result of low penetrative power to visualize the more posterior cardiac structures. That can be effectively overcome by TEE being a minimally-invasive technique, and it helps in diagnosing LV pseudoaneurysm more accurately, and also in determining any thrombus in the expanded cavity, presence of mitral valve dysfunction and consistency of the fibrous cap. More interestingly, 3D TEE can provide an excellent image of the LVPs by navigation technique and it is also helpful to determine the extension of the thrombus and overall LV and valve functions. In our first patient, the TEE further facilitated the diagnosis of this condition by overcoming the limited echo windows of TTE

for the visualization of the LV inferior wall. Addition to that TEE was also helpful in the intra-operative period to assess the surgical procedure and any outcomes of the mitral valve repair before the final closure.

However, there are some limitations of the echocardiography in assessing the LVPs. One of a main limitation is the inability to comment about the viability of the rest of the myocardium. Apart from that, no information can be obtained regarding the state of coronary arteries. In addition, the image quality may not be superior to differentiate the thrombus which may lie over a fibrous capsule. Therefore, the other imaging modalities need to be combined to address these drawbacks.

Place of cardiac computed tomography (CT)

Cardiac CT with 3D reconstruction has the ability to acquire accurate anatomical and functional information on the myocardium and the pericardium [10]. The capacity to distinguish different tissue planes (i.e. myocardium, fibrous tissue planes and thrombi) by the CT may overcome the deficiencies that may be encountered in echocardiography. As in our second patient, the cardiac CT was able to delineate the dimensions of the sac, consistency of the expanded cavity and the details of the accompanying thrombus. However, the imperfect temporal resolution, the requirement of iodinated contrast and the use of ionizing radiation, makes it less favorable in some instances. In addition, it does not provide much information regarding the viability of the remained myocardium. One of the extra advantages of cardiac CT is the ability to provide the information regarding the coronary anatomy. This information is extremely important for surgeons, before planning of the surgical intervention.

Diagnostic value of cardiac MRI

Cardiac MRI being a non-invasive imaging modality and without having the risk of radiation exposure, has a great place in distinguishing LV pseudoaneurysm from true LV aneurysm. It has a sensitivity of 100% and a specificity of 83% [11] for this purpose.

It is also useful in identification of the different consistency of cardiac soft tissue planes, detection of thrombi and making an assessment of the infracted myocardium [1]. The last feature is very important to assess the viability of the remained myocardium to justify the surgical repair of the defect and revascularization.

3D reconstruction of MRI provides morphological description of the LV pseudoaneurysm by location, extension and relationship to neighbouring structures as described in our patient. This is possible as a result of its ability to obtain cross sectional assessments in any image plane. All these features are essential to determine the optimal management of this type of complex cardiac patients.

Though the MRI is providing an excellent assessment of the cardiac status, the cost may be a barrier in some cases making it the main limiting factor for wider unrestricted usage.

Surgical management is considered as the treatment of choice in suitable candidates. Though these patients have high mortality rates irrespective of the treatment modality, lengthy survival has also been observed in some patients who do not undergo any surgical therapy [12]. However, mechanical intervention is justifiable in those patients with LV pseudoaneurysm in whom the risk of rupture outweighs the risk of surgery [13,14].

According to current evidence, small retrospective studies have revealed that asymptomatic, chronic and small (<3 cm) LV pseudoaneurysm [14] and patients with higher operative risk [9] can be managed conservatively. However, there should be large scale studies to determine the long term outcome of medical management over surgery, and until such time the preferred approach would remain as the surgical management for LVPs.

The authors would suggest that the aggressive management of an incidentally detected LVP should be an individualized decision and always the multidisciplinary inputs and the patient's preference must be considered.

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