

## CASE SERIES

## EPICARDIAL FAT MIMICKING PERICARDIAL TUMOURS: CASE SERIES AND REVIEW OF LITERATURE

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Advances in imaging modalities have improved diagnosis of diseases in patients allowing physicians to make earlier and accurate diagnosis with resultant improved overall outcome for patients. Sometimes, however this comes at a cost of over estimation of normal variants leading to further unnecessary investigations or in extreme cases interventions. In this article, we demonstrate three cases where epicardial fat is misdiagnosed as pericardial masses which are an example of misinterpretation of normal findings. Correct identification of pericardial fat on transthoracic echocardiograms is important in reducing misdiagnosis and also anxiety for both physicians and patients. Knowledge about normal variants not only improves patients care but also reduce unnecessary investigations that are subsequently ordered for clarification.

**Keywords:** Epicardial fat; Pericardial tumours; Pericardial effusion; Epicardial adipose tissue; EAT

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## INTRODUCTION

Emerging new cardiac and non-cardiac imaging modalities with improved resolution allow early detection of slight variants of normal structures as well as abnormalities and improve patients' care worldwide. Incidental findings of unexplained masses or tumours is however inevitable. Hence, recognition and distinction between normal variants and abnormalities like tumours poses a significant challenge in the current practicing environment.

In this article, we present three cases in which pericardial effusion on computerized tomography (CT) led to misdiagnosis of epicardial fat as pericardial masses on transthoracic echocardiography (TTE). We also discuss the characteristics of pericardial fat on TTE to enable making a correct diagnosis when this entity is encountered. Though there are limitations, the distinction between normal and abnormal pericardial findings is important as unnecessary tests can be avoided if epicardial fat is correctly identified based on its echocardiographic features particularly in presence of pericardial effusion.

## CASE-1:

An 80-year-old lady underwent CT of thorax and abdomen for assessment of presenting features suggestive of peritonitis with deranged liver function tests, and positive blood cultures for *Staphylococcus Aureus* and *Streptococcus Milleri*. She was diagnosed with cholecystitis and treated with appropriate antibiotics. Her CT thorax reported a 7 mm pericardial effusion.

## CASE-2

A 79-year-old lady presented with left sided abdominal pain and tenderness with elevated c-reactive protein at 259mg/L. An abdominal CT scan was performed for

suspected diverticulitis. It revealed a partially intussuscepting tumour in the sigmoid colon which was confirmed as an invasive adenocarcinoma on colonoscopy and biopsy report. The CT scan additionally showed bilateral basal lung consolidations and a small pericardial effusion.

## CASE-3

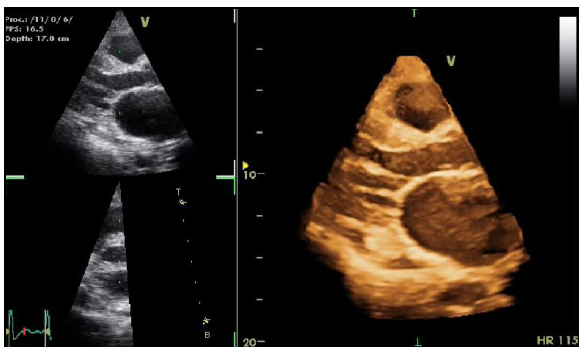
A 59-year-old lady presented with lethargy and polydipsia. Her blood tests revealed hypercalcaemia. A CT scan of the chest was performed for suspected sarcoidosis which revealed 2-4 mm pleural nodules in the mid and upper zones as well as hilar and mediastinal lymph node enlargement. There was pericardial thickening and increased pericardial fluid within the superior pericardial recesses. The CT scans (Figures-2, 4, 7) in these three cases reported pericardial effusions and TTE was performed in all cases. TTE confirmed presence of pericardial effusion, but also reported multiple unexplained echogenic masses within the effusion in different locations (Figures-1, 3, 5, 6).



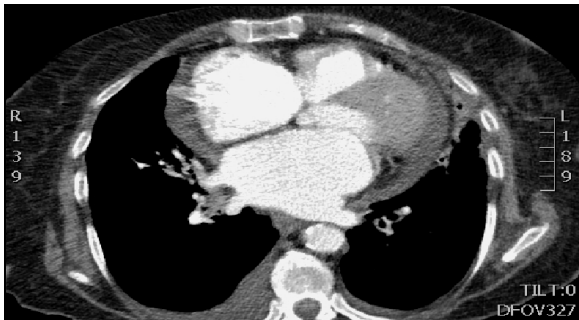
**Figure-1:** Pericardial mass identified in the AV groove and thickened echo dense structure around free RV wall



**Figure-1: CT scan of chest - showing radio-opaque shadows in AV groove**



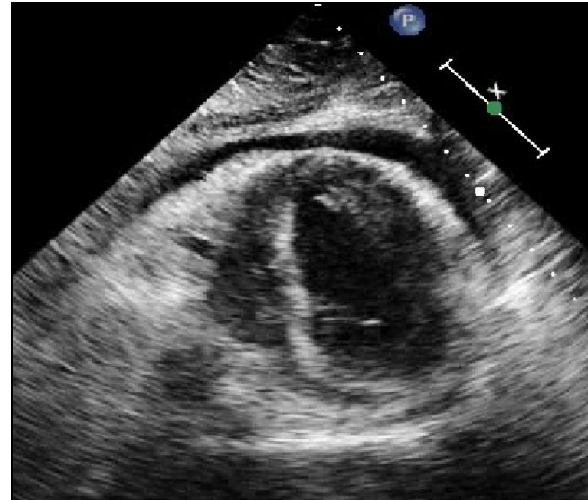
**Figure-2: TTE showing pericardial effusion with suspicious mass in AV groove**



**Figure-3: Fat deposition in the AV groove and adjacent to anterior wall**



**Figure-4: TTE in long parasternal view shows the echogenic mass in pericardium**



**Figure-6: TTE in 4 chamber view shows clearly an echogenic structure adherent to the RV wall**



**Figure-5: CT chest showing large area of radiolucent shadow mimicking density of fat**

Findings on CT scans and echocardiograms were discussed at the cardiac multidisciplinary meeting which concluded that while there was pericardial effusion in all echocardiograms, the masses detected within the effusion actually represented epicardial fat. Presence of epicardial fat was confirmed following correlation of CT and TTE images as the echogenic structures were located in the AV groove on the epicardial surface, an arrangement that is typical of epicardial fat pad.

It can be seen in the figures that while it might be difficult to differentiate epicardial fat from pericardial effusion on non-gated CT scan of the chest, this distinction can be made if echocardiograms are closely examined.

## DISCUSSION

Epicardial fat is the fat deposit between the heart and the pericardium in close proximity to the myocardium. It has previously been described as 'pericardial', 'thoracic', 'mediastinal' fat or epicardial adipose tissue (EAT). Mediastinal or thoracic fat includes both epicardial and extra epicardial fat. It is visceral fat found around the heart,

attached to the free wall of the right ventricle, left ventricular apex and atrium.<sup>1</sup> Another more straightforward classification of is to classify the adipose tissue surrounding the heart into intra and extra epicardial fat, where-extra epicardial fat comprises thoracic fat external to the parietal pericardium, while intrapericardial fat includes both pericardial fats contained within the pericardium and epicardial fat as described above.<sup>2</sup>

Extensive studies have been done with regards to epicardial fat and it has been shown that its proximity to the right ventricle with absence of a fascial boundary may directly affect the coronaries and the myocardium.<sup>3</sup> Epicardial fat is present on the lateral right ventricular wall and the anterior wall of left ventricle<sup>(4)</sup> surrounding the coronary arteries for most of their course and has been shown to be related to coronary artery disease with an increase in coronary plaque burden.<sup>2,3,5-8</sup> It has been observed to be more concentrated in the acute marginal, atrio-ventricular and interventricular sulci.<sup>4</sup>

The epicardial fat predominantly functions as perivascular adipose tissue for the coronaries, containing inflammatory cells and a relatively higher concentration of cytokines. It forms a storage depot for triglycerides and is considered a predictor of metabolic syndrome<sup>8-10</sup> and more recently of its severity.

In 2008, Gorter PM *et al* have shown that epicardial fat volume in patients with body mass index less than 27 was related to severity of coronary artery disease and plaque burden<sup>10</sup> making it an important indicator of cardiovascular risk. A further study by Konishi *et al* suggested that epicardial fat is more related to earlier development of coronary artery disease than abdominal obesity.<sup>11</sup>

The Framingham Heart Study by Thanassoulis *et al* in 2010 showed a significant association of epicardial fat with atrial fibrillation.<sup>12</sup> Similar findings were reported in an observational study conducted by Mookadam *et al* in 2010 of 97 patients showed that increased epicardial fat size of >5 mm on echocardiogram was associated with left atrial enlargement, lower ejection fraction, increased LV mass and an abnormal diastolic function independent of age.<sup>13</sup>

#### Echocardiographic recognition

Distinguishing epicardial fat from other similar structures depends on its characteristic echocardiographic features. Generally, epicardial fat produces hypoechoic shadows indistinguishable from pericardial effusion, however, pericardial fat is slightly more echogenic than pericardial fluid. Rarely however epicardial fat can present as hyperechoic mass and this is particularly true when there is an associated pericardial fluid potentially leading to

misdiagnosis, or when it is excessive it might be confused with tumours contained in the pericardium.<sup>14,15</sup> In this setting, some features aid making a diagnosis such as that Epicardial fat is most commonly located anterior to the right ventricular wall<sup>1,16,17</sup> and location in atrioventricular groove is considered characteristic, and was the clue to diagnosis in our cases (Figures 1 to 4). Maximum thickness of epicardial fat is said to be found between mid and distal right ventricular walls which can also help in diagnosis<sup>15</sup>, see figures (1 & 4 to 6). Epicardial fat also tends to deform with cardiac cycle.<sup>16,18</sup>

#### CONCLUSIONS

It is important to highlight that normal epicardial structures can become visible on TTE particularly in the setting of small pericardial effusions and should not be confused with malignancy or pericardial empyema. Correlation with other imaging modalities such as MRI or CT in the same patient can aid diagnosis if the modalities are already performed for other ailments (Figure-7).

The patients we are reporting had CT thorax prior to TTE. However, had they had MRI with fat sequence, areas of epicardial fat would have easily been identifiable confirming the diagnosis.

Imaging scanners have improved over the last decade and are able to detect structures that were not detectable before with older generation scans. However as some of the findings are physiological, they wouldn't not require further investigations if location and characteristics of the lesion are considered.

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