

Imaging findings of pericardial lipoma. Review of the literature

Hallazgos por imagen de lipoma pericárdico. Revisión de la literatura

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Summary

Introduction: Pericardial lipomas are benign and infrequent cardiac tumors with variable clinical presentation. We reviewed the imaging findings reported in the literature in radiography, echocardiography, computed tomography, and magnetic resonance. ***Methodology:*** We identified case reports, congress presentations and observational studies published in PubMed, Scopus, Web of Science, Embase and Cochrane until June 1st, 2022. ***Results:*** Pericardial lipoma occurs proportionally in women and men, at a mean age of 51 years. Past medical history is unremarkable and if present, cardiovascular risk factors are the most common comorbidity. The most common symptoms are chest pain and palpitations. Up to 15% of cases are incidental findings in asymptomatic patients. The most frequent imaging methods are echocardiography and computed tomography followed by radiography and magnetic resonance. Descriptions include echogenic masses, cardiomegaly, densities below 0 UH, T1 and T2 hyperintensity, fat saturation and lack of contrast enhancement. A frequent finding was pericardial effusion. ***Conclusions:*** The accuracy of the different imaging methods for lipomas has not been estimated. However, multimodal imaging is highly reliable for non-invasive diagnosis.

Resumen

Introducción: El lipoma pericárdico es un tumor benigno infrecuente cuya presentación clínica es variada. Se revisaron los hallazgos por imagen descritos en la literatura en las modalidades de radiografía, ecocardiografía, tomografía axial computarizada (TAC) y resonancia magnética (RM). ***Metodología:*** Se identificaron reportes de caso, presentaciones en congreso y estudios observacionales de lipomas pericárdicos en PubMed, Scopus, Web of Science, Embase y Cochrane hasta el 01 de junio de 2022. ***Resultados:*** El lipoma pericárdico se ha descrito proporcionalmente en hombres y mujeres, en promedio a los 51 años de edad. Por lo general, los pacientes no presentan comorbilidades y de presentarlas, corresponden a factores de riesgo cardiovascular. Los síntomas más comunes son el dolor torácico y las palpitaciones. Hasta el 15 % de los casos son hallazgos incidentales en pacientes asintomáticos. Los métodos de imagen más frecuentemente descritos son la ecografía y la TAC, seguidos de la radiografía y la RM. Las descripciones incluyen masas ecogénicas, cardiomegalia, masas con densidad grasa menor a las 0 UH y por RM hiperintensas en T1 y T2 con saturación grasa y sin realce del medio de contraste. Un hallazgo frecuente es el derrame pericárdico. ***Conclusión:*** El rendimiento de las imágenes para el diagnóstico de lipomas pericárdicos no se ha calculado. Sin embargo, los hallazgos multimodales son altamente confiables para el diagnóstico no invasivo.

1. Introduction

Lipomas are rare benign tumors that constitute 8 to 12% of benign tumors of the heart and pericardium (1, 2). According to their location, they can be classified as intracavitary (atrial, ventricular or valvular), intramyocardial (myocardial or subendocardial) and extramyocardial (subpericardial and epicardial) (1-3) (Figure 1).

Cardiac lipomas are intracavitary in 53.1% of cases, pericardial in 32.5% and intramyocardial in 10.7% (4). These circumscribed entities differ from diffuse fatty infiltration of the myocardium that occurs in pathologies such as post-infarction myocardial areas, arrhythmogenic right ventricular heart disease, lipomatous hypertrophy of the interatrial septum and other types of cardiomyopathies (5).

The histologic composition of lipomas consists of well-differentiated mature adipocytes forming circumscribed, oval-shaped masses (2, 3). Other pericardial tumors with fatty histologic content occasionally reported in the literature include liposarcoma, lipoblastoma, hibernoma, angiomyolipoma and myolipoma. Liposarcoma is a rare malignant tumor containing cells with pleomorphic nuclei, lipoblasts; the most common subtype is atypical lipoma or well-differentiated liposarcoma (6). Lipo-

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blastoma is a benign infantile tumor derived from embryonal white fat containing adipocytes in different stages of maturation, myxoid matrix, fibrous septa and signet ring lipoblasts (7). Hibernoma is a benign tumor derived from embryonic brown fat containing multivacuolated adipocytes, specific for this diagnosis (8). Myolipoma is a benign tumor containing combined areas of mature adipocytes with smooth muscle (9) and angiomyolipoma shows associated vascular tissue (10).

In these less frequent tumors the definitive diagnosis is histological, since the imaging findings described are similar to those of pericardial lipoma (6-10). Despite this, most pericardial lipomas can be characterized noninvasively by ultrasound, radiography, tomography and magnetic resonance imaging, so knowledge of their appearance in the different modalities is essential for their detection, characterization, management and, in some specific cases, surgical conduct (11).

The main objective of this narrative review of the literature is to describe the demographic and clinical aspects and imaging findings related to pericardial lipoma, in the modalities of echocardiography, conventional radiography, computed tomography (CT) and magnetic resonance imaging (MRI).

2. Method

A literature search was performed using combinations of MeSH terms using Boolean AND and OR operators among three groups of terms related to pathology ("Lipoma"), anatomical location ("Epicardium", "Pericardium") and imaging methods ("Echochardiography", "Mutlidetector Computed Tomography", "Magnetic Resonance Imaging"). The terms were searched in PubMed, Embase, Scopus and Web of Science databases on June 01, 2022. The literature search identified a total of 48 cases of pericardial lipoma published between 1963 and 2021 (11-55).

3. Demographic and clinical aspects

Fifty-two percent of the cases described (n = 25) were female. The ages of the patients ranged from 38 weeks of gestation to 83 years (mean 51.6 years). Most of the patients had no comorbidities (n = 16; 33.3 %) and of those that did, the most frequent were hypertension (n = 7; 14.6 %), smoking (n = 5; 10.4 %) and obesity (n = 4 ; 8.3 %). The most common clinical findings were chest pain and palpitations (n = 9; 18.8 %), followed by incidental finding in asymptomatic patient (n = 7; 15 %). Other symptoms with a frequency of less than 5 % included syncope, lower limb edema, lipothymia, exercise intolerance, orthopnea, cough, trepopnea in right lateral decubitus and upper abdominal pain. Strikingly, in one patient the debutant clinical presentation was cardiac arrest (23). In the cases that documented physical examination findings, most of them were normal (n = 8; 16.6 %) and the most frequent positive finding was decreased heart sounds (n = 5; 10.5 %). Other findings with a frequency of less than 5 % included lower limb edema, murmurs, tachycardia, increased anteroposterior chest diameter, elevated jugular venous pressure, orthostatic hypotension, decreased breath sounds at the right base, and tachypnea. The electrocardiogram was normal in most cases (n = 13; 27 %), 8.3 % presented sinus tachycardia (n = 4) and 6.4 %, atrial fibrillation, atrial flutter or intraventricular block (n = 3). Other less frequent alterations were supraventricular tachycardia, nonspecific T-wave changes, low voltage and left axis deviation. Only one patient debuted as monomorphic ventricular tachycardia (27).

4. Imaging findings

The most frequently described imaging method was echocardiography, followed by CT, radiography and MRI, in descending order. Over time there is a downward trend in radiographic findings, stable in MRI report since 1981 and upward in echocardiography and CT since 1981 (Figure 2).

4.1. Echocardiography

Echographic evaluation detects masses that are most frequently described as echogenic and hypoechoic presentation is uncommon (11, 15). The most common associated finding is pericardial effusion (21, 24, 29, 33, 44, 45). Dynamic assessment allows characterization of cavity collapse and signs of pericardial tamponade which, although potentially fatal, are infrequent (13, 45, 52). Only one case reported a direct communication between the right ventricle and a pseudoaneurysm contained by the pericardial lipoma (16).

4.2. Chest radiography

In conventional radiography studies, the finding of cardiomegaly was described in 38% of the cases (Figure 3). The morphology of the cardiac silhouette is described as "balloon-shaped" or "bottle-shaped", and some authors have used it as a conclusive descriptor of pericardial effusion in cases where complementary studies are not available (47). A detailed evaluation of the density of the cardiac silhouette may show radiolucent masses of lower density that could correspond to lipomas (56).

4.3. Computerized axial tomography

The characterization of lipomas by means of CT allows showing their content through the visualization of fat density and its anatomical relationships (figures 4 and 5). In this regard, the report of the average attenuation values of the masses is inconstant throughout the studies and low density masses with attenuation between 0 and -160 Hounsfield Units have been described (17, 43). Homogeneous masses that infrequently have calcifications are documented (11, 46).

Although pericardial lipomas are frequently encapsulated masses with defined borders that do not invade adjacent structures, CT allows identifying the extension, displacement and compression of mediastinal structures such as the source bronchi, trachea, superior vena cava, pulmonary artery and veins (17, 22, 23, 51, 52, 56).

These tumors do not enhance after contrast injection (52). Hayashi et al. describe the "split pericardium sign" as the separation of the parietal and visceral pericardial layers covering the surface of the mass (26). This tomographic sign is not frequently found in the reviewed literature.

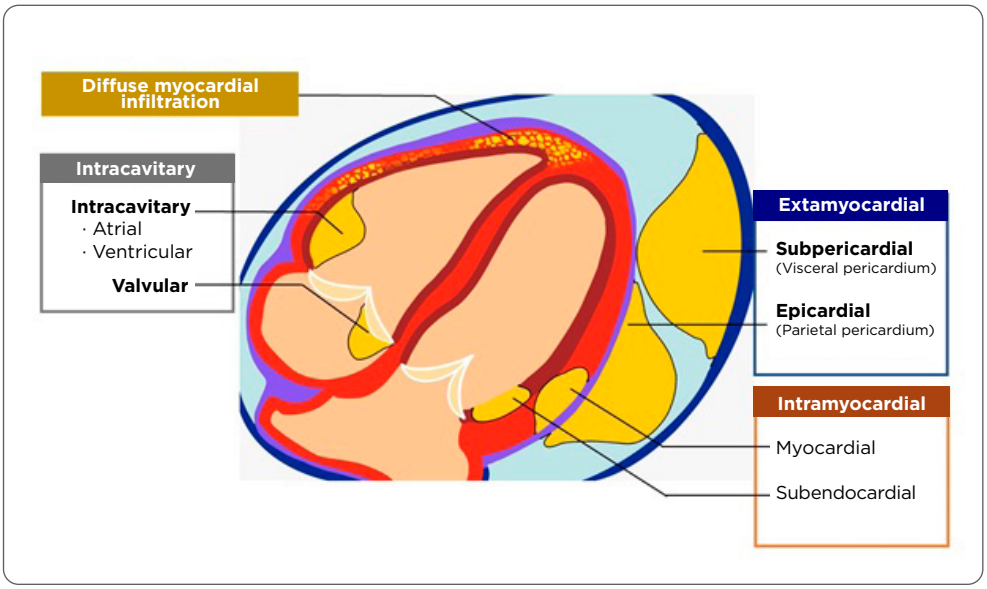


Figure 1. Anatomical illustration of the possible locations of cardiac lipomas described in the literature.
Source: Francisco Calle (author).

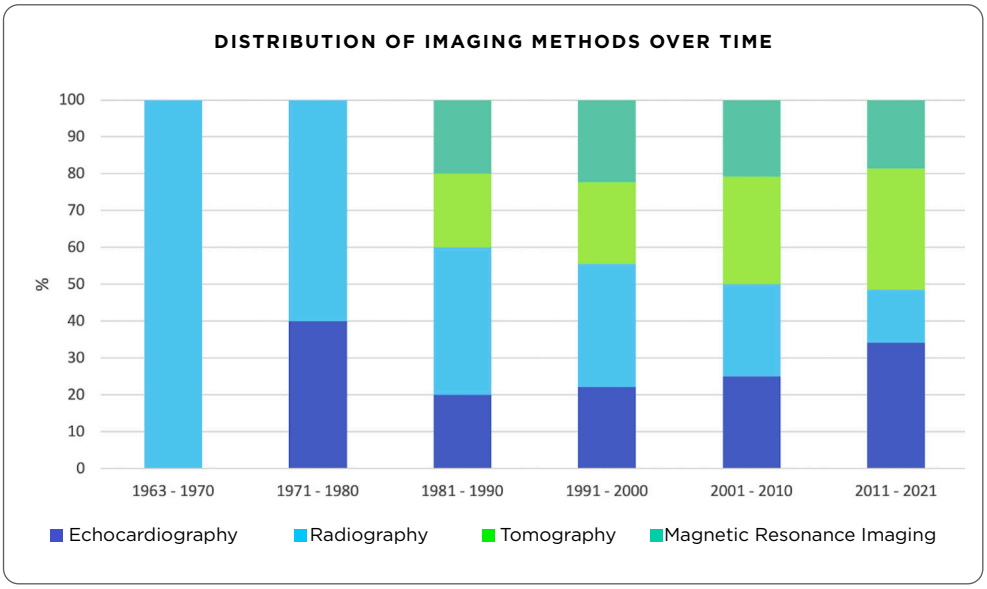


Figure 2. Percentage distribution of imaging methods over time.



Figure 3. Simple radiography in posteroanterior and lateral projections showing cardiomegaly with prominence of the left cavities and globular shape. There is a hint of a second minor density in the left cardiomediastinal border. Note the contact of the left ventricular border with the anterior wall of the descending aorta in the lateral projection. There is concomitant left hemidiaphragmatic elevation. Incidental finding in an 82-year-old patient hospitalized for mandibular squamous cell carcinoma.

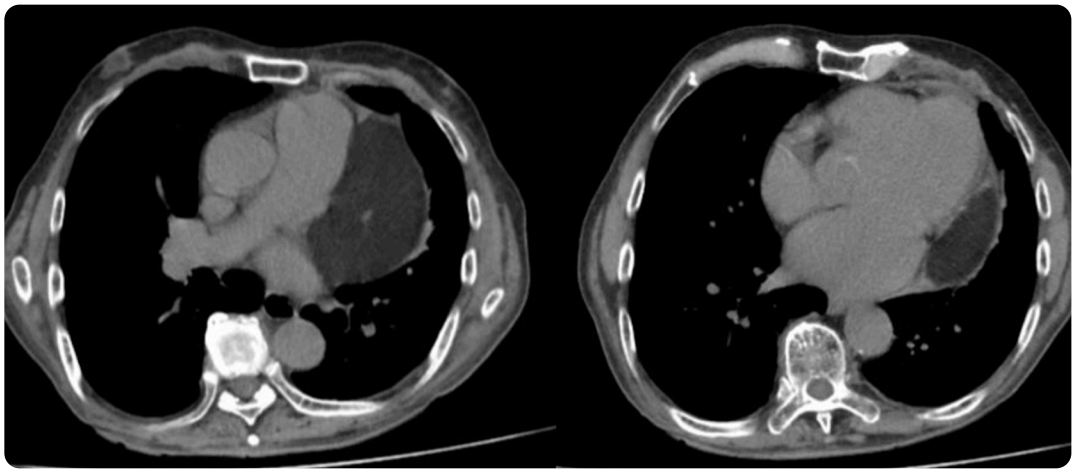


Figure 4. Chest CT scan of the same patient in Mediastinal window, without intravenous contrast medium. Axial slices showing an oval, low-density, homogeneous, homogeneous mass with well-defined borders located in the pericardial space adjacent to the left lateral surface of the heart in contact with the left border of the pulmonary artery trunk. Average attenuation of -98 HU and dimensions of 9 × 6 × 7 cm (AP × T × L). No displacement of adjacent structures or cardiomediastinum was observed, nor pericardial effusion.

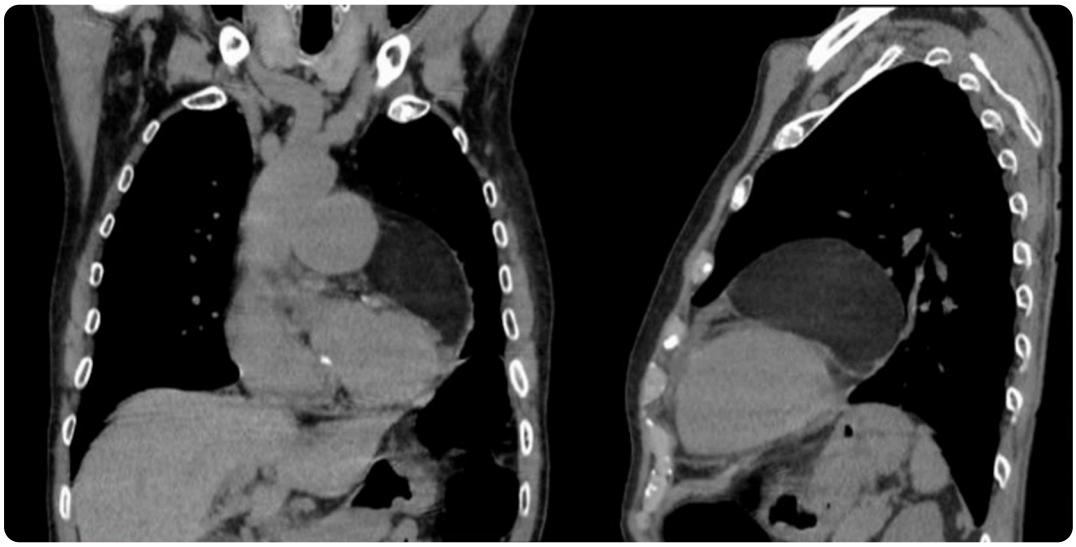


Figure 5. Chest CT of the same patient in mediastinal window, without intravenous contrast medium. Multiplanar reconstructions in coronal and sagittal planes show again the lipomatous lesion in the pericardial space that simulated cardiomegaly in the radiographs of figure 3 by interposition of similar densities.

4.4. Magnetic resonance imaging

MRI allows characterization of the fat content of these lipomatous tumors through the appearance of high signal in T1- and T2-weighted sequences (13, 15, 18, 24, 30). Most case report descriptions are limited to these sequences. However, other authors emphasize the importance of fat signal dropout on saturation sequences as a necessary finding for confirmation (11, 13, 27, 43, 51).

The characterization of these masses is consistent with the findings described by CT, since ovoid and homogeneous morphologies that do not enhance after the administration of paramagnetic contrast medium are described (27, 38, 40, 41, 43).

In some cases, the appearance of lipomas may be heterogeneous and linear images with a signal void corresponding to coronary tracts may be evidenced, a finding of great importance for surgical planning and evaluation of the resectability of these lesions (13, 24).

The CINE sequences by MRI allow us to evaluate the effect that pericardial lipomas can have on the normal movement of the heart. As it was exposed, lipomas can have an asymptomatic course related to the normal movement of the myocardium in CINE sequences (57). In cases of hemodynamic compromise, dynamic sequences may show findings compatible with pericardial constriction, such as respiratory inversion of the interventricular septum or abnormal curvature of the left ventricle (38). Other related findings include thinning of the ventricular walls and regional motility alterations (11).

5. Discussion

From the results of this review it can be inferred that echocardiography is the most common imaging modality in the diagnosis of pericardial lipoma, followed by CT and MRI. Of the 48 cases included in the review, 14 patients (28 %) were diagnosed exclusively by echocardiography and only 6 (12 %) by CT. Finally, 28 cases had ultrasound and CT as complementary diagnostic methods. In this review, CT was found to be the most common pre-surgical study of choice, thanks to its volumetric and multiplanar assessment. In conventional radiology studies, cardiomegaly was the most consistent finding, which was

described in 38% (n = 9) of the subjects, a finding in accordance with the literature. MRI findings confirmed the lipomatous nature of the lesion. A limitation of this review is that the impact of advanced MRI techniques on diagnostic accuracy was not extensively addressed.

The results of the review amply demonstrate the variability of clinical presentation and findings on different imaging methods that this entity can have.

A limitation of the available literature is that, to our knowledge, the diagnostic performance of the different imaging modalities compared to the gold standard of histopathologic confirmation of lipoma has not been addressed. This limitation can be explained by the absence of histopathological confirmation in 17% of cases. However, it is emphasized that the multimodal and non-invasive characterization of the lipomatous content is highly reliable, specifically by CT and MRI of these masses, since all the cases reported as lipomas preoperatively had histopathologic confirmation. This concept is reinforced by the remaining 17% of cases in which the lipomatous nature and benign behavior of the lesions was sufficient for clinical diagnosis and histological confirmation was not required.

Finally, a checklist is proposed for the description of these lesions in the most frequently encountered modalities in radiology (Table 1).

Table 1. Proposed checklist of descriptors related to pericardial lipoma by radiography, CT and MRI

Conventional radiography	CT	MRI
· Cardiomegaly · Balloon morphology	· Fat attenuation · Pericardial effusion · Split pericardium sign "split pericardium sign". · Extension, compression or displacement of adjacent mediastinal structures: vena cava, pulmonary veins, pulmonary arteries, trachea and bronchus Source · Relation of the mass to the coronary arteries	· High T1 and T2 signal · Signal drop in sequences with saturation · Pericardial effusion · Compromised cardiac motility on CINE sequences · Extension, compression or displacement of adjacent mediastinal structures.

Conclusions

This narrative review of the literature confirms the importance of multimodality assessment of pericardial lipomas for noninvasive diagnosis. Pericardial lipomas are benign entities that present with clinical pictures ranging from incidental finding to life-threatening conditions, such as pericardial tamponade and arrhythmias. Currently, imaging diagnosis of this entity is recognized most frequently by CT, as a first choice by echocardiography and increasingly by MRI.

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