

Right atrial lipoma: A case report and literature review

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Abstract. Cardiac lipomas are generally asymptomatic even in large dimensions. Echocardiograms can identify tumors, but cardiac magnetic resonance imaging or cardiac computerized tomography can differentiate cardiac lipomas from other cardiac tumors. The present study is a case report of an asymptomatic 30-year-old man diagnosed with atrial lipoma. The patient received cardiac surgery and the intervention consisted of exclusion of the right atrial (RA) tumor and reconstruction of the right atrium with 'XenoSure' patch in extracorporeal circulation through a minimally invasive approach. A short PubMed literature review was performed and 26 cases of RA lipomas with available details were found. Cardiac tumors may cause clinical presentation through different pathways. Symptoms related to an RA lipoma were present in 21 out of 26 patients (80%). The symptoms varied greatly, dyspnea being the most common of them. In one case, the lipoma was found during the autopsy of a patient after sudden death. Large cardiac lipomas can lead to complications such as obstruction of ventricular outflow tract, electric disorders, embolism or pericardial effusion. Obstruction of the right ventricular outflow tract was reported in 11 out of 26 patients (42%) diagnosed with RA lipoma. Generally, atrial lipoma can have various sizes. The most useful imaging technique was transthoracic echocardiography. Accurate diagnosis and evaluation of cardiac lipoma is dependent on multimodality imaging methods, including cardiac magnetic resonance. Surgery is the treatment of choice, but the risk-benefit ratio must be considered, and shared decision making must be taken into account. The present review data showed that 23 out of 25 patients (92%) underwent surgery. Among these patients,

only 1 out of 23 received a minimally invasive approach in 2021. Cardiac lipomas are rare entities, usually asymptomatic, that can occur at any age. The most useful diagnostic method of cardiac tumors is echocardiography, but nuclear magnetic resonance can also specify the type and characteristics of tumors.

Introduction

The most common cardiac tumors in adults are metastatic tumors (1). In autopsies, the incidence of primary cardiac tumors is <0.2% (2). Cardiac lipomas are rare entities, with a 2.9-8% incidence among all benign cardiac tumors, which positions them at the third place after myxomas and papillary fibroelastomas (3). Most cardiac lipomas do not cause symptoms, but they can be fatal when they cause arrhythmic or obstructive symptoms (1). They can be associated with symptoms that are related to the size and location (4). For example, lipomas that are large can cause left ventricular outflow tract obstruction and lead to symptoms ranging from syncope to cardiogenic shock, while lipomas situated near the atrioventricular valves can lead to valvular insufficiency or stenosis and manifest clinically as heart failure. The current case report presented a rare case of a large right atrial (RA) mass, in a completely asymptomatic patient who was in the otolaryngology service for a frontal osteoma resection.

Echocardiography is the most useful imaging technique to diagnose cardiac tumors due to its availability, accuracy and safety, but cardiac magnetic resonance can better characterize the tumors (5). In this case, echocardiography revealed the tumor and cardiac magnetic resonance raised the suspicion of cardiac lipoma, but the differential diagnosis with a liposarcoma remained. Conservative management requires periodic clinical and echocardiographic monitoring. Surgery is the treatment of choice and is considered curative, but the risk-benefit ratio must be considered, and shared decision making must be taken into account. Whether one approach is superior to the other is unknown (6). Due to the lack of large studies on cardiac lipomas, there are no exact data regarding risk factors or mortality in these patients; however, literature reviews can be helpful.

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Case report

In February 2018, a 30-year-old male was admitted to the Otolaryngology service of the Coltea Clinical Hospital (Bucharest, Romania) for a frontal osteoma resection. The patient was completely asymptomatic, with good effort tolerance, practicing sports during adolescence, without significant family history. The physical examination did not yield any pathological results. In addition, laboratory tests were within normal limits: Hemoglobin level, 15.7 g/dl (normal limits, 14-17 g/dl); white blood cell count, 7,600/ μ l (normal limits, 4,000-11,000/ μ l; C reactive protein, 0.31 mg/dl (normal limits, 0-0.32 mg/dl); and D-Dimer, 0.23 (normal limits, 0-0.5 μ g/ml).

Preoperative standard twelve-lead electrocardiogram (Fig. 1) showed sinus rhythm, ventricular rate of 83 beats per minute 'pulmonale P waves' (tall and peaked, height of 3 mm in D II) and QRS with right bundle branch block aspect. The findings suggested the presence of RA enlargement. Because of these electrical abnormalities, the patient was sent to the cardiologist. Transthoracic echocardiogram showed a large mass occupying the right atrium (40x28 mm), oval-shaped, hyperechoic, homogenous, with borders attached to the free wall of the right atrium (Fig. 2Aa-Ac), which was compatible with a benign tumoral mass. Inferior vena cava was normal (Fig. 2Ad). Transesophageal echocardiogram was performed to appreciate better the mass and to search for associated abnormalities and indicated the size of the atrial tumor (54x39 mm) (Fig. 2Ba and Bb). To improve tumor characterization and differential diagnosis, cardiac magnetic resonance was considered appropriate. Cardiac magnetic resonance showed a large mass originating on the RA lateral wall and occupying almost the entire RA cavity without any contact with the inter-atrial septum (Fig. 3A; cine 4 chamber view), which did not interfere with the blood flow from either superior or inferior vena cava (Fig. 3B; cine bi-caval view). The three-dimensional whole heart sequence revealed that the mass had a poli-lobulated and septate appearance (Fig. 3C). The mass was hypointense in T2-weighted short inversion time inversion recovery (Fig. 3D). In T1-weighted turbo spin-echo dark blood sequence, the mass appeared hyperintense (Fig. 3E). Early gadolinium enhancement imaging showed no evidence of thrombus attached to the surface of the mass (Fig. 3F) and late gadolinium enhancement imaging with a time of inversion chosen for myocardial nulling showed homogenous intensity of the RA mass (Fig. 3G). Advanced tissue characterization techniques (T1 mapping) were performed that definitely identified the lipomatous nature of the RA mass: Native T1 maps showed homogenous and significantly lower T1 values 250 msec of the mass compared with the normal myocardium and blood, while it was similar to subcutaneous and epicardial fat (Fig. 3H). Post-contrast administration T1 mapping of the RA mass showed a T1 of 260 msec, similar to the native T1 value, indicating that the tumor did not retain contrast (Fig. 3I). These findings were consistent with a diagnosis of cardiac lipoma.

The patient was referred with their consent to cardiac surgery where the option was the excision of the tumor. Further, the RA wall was reconstructed with 'XenoSure' patch (LeMaitre Vascular, Inc.) in extracorporeal circulation through a minimally invasive approach (right mini-thoracotomy).

The intervention was performed under general anesthesia with selective intubation. Transesophageal echocardiography monitoring was set up. A 4-cm incision was made in the right groin and the femoral vessels were dissected. Extracorporeal circulation was performed through the insertion of a right femoral artery cannula (size 20) and two venous derivations (the superior cava vein percutaneous using a cannula size 17 and the inferior cava vein through the right femoral vein using a long venous cannula size 25). Right mini-thoracotomy was performed in the third intercostal right space (Fig. 4A). After lung deflation, lateral pericardiotomy was performed (3 cm anterior to the phrenic nerve) and a cardioplegia cannula was applied. Myocardial protection was achieved via administration of anterograde cardioplegia in the aortic bulb, thereby inducing hypothermia at 34°C. Inspection of the right atrium revealed dilated atrium due to the tumor invasion of the anterior atrial wall (Fig. 4B).

A 5-cm long right atriotomy was performed. Exposure revealed a lipomatous mass, oval in shape, encapsulated, with estimated dimensions of 6.5x5.5x3.5 cm (Fig. 5A), attached to the anterior wall of the right atrium. The tumor was removed along with the implantation base from the anterior wall of the right atrium (Fig. 4C). Reconstruction of the right atrium was operated with a 'XenoSure' patch of 4/5 cm sutured with Prolene 5.0. The right atriotomy was closed using continuous Prolene 5.0 running suture (Fig. 4D). The bypass was stopped after rewarming the patient to 36.5°C. The total operative time was 120 min. After the surgery, transesophageal echocardiography examination was performed and did not show any complications.

The sampled tissue was fixed with formalin (10%) for 18-24 h at 22°C, then the sections were placed in paraffin blocks. The thickness of tissue section was 2-3 μ m, and it was sent for histopathological analysis by the Department of Pathology, where a light microscope was used for analysis. Hematoxylin and eosin staining of the specimen revealed mature white adipose tissue without atypia, findings consistent with a lipoma (Fig. 5B). Short-term evolution was favorable, with rapid clinical recovery.

At the 1-year follow-up, conventional echocardiography was normal, with no signs of atrial enlargement and aforementioned echocardiographic changes resolved.

Discussion

Cardiac lipomas may be asymptomatic even in large dimensions and are typically found incidentally on autopsies or via imaging methods (1,4). Regarding their incidence, there are no differences between age groups or sexes (4). Cardiac lipomas can be associated with symptoms that are related to the size and location of the lipoma (1,4). The present one is a rare case, where the tumor was large and asymptomatic. The etiology of cardiac lipomas is unknown. The origin of lipomas can be from all the three cardiac tissues: Subendocardial (the majority), pericardial or myocardial (7).

They are usually encapsulated masses, but sometimes they can infiltrate the walls of the heart (4). The most common complications of these tumors can be due to intracardiac obstruction of blood flow, which can cause symptoms varying from fatigue to even syncope (4), or electrical disorders such as atrioventricular or intraventricular conduction disorders,

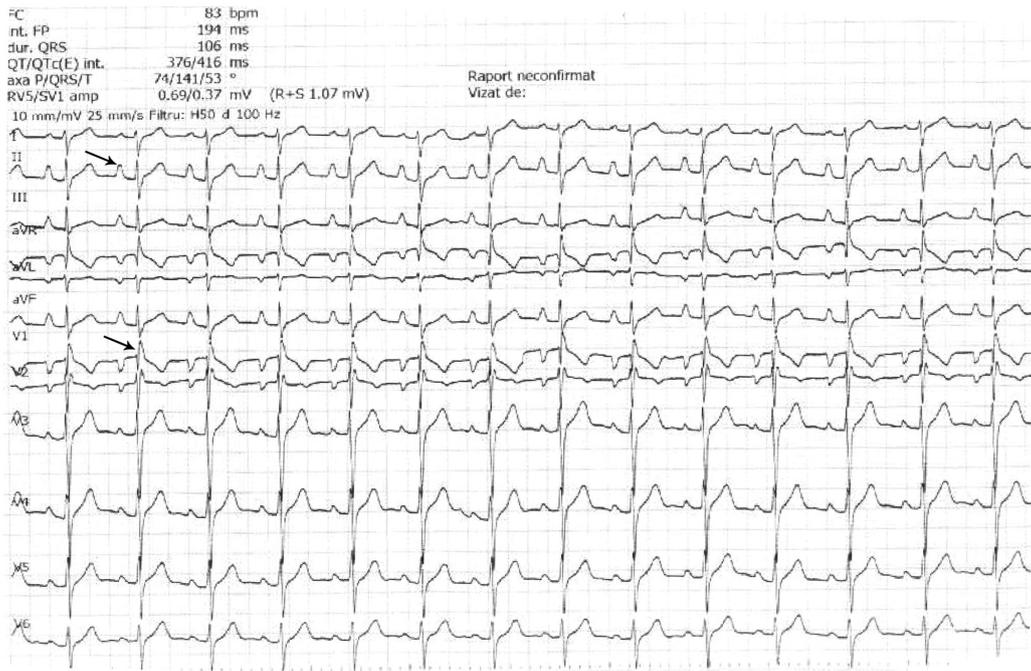


Figure 1. Twelve-lead standard electrocardiogram. Normal sinus rhythm, ventricular rate of 83 beats per minute 'pulmonale P waves' (arrow) (tall and peaked, height of 3 mm in D II) and right bundle branch block morphology (arrow) were revealed.

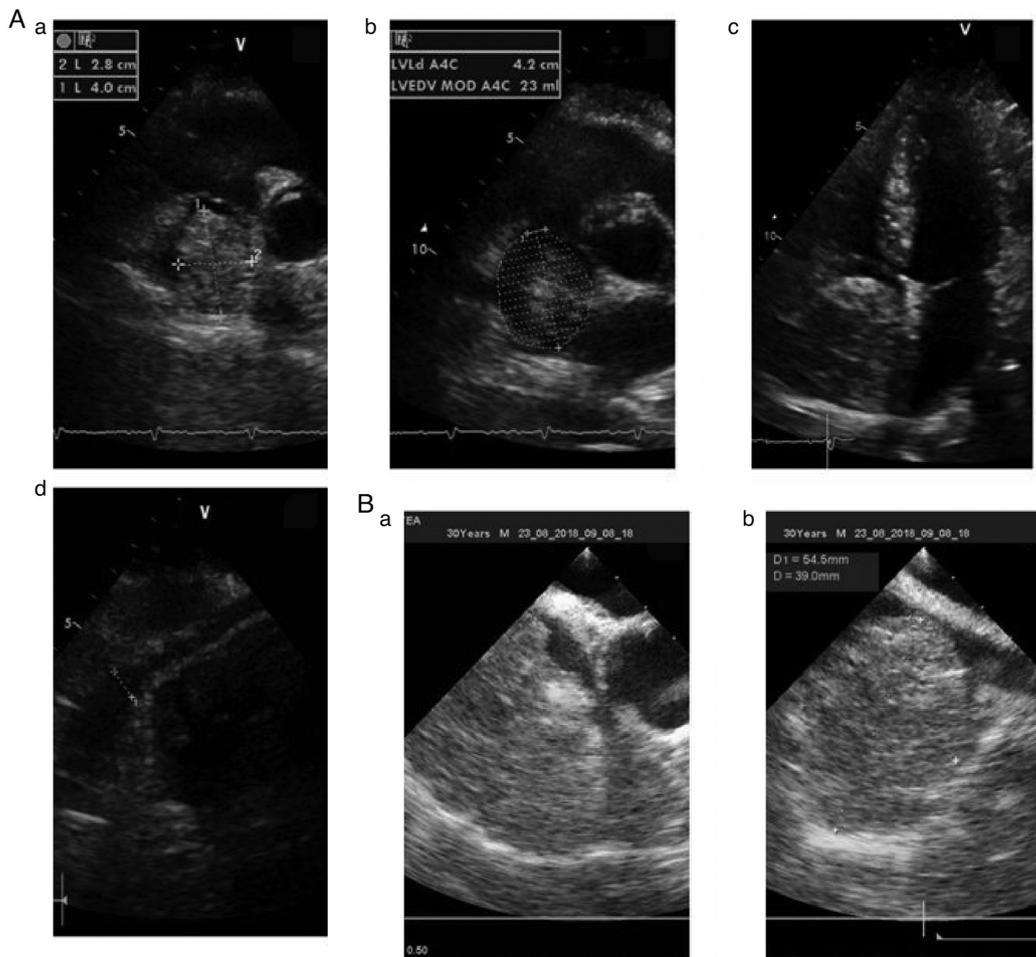


Figure 2. Echocardiography. (Aa-Ac) Transthoracic echocardiogram showed a large mass in the right atrium (40x28 mm), oval-shaped, hyperechoic and homogenous, with borders attached to the free wall of right atrium without affecting the inter-atrial septum. (Ad) Inferior vena cava with normal diameter and complete inspiratory collapse. (Ba-Bb) Transesophageal echocardiogram indicated the size of the atrial tumor (54x39 mm) and showed its attachment to the free wall of the right atrium.

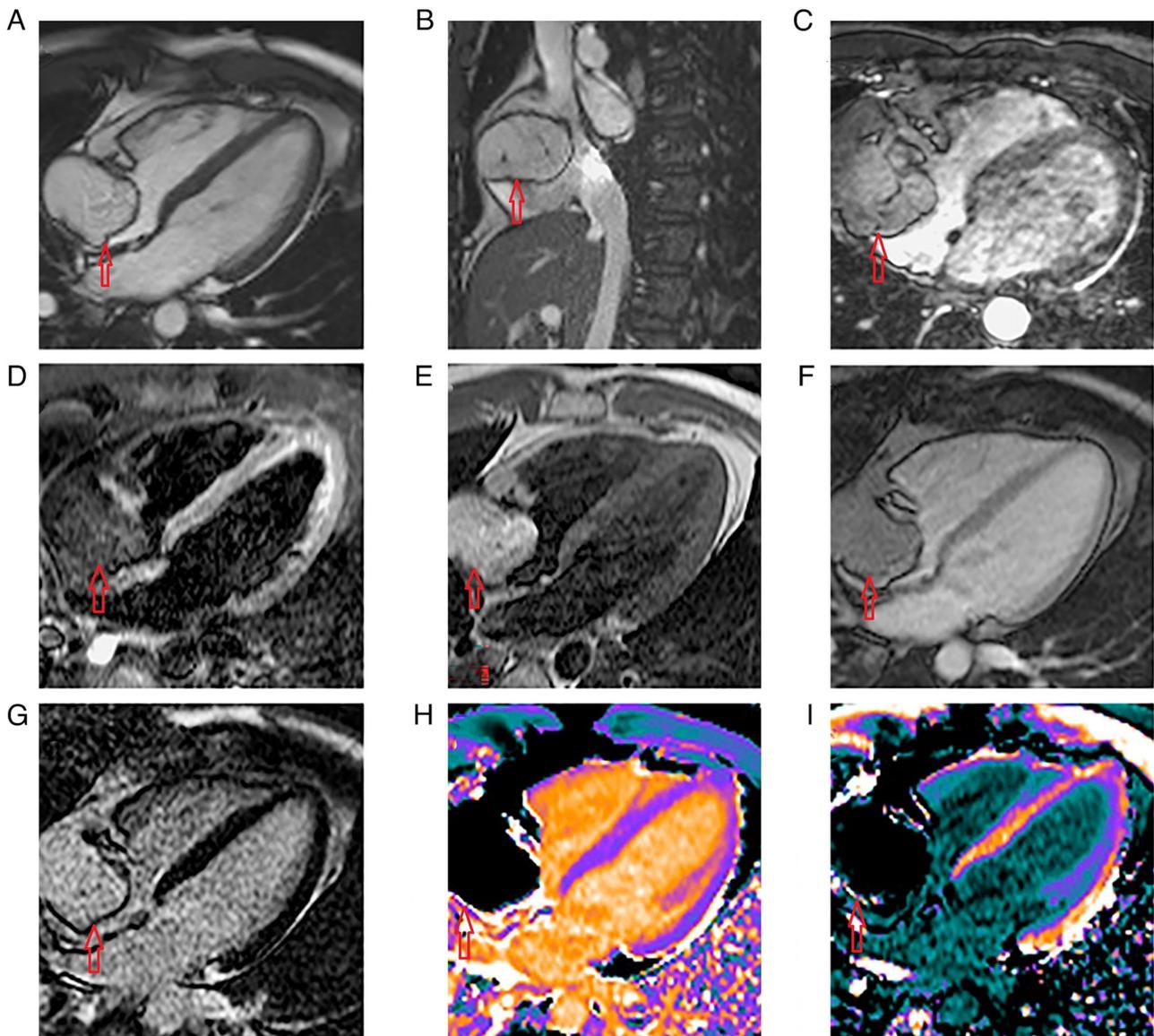


Figure 3. Tissue characterization of the RA mass through cardiac magnetic resonance. (A) Cine 4 chamber view showing a large mass originating on the RA lateral wall and occupying almost the entire RA cavity without any contact with the inter-atrial septum. (B) Cine bi-caval view showing that the mass does not interfere with the blood flow from either superior or inferior vena cava. (C) Three-dimensional whole heart sequence. The mass has a poli-lobulated and septate appearance. (D) T2-weighted short inversion time inversion recovery indicating that the mass was hypointense. (E) T1-weighted turbo spin-echo dark blood sequence indicating that the mass was hyperintense. (F) Early gadolinium enhancement imaging showing no evidence of thrombus attached to the surface of the mass. (G) Late gadolinium enhancement imaging with a time of inversion chosen for myocardial nulling showing homogenous intensity of the RA mass. Advanced tissue characterization techniques (T1 mapping) were performed which identified the lipomatous nature of the RA mass. (H) Native T1 maps showed homogenous and significantly lower T1 values 250 msec of the mass compared with the normal myocardium and blood, while it was similar to subcutaneous and epicardial fat. (I) Post-contrast administration T1 mapping of the RA mass showed a T1 of 260 msec, similar to the native T1 value, indicating that the tumor did not retain contrast. These findings were consistent with a diagnosis of cardiac lipoma. The cardiac tumor, in the different sections of the cardiac magnetic resonance analysis, is highlighted by red arrows. RA, right atrial.

which are manifested by arrhythmias, interfering in the cardiac dynamic and leading to sudden death (8,9). In the present case, the patient had right bundle branch block and abnormal P wave, which resigned after the surgery. Pulmonary thromboembolism and pericardial effusion have also been reported in certain studies (10-13). An intra-aortic lipoma, that invaded the left coronary ostium and was responsible for sudden cardiac death in a 52-year-old man was reported (9).

Echocardiography is the most useful imaging technique to diagnose cardiac tumors due to its large availability, accuracy and safety (14). Surgery is the treatment of choice in these cases, but the risk-benefit ratio must be considered, and shared

decision making must be taken into account. Shared decision making is not widely used in Romania, and it depends on numerous factors, such as the level of education (15). Shared decision making is very important as these patients are subjected to significant mental stress, being sent for cardiac surgery even though they are asymptomatic.

After reviewing the literature, only one case of RA lipoma treated via a minimally invasive cardiac surgery technique was found (16). The main particularities of the case were the absence of clinical signs considering the dimensions of the tumor (6.5x5.5x3.5 cm; no right ventricular filling abnormalities) and the minimally invasive cardiac surgery

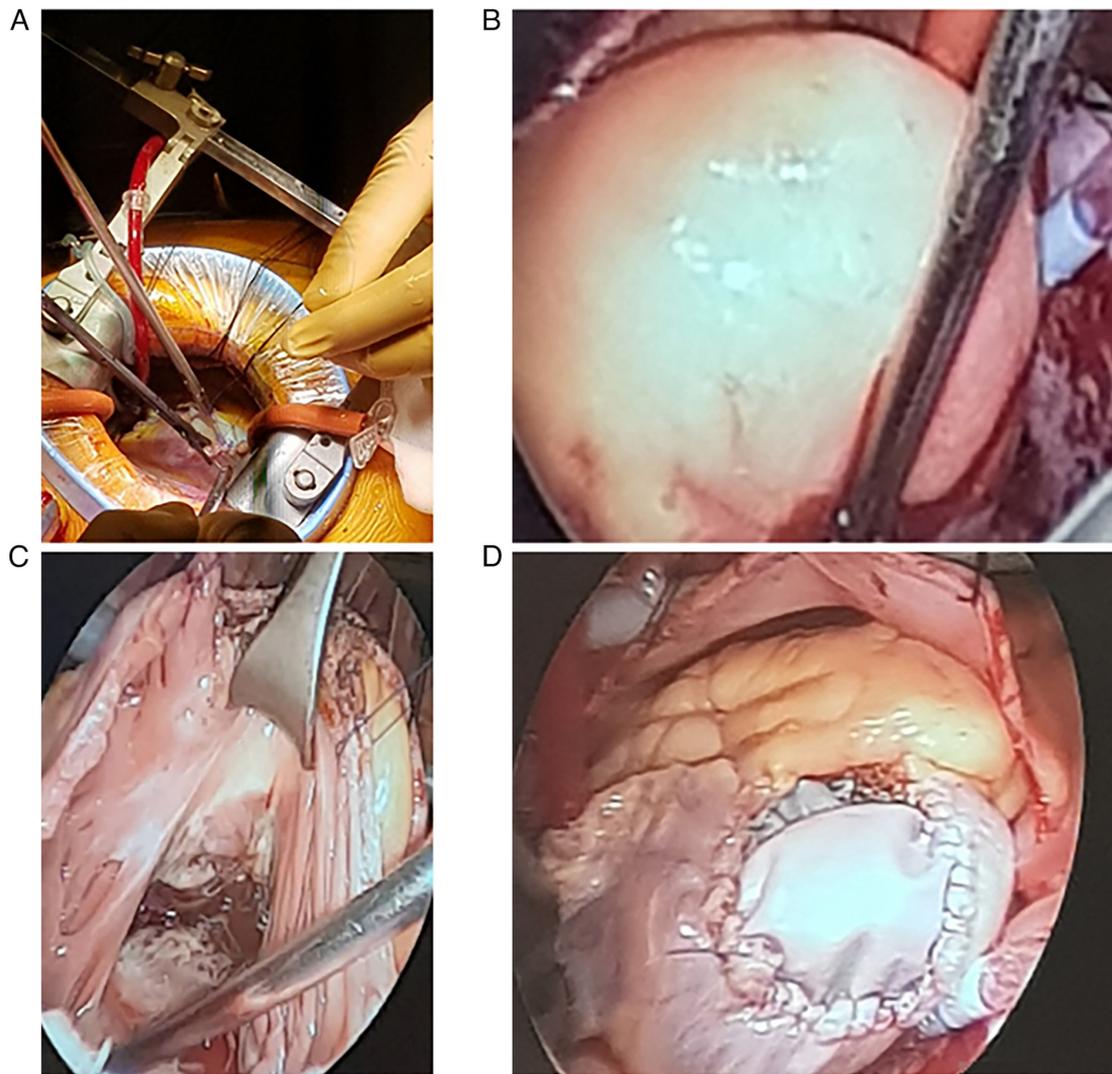


Figure 4. Intraoperative images. (A) Right mini-thoracotomy in the third intercostal right space. (B) Dilated atrium due to the tumor invasion of the anterior atrial wall. (C) The tumor was removed along with the implantation base from the anterior wall of the right atrium. (D) Reconstruction of the right atrium using a 'XenoSure' patch.

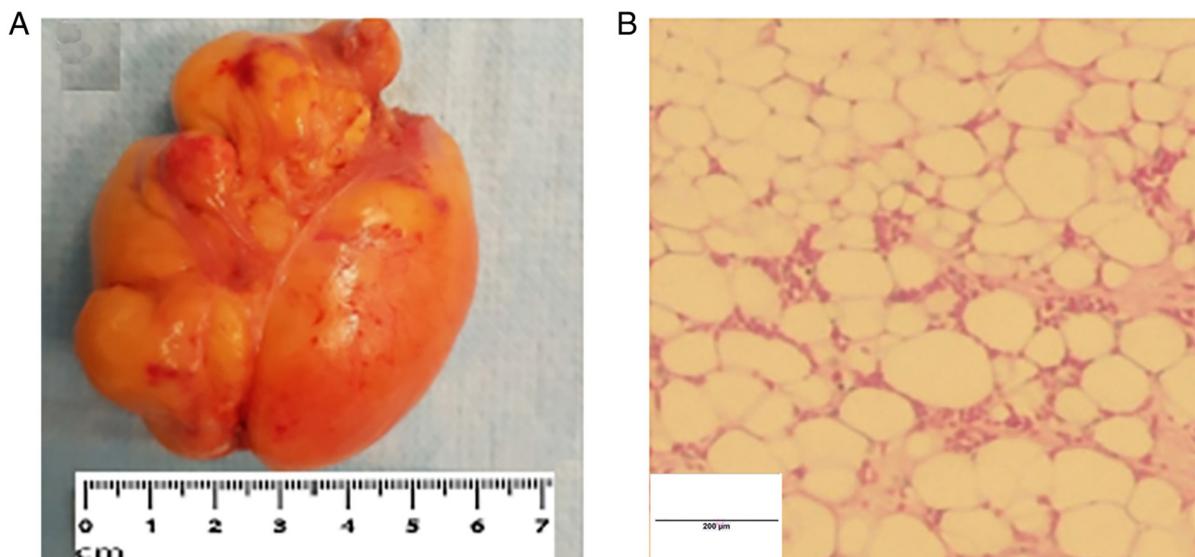


Figure 5. Macro- and microscopy. (A) Image of the right atrial mass showing a lipomatous mass that is oval-shaped, encapsulated and with estimated dimensions of 6.5x5.5x3.5 cm. (B) Micrograph of mature white adipose tissue without atypia.

Table I. Documented cases of right atrial lipoma based on PubMed based search.

First author, year	Age, years/sex	Symptoms	Size, cm	Diagnostic Method	Obstruction	Interatrial septum involvement	Treatment	(Refs.)
Present case, 2019	30/m	Asymptomatic	6.5x5.5x3.5	ECHO, CMR	No	No	Mini-thoracotomy	Not applicable
Mullen <i>et al</i> , 1995	17/f	Dyspnea	25x15x8	ECHO, CMR	No data	No data	Sternotomy	(18)
Sankar <i>et al</i> , 1998	38/m	Palpitations	5x4	X-RAY, ECHO	No data	No	Sternotomy	(20)
Maurea <i>et al</i> , 2001	54/f	No data	No data	ECHO, CCT	Yes	Yes	Sternotomy	(21)
Pego-Fernandes <i>et al</i> , 2003	48/m	High blood pressure, epistaxis	5x4.5x4	ECHO, CMR	Yes	No	Sternotomy	(22)
Templin <i>et al</i> , 2008	51/m	Dyspnea	7.3x4.2	ECHO, CMR	Yes	No	Sternotomy	(23)
Smith, 2007	53/f	Fatigue, dyspnea	3 lipomas: 7x4x2; 6x3x2; 4x2.5x1.5	ECHO	Yes	Yes	Sternotomy	(24)
Gulmez <i>et al</i> , 2009	68/f	Asymptomatic	5x4x4	ECHO, CT	No	Yes	Sternotomy	(25)
Joaquim <i>et al</i> , 2009	27/m	Fatigue, tachycardia	5.5x5.3	ECHO	No data	No data	Sternotomy	(26)
Ceresa <i>et al</i> , 2010	62/m	Palpitations	No data	ECHO, CMR	No data	Yes	Sternotomy	(27)
Alameddine <i>et al</i> , 2011	21/transgender m	Dyspnea, dry cough	15x13x6	X-RAY, CCT, CMR	Yes	No data	Sternotomy	(28)
Habertheuer <i>et al</i> , 2014	71/f	Dyspnea Cardiac tamponade	No data	ECHO, CCT	Yes	No	Sternotomy	(29)
Barbuto <i>et al</i> , 2015	66/m	Asymptomatic	7.6x5.5	CCT, CMR	No	No	Sternotomy	(30)
Khaliili <i>et al</i> , 2015	56/m	Dyspnea, cardiac tamponade	11x7.5	ECHO, CCT	Yes	Yes	Sternotomy	(31)
Singh <i>et al</i> , 2015	74/f	Dizziness, syncope	6x6	ECHO	No	Yes	Sternotomy	(1)
Wang <i>et al</i> , 2015	55/f	Asymptomatic	3.2x1.7x7	ECHO, CCT	No	No	Sternotomy	(32)
Wu <i>et al</i> , 2015	65/f	Chest pain	1.4x1.1	X-RAY, ECHO, CCT	Yes	No	Sternotomy	(2)
Rainer <i>et al</i> , 2016	67/f	Acute limb ischemia	7.7x5.5x4	X-RAY, ECHO	No	No	Sternotomy	(33)
Wahab <i>et al</i> , 2017	70/f	Palpitations, headaches	2.6x1.6x1.6	MRI	Yes	No	Sternotomy	(34)
Lapinskas <i>et al</i> , 2017	49/m	Dizziness, fatigue	3.2x2.7x4.9	ECHO, CMR	Yes	No	Sternotomy	(19)
Naseerullah <i>et al</i> , 2018	50/f	Chest pain	4x5.7, 8x7	ECHO	No	Yes	Sternotomy	(7)
Shah <i>et al</i> , 2019	61/f	Chest pain	No data	ECHO, CCT, CMR	Yes	Yes	Sternotomy	(35)

Table I. Continued.

First author, year	Age, years/sex	Symptoms	Size, cm	Diagnostic Method	Obstruction	Interatrial septum involvement		Treatment	(Refs.)
Wang <i>et al.</i> , 2019	49/m	Chest pain	1.5x1.2x0.8	ECHO, CCT, CMR	No	No	No	Sternotomy	(36)
Bath <i>et al.</i> , 2019	74/m	Asymptomatic	3.0x4.3x5.9	ECHO, CMR	No	Yes	Yes	Monitoring	(37)
D'Errico <i>et al.</i> , 2019	67/m	Sudden death	4x3x3	Autopsy	No	Yes	Yes	Not applicable	(8)
Molek <i>et al.</i> , 2021	67/f	Dyspnea, cough	3x3	CT, ECHO, CMR	No	No	No	Monitoring	(16)
Fan <i>et al.</i> , 2021	44/m	Asymptomatic	4.6x3.0	CT, ECHO	No	No	No	Mini-thoracotomy	(38)

ECHO, echocardiogram; CMR, cardiovascular magnetic resonance; CT, computerized tomography; CCT, cardiac CT; MRI, magnetic resonance imaging; m, male; f, female.

technique, which was also permissive for rapid recovery of the patient. Cardiac lipomas are rare entities, with a 2.9-8% incidence among all benign cardiac tumors (2). Reviewing the location of cardiac lipomas revealed that ~40% were in the right atrium (4).

In the present study, a short PubMed literature review (<https://pubmed.ncbi.nlm.nih.gov/>) was performed to analyze the RA lipoma cases reported from 1995-2021. Search criteria included the following key words: 'Right atrial lipoma'. The cases that had patients <16 years of age and with patients that had no follow-up data were excluded. Collected data are illustrated in Table I. A total of 26 cases of RA lipomas with available details were found. Among these cases, no significant difference in the distribution between genders (13 female, 12 male and 1 transgender) was found. The median age of the included patients was 55.5 years old (age range, 17-74 years).

Cardiac tumors may cause clinical presentation via different pathways. Symptoms related to RA lipoma were present in 21 out of 26 patients (80%). The symptoms varied greatly, dyspnea being the most common of them (35%), followed by chest pain (15%) and palpitation (12%). Although it has been reported that cardiac lipomas are generally silent (4), the present literature review, which included RA lipomas, showed that only 5 out of 26 patients (19%) were completely asymptomatic. In one particular case, the lipoma was found during the autopsy of a patient with sudden death (8).

Large cardiac lipomas can lead to complications such as obstruction of ventricular outflow tract, electrical disorders, embolism or pericardial effusion (10,12,13,17). Obstruction of right ventricular outflow tract was reported in 11 out of 26 patients (42%) diagnosed with RA lipoma (2,16-25).

Generally, atrial lipomas can have various sizes (4). In the present review, the largest lipoma was 25 cm and was found in a 17-year-old girl in 1995 (18).

The most useful imaging technique was transthoracic echocardiography. Among these patients, 9 out of 26 cases (35%) of RA lipoma underwent cardiac magnetic resonance for a better tumor characterization. Accurate diagnosis and evaluation of cardiac lipomas is therefore dependent on multimodality imaging methods.

The present literature review showed that 23 out of 25 patients (92%) underwent surgery. Among these patients, only 1 out of 23 received a minimally invasive approach in 2021 (16). Minimally invasive surgical techniques should be considered in certain patients with cardiac lipoma in the future.

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Availability of data and materials

All data generated or analyzed during this study are included in this published article.

Authors' contributions

MB is the corresponding author and participated in the design of the case report. SO performed and described the cardiac magnetic resonance. VC performed and described the surgery. SB performed the histopathology. AG performed additional literature review and revised the draft. MB and AG confirm the authenticity of all the raw data. All authors read and approved the final version of the manuscript.

Ethics approval and consent to participate

Ethics approval was obtained from the Medical Ethics Committee of Coltea Clinical Hospital (approval no. 26/07.12.2021).

Patient consent for publication

Written informed consent was obtained from the patient prior to publication at the time of admission.

Competing interests

The authors declare that they have no competing interests.

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