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CASE REPORT

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Report of a giant invasive, wall-penetrating cardiac lipoma

Jingze Zhu[1†], Xiangyu Cao[2†], Lei Chen[1], Junjie Song[1], Zhenya Shen[1,2*] and Yunsheng Yu[1,2*]

Abstract

Background Cardiac lipoma, a seldom-encountered benign tumor positioned beneath the endocardium, has the potential to impair electrophysiological functions. Diagnosis is principally based on imaging modalities. The uniqueness of this case lies in the tumor's extension both internally and externally within the right atrium, rendering it of special interest. From a clinical standpoint, surgical removal is commonly advocated, wherein early intervention is pivotal in improving patients' long-term prognoses.

Case presentation A 35-year-old male was admitted to the hospital for treatment subsequent to the identification of a cardiac mass two days prior. Initial diagnostic assessments, encompassing CT scans and echocardiography, identified a space-occupying lesion within the heart. The patient underwent surgical excision of the cardiac tumor, utilizing mild hypothermic extracorporeal circulation via femoral vessel access. Intraoperative findings revealed adipose-like tissue of a "dumbbell-shaped" configuration situated both within and external to the right atrium, measuring approximately 8 cm*9 cm internally and 7 cm*6 cm externally, with the extracardiac mass being marginally larger. Postoperative pathological analysis confirmed a cardiac lipoma diagnosis. A follow-up echocardiogram conducted three months post-surgery exhibited no notable abnormalities. The patient is under continuous observation to monitor for any recurrence or potential long-term complications.

Conclusion In this case report, we detail with precision a rare cardiac pathology manifested by an expansive infiltrative lipoma that pervades the endocardial and epicardial layers of the right atrium. After thorough preoperative diagnostic workup and evaluation, we contend that surgical intervention represents the optimal therapeutic approach for managing such conditions, with the goal of preemptively reducing the likelihood of cardiac compression or intracardiac obstruction.

Keywords Invasive cardiac lipoma, Right atrium tumor, Cardiac tumors, Cardiovascular surgery

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Introduction

Cardiac lipomas are an uncommon type of primary benign cardiac tumors. These tumors predominantly arise from the epicardium, although they can also manifest within the endocardium or myocardium. While patients may remain asymptomatic, tumors of significant size or those located in critical areas may precipitate arrhythmias, obstructive phenomena, or even heart failure. Surgical excision of the tumor constitutes the principal therapeutic strategy, aiming to relieve symptoms and reduce potential complications.

Case presentation

A 35-year-old male patient was admitted to our hospital two days after CT scan revealed a cardiac lesion suggestive of a space-occupying mass. The imaging revealed a fatty density mass within the right atrium, necessitating the patient's referral to our center for advanced diagnostic and therapeutic management. Upon physical examination, the patient's vital physical signs were stable with a temperature of 36.9 °C, blood pressure at 124/62 mmHg, and a pulse rate of 74 beats per minute. His stature was recorded at 175 cm with a body weight of 87 kg. The patient denied any family history of genetic disorders. Pulmonary auscultation was unremarkable, jugular venous pressure was not elevated, cardiac examination revealed no significant valvular murmurs, and there was an absence of notable pitting edema in the lower limbs. A confirmatory CT scan performed at admission substantiated the initial findings, delineating a nodular mass within the right atrium, measuring up to 8 cm in diameter, with associated reduction in atrial chamber size and poorly defined margins (Fig. 1A).

Bedside transthoracic echocardiography revealed the following: right atrial diameter at 47 mm, TAPSE at 19 mm. A significant, homogeneous echoic mass, approximately 7 cm by 5 cm, was noted to occupy the right atrium, featuring distinct and uniformly delineated margins. This mass, anchored to the right atrium's lateral wall near the tricuspid valve's anterior leaflet, and exhibited mobility significantly. It moved into the tricuspid valve orifice during diastole and withdrew into the

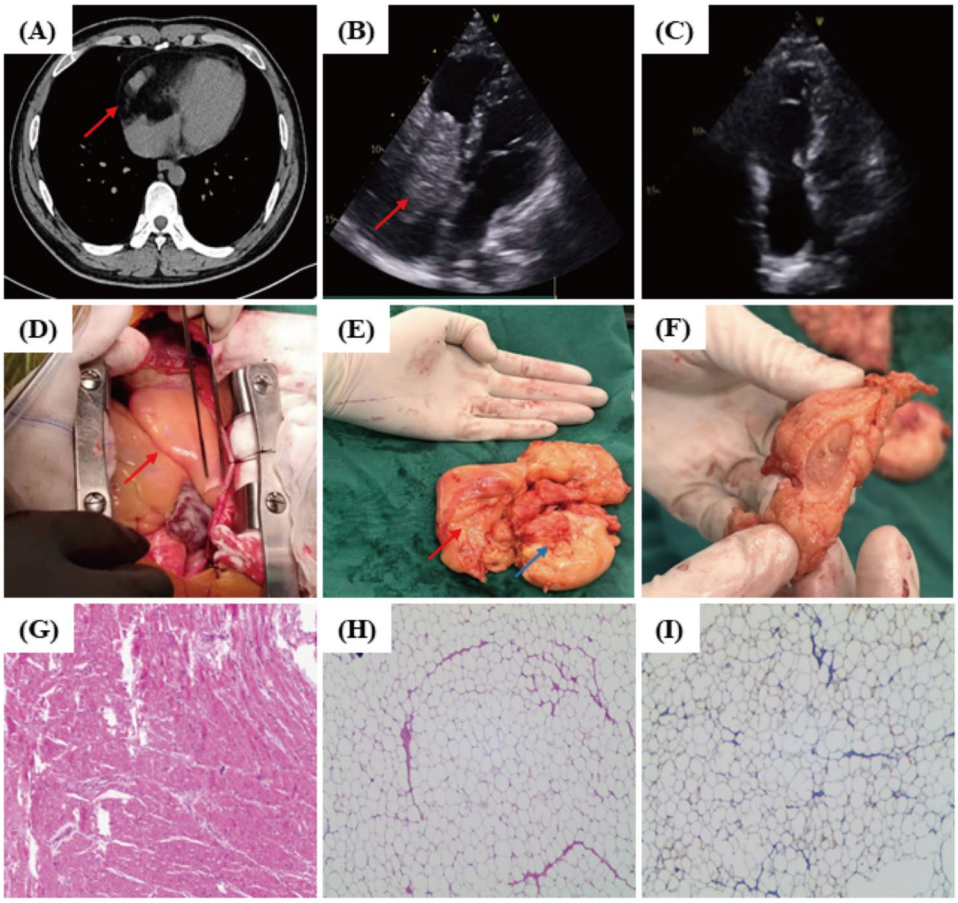

Fig. 1 Cardiac Lipoma Images **A**: Preoperative CT (the lesion indicated by the red arrow); **B**: Preoperative echocardiogram (an occupant in the right atrium indicated by the red arrow); **C**: Postoperative echocardiogram; **D**: Atrial mass observed during surgery (indicated by the red arrow); **E**: The entire specimen after excision (the extracardiac portion: red arrow; the intracardiac portion blue arrow); **F**: The tissue at the junction between the intracardiac and extracardiac portions of the mass; **G, H, I**: Pathological staining of the tumor sections (H&E 40x)

right atrium in systole. Color Doppler imaging showed a narrow blood flow jet along the mass's edges in diastole (Fig. 1B).

Routine hematological and related laboratory tests did not reveal any significant abnormalities. The diagnosis was a right atrial occupying lesion. Post-admission, the patient underwent standard pre-surgical preparation. Given the mass's considerable size and pronounced mobility, surgical resection of the cardiac tumor was performed using mild hypothermic cardiopulmonary bypass via the femoral vein and artery. Intraoperative findings included substantial adipose-like tissue adhering to the exterior of the right atrium, with an intracardiac mass also observed (Fig. 1D). Upon careful excision, the mass was found to have a 'dumbbell' configuration with a hollow interior devoid of liquid blood flow, and the cavitated space within the tumor did not communicate with the right atrium (Fig. 1F). The adipose tissues at either end of the 'dumbbell' measured approximately **8 cm*9 cm and 7 cm*6 cm**, respectively, with the extracardiac adipose-like tumor being notably larger (Fig. 1E). Following the meticulous excision of the tumor, an exploratory examination revealed no abnormalities in the tricuspid valve or right ventricle. The right atrial incision was then closed, subsequently concluding the surgical procedure. Postoperative echocardiographic assessment revealed a right atrial transverse diameter of 37 mm and a TAPSE of 14 mm, with no other significant abnormalities observed (Fig. 1C).

The postoperative pathological examination indicated the tumor was composed of adipocytes, with partially swollen nuclei observed. It largely filled the intermuscular septa and was notably sizable. Immunohistochemical staining revealed MDM2 (–), CDK4 (–),S-100 (+), P16 (+), Ki67 (2%), ruling out liposarcoma. These findings aligned with a lipoma diagnosis (Fig. 1G, H, I). A three-month postoperative echocardiographic follow-up showed no significant abnormalities.

Discussion and conclusions

Primary cardiac tumors are a rare cardiac pathology, with the majority being benign and a rare incidence rate. Cardiac myxomas are the most common, whereas lipomas account for approximately 2-8% of all benign cardiac tumors. The incidence of cardiac lipomas shows no significant correlation with age or gender, though they are most often diagnosed in individuals sporadically aged 40 to 60 years. It is reported that detection rate of the disease in the general population is under 0.1% [1–3]. Despite their rarity, cardiac lipomas are a critical clinical entity that necessitates swift identification and intervention.

Cardiac lipomas are encapsulated tumors consisting of mature adipose tissue [4]. They can occur in various anatomical locations within the heart: approximately 53% are intracavitary, 33% are intrapericardial, 11% are intramyocardial, and around 4% involve multiple structures [2]. Tumors that infiltrate both intracardiac and extracardiac spaces and extend into the myocardium are exceedingly rare [1]. In the present case, a mass infiltrating the myocardium adjacent to the inferior vena cava was observed, presenting a "dumbbell-like" morphology. Pathological evaluation led us to classify this mass as an infiltrative, transmural giant lipoma of the right atrium.

Cardiac lipomas typically manifest without significant clinical symptoms and are often discovered incidentally during routine clinical examinations. The symptoms, when present, depend on the tumor's specific anatomical location. For instance, subepicardial masses may induce angina by compressing coronary arteries or may lead to reduced contractility by continuously compressing the left ventricle. Additionally, infiltration into the myocardium can affect the conduction bundle, causing arrhythmias [5, 6]. Echocardiography, alongside CT or MRI, constitutes the standard imaging techniques for diagnosing cardiac lipomas. Echocardiography, being convenient and non-invasive, allows for the evaluation of heart function and the determination of the size, position, and mobility of intracardiac lipomas. CT/MRI complements echocardiography by overcoming its limitations in visualizing extracardiac lipomas and more precisely determining the tumor's histological characteristics and its infiltration extent into the myocardium or adjacent organs. This combination of imaging modalities is crucial for a definitive diagnosis and for assessing the feasibility of thorough tumor resection [3, 7]. The microscopic differentiation between lipomas and liposarcomas poses a challenge. Therefore, multiple studies indicate that MDM2 amplification is significantly associated with histological outcomes, offering a diagnostic sensitivity of 94% for liposarcomas [8].

Pathologically, cardiac lipomas are benign tumors, yet they may occasionally manifest clinical signs suggestive of malignancy, including significant arrhythmias, valvular stenosis, intracardiac blockages, cardiac compression, and peripheral vascular embolism [4]. Currently, there are no unified treatment guidelines based on extensive clinical cohort studies or randomized controlled trials. In clinical practice, physicians typically advise periodic monitoring for patients with small, asymptomatic cardiac lipomas. Conversely, tumors exhibiting pronounced symptoms, increased size, or hemodynamic alterations require surgical interventions [9]. While surgical excision may alleviate symptoms caused by the compression of surrounding structures, and the risk of sudden death from ventricular arrhythmias may still exist [4]. Our case underscores the clinical diversity of cardiac lipoma presentations, highlighting the importance of early disease

recognition, diagnosis, treatment and long-term patient follow-up.

Abbreviations

CT	Computed tomography
TAPSE	Tricuspid annular plane systolic excursion
H&E	Hematoxylin-eosin staining
MRI	Magnetic Resonance Imaging

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Author contributions
J Zhu was involved in drafting the manuscript. Y Cao contributed in revising and polishing the manuscript. J Zhu and L Chen and Y Yu operated the surgery. J Zhu and J Song contributed to preparing the figures. Z Shen and Y Yu revised the manuscript. All authors read and approved the final manuscript.

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Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
The experimental protocol was established, according to the ethical guidelines of the Helsinki Declaration and was approved by the Human Ethics Committee of The First Affiliated Hospital of Soochow University. Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

Consent for publication
Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Competing interests
The authors declare no competing interests.

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