Medical Oncology (2025) 42:110
https://doi.org/10.1007/s12032-025-02661-0

REVIEW ARTICLE

Diagnosis and treatment of cardiac tumors

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Received: 14 November 2024 / Accepted: 4 March 2025 / Published online: 17 March 2025

Abstract

Cardiac tumors, though rare, present significant diagnostic and therapeutic challenges due to their diverse nature and potential severity. These tumors, which can be primary or metastatic, are often detected incidentally through imaging modalities such as echocardiography or CT scans. Differentiating between benign and malignant forms is crucial for guiding appropriate management strategies. This review synthesizes current diagnostic approaches and treatment modalities for cardiac tumors, with a focus on the role of imaging techniques like UCG, CT, MRI, and PET in tumor characterization. Multidisciplinary treatment plans are necessary, including surgical resection for benign tumors, chemotherapy, and radiotherapy for malignant tumors, and novel targeted therapies such as MDM2 inhibitors for selected cases. While primary malignant tumors like sarcomas and mesotheliomas exhibit rapid progression and poor prognosis, recent advances in multimodal therapy offer potential improvements in survival. The incidence of primary cardiac tumors is low, with an autopsy-reported occurrence rate of 0.02%. Benign cardiac tumors, such as myxomas and fibromas, generally have favorable outcomes with surgical resection. In contrast, primary malignant tumors like sarcomas and mesotheliomas exhibit rapid progression and poor prognosis, necessitating aggressive treatment including surgery, chemotherapy, and radiotherapy. Metastatic cardiac tumors occur in approximately 10% of cancer patients at autopsy and are managed according to the treatment plan for the primary malignancy. The management of cardiac tumors requires a multidisciplinary approach tailored to tumor type, location, and systemic effects. While benign tumors often respond well to surgical management, malignant and metastatic tumors demand more complex strategies to optimize patient outcomes.

Keywords Primary cardiac tumors · Malignant soft tissue sarcoma · Metastatic cardiac tumors · Benign tumors

Abbreviations

UCG	Ultrasound cardiography
CT	Computed tomography
MRI	Magnetic resonance imaging
PET	Positron emission tomography
PCTs	Primary cardiac tumors
PFE	Papillary fibroelastoma

Background

Cardiac tumors, though rare as primary tumors, can manifest in both benign and malignant forms. Cardiac masses are frequently discovered incidentally during echocardiographic or CT scans. These masses are categorized into tumor and non-tumor lesions, with tumors further subdivided into primary and secondary (metastatic) tumors. When echocardiography detects an abnormal cardiac structure, it is essential to distinguish it from benign embryonic remnants and congenital anomalies. Subsequent differentiation involves ruling out degeneration, thrombosis, or papilloma, although primary cardiac tumors are exceptionally rare. According to data from 22 large autopsy series, the incidence of primary cardiac tumors is approximately 0.02%, equating to around 200 tumors per 1 million autopsies [1, 2]. Metastatic cardiac tumors, in contrast, are not uncommon, with autopsy studies in cancer patients revealing a prevalence of 10.7% [3]. Malignancies like pleural mesothelioma and malignant melanoma have a high propensity for cardiac metastasis, while

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metastases from lung and breast cancer are also frequently observed [4]. While benign cardiac tumors generally have a favorable prognosis, primary malignant cardiac tumors are associated with poor outcomes, with a 1-year survival rate of 44.3% and a 5-year survival rate of only 16.6% [5].

These tumors often present significant diagnostic challenges and are associated with severe clinical symptoms, necessitating a comprehensive understanding of their diagnosis and treatment. Effective management requires a collaborative, multidisciplinary approach. This paper provides a detailed overview of the epidemiology, diagnosis, and treatment of cardiac tumors, with a particular focus on the primary benign and malignant types.

Diagnosis

Accurate diagnosis of cardiac tumors relies heavily on clinical information. Although biopsy is the gold standard for definitive diagnosis, its feasibility is often limited by case complexity or institutional constraints. Thus, imaging and clinical data are critical for differential diagnosis. Surgery often serves both therapeutic and diagnostic roles, and in some cases, a diagnosis can be inferred from non-invasive methods before being confirmed surgically. The following four key factors are essential for differentiation prior to biopsy or surgery:

(1) Epidemiology: The frequency of cardiac tumors varies by age. In individuals over 16, myxomas (45–50%), lipomas (20%), and papillary fibroelastomas (12–15%) are most common [6]. In children under 16, the most frequent primary tumors are rhabdomyomas (45%), fibromas (15%), myxomas (15%), and teratomas (15%) [7]. The incidence of cardiac tumors by age is presented in Table 1 and Table 2 [6, 8–10].

Table 1 Frequency of cardiac tumors in pediatrics

Tumor type	Frequency (%)
Benign	
Rhabdomyoma	45%
Teratoma	15%
Fibroma	15%
Myxoma	15%
Angioma	5%
Hemangioma	5%
Malignant	
Rhabdomyosarcoma	~2%
Fibrosarcoma	~2%
Malignant teratoma	Rare
Lymphoma	Rare

Table 2 Frequency of cardiac tumors in adults

Tumor type	Frequency (%)
Benign	90%
Myxoma	45–50%
Lipoma	20%
PFE	12–15%
Angioma	10–12%
Fibroma	3%
Rhabdomyoma	~2%
Malignant	10%
Sarcoma	–
Angiosarcoma	*40%*
Undifferentiated sarcoma	*25%*
Leiomyosarcoma	*8–9%*
Lymphoma	~1%
Mesothelioma	~1%

(2) Clinical Symptoms and Medical History: Present and past medical history are vital for differential diagnosis. Information such as immune deficiency, presence of artificial valves (which heighten the risk of infective endocarditis), or a history of atrial fibrillation (which increases the risk of atrial thrombosis) is important for distinguishing non-tumor cardiac masses.
(3) Tumor Location: Primary cardiac tumors tend to localize in specific areas and exhibit distinct patterns, such as being solitary or multiple. The most frequent tumors based on location within the heart should be considered.
(4) Imaging Diagnostics Using Multiple Modalities: Some tumors exhibit characteristic imaging features, and combining various imaging techniques—such as echocardiography, CT, and MRI—can improve diagnostic accuracy.

By considering these factors, the differential diagnosis becomes more precise, paving the way for surgical intervention or biopsy if needed. Figure 1 illustrates the diagnostic pathway leading to biopsy or surgery. The next section will discuss the critical role of imaging and pathological examinations in these diagnostic processes.

Imaging test

Ultrasound cardiography: UCG

Transthoracic UCG is typically the first diagnostic modality employed when a cardiac tumor is suspected. It is non-invasive, cost-effective, and offers excellent spatial and temporal resolution, enabling the detection of even small mobile

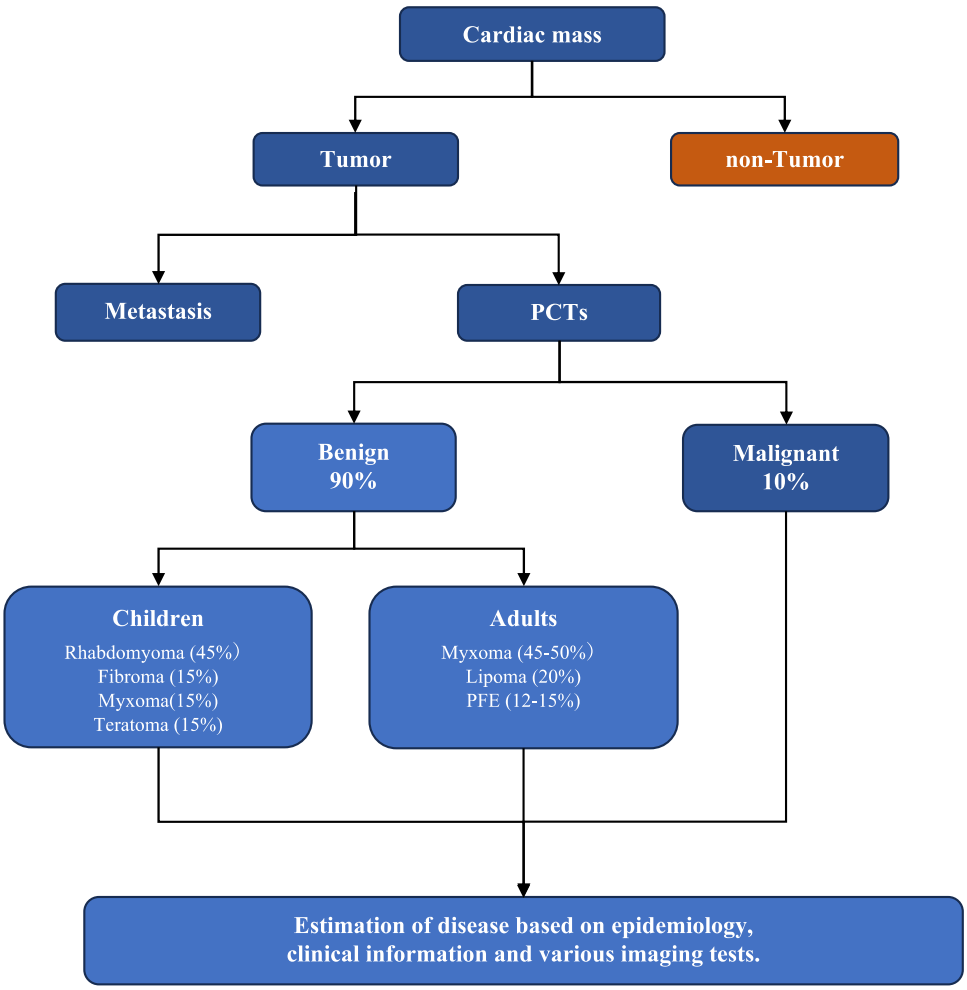

Fig. 1 Diagnostic flow for cardiac tumors. Tumors are classified into malignant and benign categories and further classified as metastatic or primary. Approximately 90% of these tumors are benign, while 10% are malignant. The diagnosis is made by integrating clinical information such as the location of the tumor and the patient's age, along with imaging findings

tumors. However, its utility may be limited in patients with obesity or chronic lung disease, and it struggles to assess tumor extent or origin. Transesophageal UCG excels in imaging the left side of the heart and is particularly useful for evaluating the left atrium and mitral valve. It can also be employed intraoperatively to assess valvular function after tumor resection.

Computed tomography: CT

CT provides high-resolution imaging of the heart and surrounding structures, making it ideal for evaluating potential cardiac metastases from extracardiac malignancies. It is particularly effective for visualizing calcifications and vascular structures. Coronary angiography CT plays an important role in surgical planning. However, the drawbacks include radiation exposure and the potential for contrast-induced nephropathy. CT is particularly useful for evaluating calcifications and vascular structures. For example, angiosarcomas show heterogeneous enhancement, while fibromas often appear as homogeneously calcified tumors.

Magnetic resonance imaging: MRI

Cardiac MRI offers detailed assessment of morphology, size, location, extent, and tissue characteristics (such as fat infiltration, necrosis, hemorrhage, calcification, and vascularity). It is less invasive than other techniques and is typically used following UCG. Limitations include long scan times, unsuitability for patients with unstable hemodynamics, and inapplicability in individuals with MRI-incompatible devices or claustrophobia.

Positron emission tomography: PET

PET, in conjunction with CT or MRI, can assess cardiac tumors by detecting FDG uptake. Malignant and metastatic tumors often exhibit higher FDG uptake, helping differentiate benign from malignant masses [11]. However, PET's lower sensitivity compared to MRI and its susceptibility to false positives (e.g., benign lipomatous hypertrophy) limit its utility [12]. PET, in conjunction with CT or MRI, can assess cardiac tumors by detecting FDG uptake. Notably, cardiac

lymphomas often exhibit intense FDG uptake, whereas benign lipomatous hypertrophy may cause false positives.

Each of these imaging modalities has distinct advantages and limitations, but together they form an essential part of the diagnostic toolkit for cardiac tumors, aiding in the differentiation, planning, and management of treatment.

pathological examination

Cardiac cytoplasm cytology

Pericardial metastasis is common in primary cardiac malignancies, with a prevalence of 10–20% in autopsy cases. Cytological examination of pericardial fluid can aid in diagnosis if safe aspiration is possible. Aspiration should also be considered for cases presenting with symptoms of pericardial effusion.

Tissue biopsy

Pathological diagnosis is critical for guiding treatment, as the prognosis for cardiac tumors varies significantly by pathological subtype. Biopsy is particularly important when malignancy is suspected and surgical excision is not feasible. However, biopsy procedures are often challenging due to the rarity of primary cardiac tumors (PCTs) and the limited experience many oncologists and cardiologists have with these procedures [13]. The risk of complications must also be considered. Biopsy methods include percutaneous, transvascular, and thoracotomy approaches, depending on tumor location. In cases of right-sided endocardial tumors where surgery is difficult, histological biopsy may be performed despite the high risk of complications [14].

Primary cardiac tumor: PCT

Benign tumors

The majority of PCTs are benign (90%). Since the incidence of benign PCTs varies between children and adults, it is essential to consider age when making a differential diagnosis. Surgery is generally recommended due to the risk of embolization, especially for left-side tumors. For right-sided tumors, assessing the presence of a patent foramen ovale or septal defect is crucial. On the other hand, subtypes such as rhabdomyosarcoma may regress spontaneously. Even when surgery is not indicated, regular echocardiographic monitoring is advisable. Thus, treatment plans should be confirmed based on the histological type and location of the tumors. Table 3 outlines the frequency, common sites, imaging findings, and treatment strategies for benign PCTs, which are relatively common in both pediatric and adult populations.

Table 3 Characteristics of benign primary cardiac tumors

	Frequency/preferred locations	Imaging findings	Treatment strategy
Myxoma	Most frequent in adults Middle-aged women, Left atrium(75%), right atrium (15%)	On UCG, it often appears as pedunculated and mobile. Shows high signal intensity on T2-weighted MRI images	Surgical resection. In cases of familial myxomas, there is a higher risk of recurrence
Lipoma	More frequent in middle-aged and older people, Right atrium most common, but can appear anywhere in the heart	On UCG, it often appears immobile with clear boundaries It shows high signal intensity on both T1-weighted and T2-weighted MRI images, with no uptake of contrast agent	If there are no severe clinical symptoms, monitoring the progression is recommended
PFE*	Commonly occurs in individuals aged 70–80 years with no gender difference Often develops on the heart valves	On UCG, it exhibits mobility It appears isointense on T1-weighted MRI images and hypointense on T2-weighted MRI images	When tumors on the left side exceed 10 mm in diameter, there is an increased risk of stroke, therefore surgical removal is recommended
Rhabdomyoma	Most frequent in children, Most likely to occur in the ventricles, no difference between right and left ventricles	On UCG, it appears as high brightness On MRI, it is isointense on T1-weighted images and hyperintense on T2-weighted images	Up to 50% of cases may regress naturally. Surgical removal is considered based on clinical symptoms such as arrhythmias or heart failure
Fibroma	Most common in children, More likely to occur in the ventricles and ventricular septum	Calcifications are observed on CT and UCG It appears isointense on T1-weighted MRI images and hypointense on T2-weighted images, with no uptake of contrast agent	Surgical resection is recommended due to the risk of sudden cardiac death

Myxoma

Myxomas are the most common PCTs in adults, accounting for 50% of all PCTs. They predominantly occur in middle age, with 90% of cases between the ages of 30 and 60 years, and are more prevalent in women than men. In contrast, myxomas are rare in children, comprising about 10% of benign PCTs in this group. Approximately 75% of myxomas occur in the left atrium, particularly near the oval foramen of the atrial septum, while 10–15% are found in the right atrium. Clinically, myxomas can cause symptoms of left heart failure, embolism, and systemic symptoms resembling collagen disease, such as fever, joint pain, weight loss, and fatigue. The most frequent clinical manifestations were constitutional symptoms (74%), dyspnea (45%), and embolism (41%) [15].

For imaging, transthoracic and transesophageal echocardiography, cardiac CT, and MRI are commonly used. Diagnosis is typically made upon identifying a pedunculated, mobile mass via echocardiography. On MRI, most myxomas appear isointense on T1-weighted images and hyperintense on T2-weighted images relative to the endocardium. Surgical resection is the primary treatment option [16]. The recurrence rate for solitary myxomas is low, at less than 3%, but higher in familial myxomas (12%) and cases associated with the autosomal dominant Carney complex (22%). Regular echocardiographic follow-up is recommended post-resection.

Fibroma

Fibromas are the second most common PCTs in children, though they also occur in adults. They are mostly found in the ventricles and ventricular septum [17]. Clinical symptoms can include chest pain, pericardial effusion, heart failure, and arrhythmias. However, most patients with cardiac fibroma are asymptomatic [18]. Mutations in the PTCH1 gene, associated with the autosomal dominant Gorlin syndrome, are known to cause these tumors [19].

Echocardiographically, fibromas appear as homogeneously bright masses, often with calcification. CT scans reveal homogeneously calcified tumors, particularly in the central areas. On MRI, fibromas are isointense to normal myocardium on T1-weighted images and hypointense on T2-weighted images. Due to their avascular nature, they generally do not show enhancement after contrast administration. Surgical resection is recommended due to the risk of sudden cardiac death from arrhythmias caused by conduction pathway disruption, regardless of symptom presence [20].

Papillary fibroelastoma: PFE

PFEs are rare PCTs that most commonly affect heart valves, comprising approximately 11.5% of all PCTs. They most frequently affect the aortic valve (75% of cases), especially on its downstream side [21]. The typical onset is between 70 and 80 years, with no gender difference. While valve dysfunction can occur, embolic symptoms, such as stroke, are more common due to the left-sided valve involvement. However, a significant proportion of patients (approximately 60%) may not show symptoms [22].

Echocardiographically, PFEs are small, attached to the endocardium, and exhibit independent motion. Due to their small size, transesophageal echocardiography often has higher sensitivity than transthoracic echocardiography. On MRI, PFEs appear isointense on T1-weighted images and hypointense on T2-weighted images [23]. For right-sided PFEs, where hemodynamic obstruction risk is low, conservative management is often practiced. For left-sided PFEs or larger than 10 mm, surgical removal is recommended due to the increased risk of stroke [24]. In cases where surgery is not performed, antiplatelet medications may be considered, although data on this approach are limited [25].

Lipoma

Lipomas are rare benign PCTs that predominantly occur in middle-aged and elderly individuals. Often asymptomatic, they are usually discovered incidentally through imaging. Symptoms depend on the location: subendocardial (50%), subepicardial (25%), or myocardial (25%) [20]. Subepicardial lipomas may cause chest pain due to ischemia from coronary artery compression, while myocardial lipomas frequently cause arrhythmias.

Echocardiographically, these tumors appear non-mobile and well demarcated. On T1-weighted MRI images, they show high signal intensity, similar to T2-weighted images, while appearing markedly hypointense on fat-suppressed images. Due to their avascularity, contrast agents provide poor delineation. Surgical removal is generally not indicated unless the patient experiences significant clinical symptoms [26]. If a cardiac lipoma becomes symptomatic, surgical intervention is recommended to alleviate symptoms and prevent disease progression. However, there is currently no consensus on the optimal management approach for asymptomatic patients [27, 28].

Rhabdomyoma

Rhabdomyomas are the most common tumors in pediatric PCTs, comprising 50–60% of cases. These tumors typically manifest within the first year of life [29]. They often appear as multiple tumors located in both atria and ventricles,

evenly distributed across the left and right sides of the heart [30]. Rhabdomyomas may be sporadic or associated with tuberous sclerosis, which occurs in 30–50% of cases. The tumors can cause arrhythmias, leading to symptoms such as palpitations and fainting. However, it is estimated that approximately 90% of cases remain asymptomatic [31].

Rhabdomyoma appears as bright masses on echocardiography, while on MRI, they are isointense on T1-weighted images and hyperintense on T2-weighted images. Since up to 50% of rhabdomyoma may regress spontaneously, regular monitoring with echocardiography is essential. Surgery is reserved for patients with intractable arrhythmias or heart failure [32]. In cases where surgical resection is not feasible despite the presence of symptoms, treatment with mTOR inhibitors may be considered, particularly in patients with tuberous sclerosis complex [31, 33].

Malignant tumors

Malignant tumors constitute only 5–6% of PCT, making them exceedingly rare [34]. The most common malignant PCTs are outlined in Table 4, with sarcomas comprising 64.8%, followed by lymphomas (27%) and mesotheliomas (8%). Rapid clinical progression, the presence of nutritive vessels, intratumoral necrosis, and pericardial effusion are suggestive of malignancy. Prognosis for patients diagnosed with malignant PCT is extremely poor, with a reported five-year survival rate of 11.5% [35]. A favorable prognosis is associated with negative surgical margins [36]. While complete surgical resection is desirable, the operative mortality rate is 7.4%, and the recurrence rate post-surgery is 51.8% [37]. Given the high risks of recurrence and mortality, a multidisciplinary approach involving cardiac surgeons, cardiologists, and oncologists is essential. If complete resection is not feasible, palliative chemotherapy is an alternative. For malignancies such as sarcomas and lymphomas, anthracycline-based chemotherapy is often the first choice, though it carries the risk of cardiotoxicity. The new molecular targeted therapies are developing. The efficacy of targeted therapies, such as MDM2 inhibitors for intimal sarcomas, is currently being investigated in clinical trials, showing promising results. The decision to avoid anthracyclines is not mandatory given the cardiac origin of the tumor. Prognostic factors include age, comorbidities, and metastasis [35].

Angiosarcoma

In 75% of cases, cardiac sarcomas occur in the right atrium, where they frequently invade adjacent structures [38]. At diagnosis, metastases are found in 47–89% of patients, with the lungs being a common metastatic site [39]. Angiosarcomas are more common in males, with peak onset in the 40 s. Angiosarcomas that appear on the scalp are often linked to underlying genetic abnormalities and are typically found in younger individuals [40]. Common symptoms include right heart failure and palpitations due to supraventricular arrhythmias. The most reported symptom in patients with cardiac angiosarcoma is dyspnea, occurring in 59% to 88% of cases [41].

On contrast-enhanced CT, these tumors usually show heterogeneous enhancement. MRI reveals a heterogeneous signal intensity pattern on both T1- and T2-weighted images, reflecting intratumoral necrosis and blood flow abnormalities. Surgical resection, if feasible, offers the best outcomes. The postoperative survival for patients undergoing surgery ranges from 2 to 55 months, with a median survival of 14 months [42]. If resection is not possible, the mean survival is approximately 3.8 ± 2.5 months [43]. In cases with distant metastasis, chemotherapy regimens similar to those for vascular sarcomas (e.g., paclitaxel) are used. However, literature on the treatment of cardiac sarcomas remains

Table 4 Characteristics of malignant primary cardiac tumors

	Frequency/preferred locations	Imaging findings
Angiosarcoma	Originates primarily in the right atrium (75%) More common in males, with the peak incidence in the 40 s	On contrast-enhanced CT, it shows heterogeneous enhancement. Both T1-weighted and T2-weighted MRI images also display heterogeneous signal intensities
Rhabdomyosarcoma	The most frequent malignant primary cardiac tumor (PCT) in children, with no predilection for either the left or right side	On MRI, it appears isointense on T1-weighted images, hyperintense on T2-weighted images, and shows increased signal intensity with contrast enhancement
Leiomyosarcoma	Comprises 8% of cardiac sarcomas, with the left atrium being the most common site of occurrence	On CT, it shows low attenuation with a lobulated appearance
Intimal sarcoma	Some reports suggest it is the most frequently occurring type It predominantly occurs in the left cardiac system	There are no consistent reports on imaging findings
Undifferentiated sarcoma	Accounts for about 24% of cardiac sarcomas, with an average onset age of 44 years and predominantly found in the left atrium	Imaging findings include the presence of necrosis and hemorrhage

limited to case reports and single-institution studies, and no standardized treatment protocol has been established [44].

Leiomyosarcoma

Leiomyosarcomas account for 8–9% of cardiac sarcomas [45]. They most commonly occur in the posterior left atrium but can develop in other chambers of the heart. These tumors may remain asymptomatic until they reach an advanced stage, depending on their size and location [46]. A symptom of obstruction was the most frequent complaint at diagnosis [47].

On imaging, leiomyosarcomas typically appear on CT as irregular, lobulated areas of low attenuation. Prognosis may improve with a combination of complete surgical resection followed by chemotherapy or radiotherapy. The average survival without treatment is six months, while palliative chemotherapy or post-surgical adjuvant therapy can extend survival to 10–18 months [45].

Rhabdomyosarcoma

Rhabdomyosarcomas are the most common malignant tumors in pediatric cardiac cases, accounting for 4–7% of all cardiac sarcomas [48]. Originating from the myocardium, these tumors often infiltrate the valve apparatus. There is no significant difference in frequency between the left and right sides of the heart [49]. Rhabdomyosarcomas are aggressive, with rapid proliferation. Dyspnea is the most common symptom, reported in 59% of cases, followed by chest pain (19%) and conduction disorders (19%) [50].

On CT, these tumors typically appear as areas of low attenuation in the ventricles. On MRI, they are isointense on T1-weighted images and hyperintense on T2-weighted images, with contrast enhancement noted. The standard treatment for cardiac rhabdomyosarcoma is multidisciplinary, combining surgery, chemotherapy, and radiation therapy [51]. Radiation therapy may provide symptom relief and local tumor control but carries the risk of both acute and chronic cardiac toxicity [52]. The standard chemotherapy regimen includes vincristine, actinomycin-D, and cyclophosphamide [53]. Despite comprehensive treatments, the average survival for patients with cardiac rhabdomyosarcoma is less than one year.

Intimal sarcoma

Among primary cardiac soft tissue sarcomas, angiosarcomas are frequently seen in adults, while rhabdomyosarcomas are more common in children. Intimal sarcomas also occur frequently, particularly in left-sided cardiac structures [54, 55]. Cardiac intimal sarcoma is often detected due to nonspecific symptoms such as dyspnea, palpitations, and a sensation of chest pressure [56]. Diagnostic imaging for intimal sarcomas is often inconsistent, leading to frequent misdiagnosis as myxomas or thrombi. Most reports on this tumor type remain limited to case studies [57].

Though complete surgical resection is preferred, the high invasiveness of intimal sarcomas makes it challenging [58]. The amplification of MDM2 has led to reports suggesting that MDM2 inhibitors may be effective [59].

Undifferentiated sarcoma

Undifferentiated sarcomas represent less than 24% of cardiac sarcomas, with an average onset age of 44 years and no gender preference [60]. These tumors most commonly affect the left atrium, causing diffuse wall infiltration. Clinical signs and symptoms are associated with the left atrium and may include dyspnea, palpitations, and manifestations of heart failure, as well as nonspecific constitutional symptoms such as fever and weight loss [61].

MRI findings often reveal lesions with necrosis and hemorrhage. The prognosis for undifferentiated sarcomas is poor, with treatment primarily consisting of surgery and palliative chemotherapy [62].

Mesothelioma

Most cases of cardiac mesothelioma originate from the pericardium, leading to pericardial effusion. Primary pericardial mesothelioma is an extremely rare disease, accounting for 0.8% of all mesotheliomas and 2% to 3% of all pericardial tumors [63, 64]. It is more common in males, particularly between 50 and 70 years [65]. Most cases are diagnosed at autopsy[66], with reported cases presenting with constrictive pericarditis, cardiac tamponade, or heart failure[67–69].

On CT, these tumors may show high attenuation. Pericardiocentesis for cytological examination can be performed, but obtaining a definitive diagnosis is often difficult [70]. A pericardial biopsy is the most reliable method for confirming the diagnosis.

There is no established standard treatment, but if the tumor is localized, surgical resection may be performed. Chemotherapy may be used in conjunction with surgery, though its effectiveness is not clearly established. In Japan, chemotherapy combinations such as cisplatin with pemetrexed or nivolumab with ipilimumab are used, and nivolumab is covered by insurance based on the results of the Viola trial [71]. The prognosis is extremely poor, with minimal efficacy observed for chemotherapy or radiotherapy. The average survival time is approximately 4 to 6 months [72].

Metastatic cardiac tumor

It is estimated that 10% of cancer patients exhibit metastasis to the heart or pericardium at autopsy, making metastatic cardiac tumors 20–40 times more common than PCTs [73]. Malignant pleural mesothelioma and malignant melanoma have the highest propensity to metastasize to the heart [74]. Additionally, cancers originating in the thoracic cavity, such as breast cancer, lung cancer, and esophageal cancer, are also prone to metastasizing to the heart.

Diagnosis

When patients with a history of malignancy present with cardiovascular symptoms or signs, it is crucial to consider the possibility of cardiac metastasis and to conduct appropriate diagnostic tests with this in mind. Generally, an echocardiogram, which is a straightforward and accessible procedure, should be performed first to assess for metastases. In cases of pericardial effusion, pericardiocentesis and biopsy can provide a definitive diagnosis if feasible. However, due to the invasive nature of these procedures, they are often avoided unless the results would significantly impact the treatment plan.

Treatment

Cardiac metastases are treated according to the management plan for the primary tumor, as they indicate a Stage IV condition. Surgical removal of metastatic lesions in the heart is generally not performed. However, under certain circumstances, surgical intervention may be considered for symptom relief [75], including:

(1) Metastatic lesions that significantly impair hemodynamics, potentially leading to heart failure.
(2) Isolated cardiac metastasis in patients where the primary tumor is under control and a favorable prognosis is expected.

Conclusion

Cardiac tumors are often discovered incidentally during echocardiography or CT scans. They are classified into primary and metastatic types, with metastatic tumors being found in approximately 10% of cancer patients at autopsy. Diagnosis relies heavily on imaging studies and clinical information, with epidemiology, clinical symptoms, tumor location, and imaging results being key factors for differential diagnosis. Treatment strategies vary depending on the tumor type and condition. While surgical resection by a cardiothoracic surgeon is common for tumors amenable to radical resection, treatment for metastatic tumors generally follows the protocols established for the primary malignancy. This approach ensures that the management aligns with the systemic nature of the patient's cancer. While the prognosis of malignant unrespectable cardiac tumors remains poor, advances in multimodal therapy, including targeted therapies, hold promise. Future research should focus on the integration of molecular diagnostics and novel therapeutic approaches to optimize patient outcomes.

Acknowledgements None.

Author contributions T.I. and T.S. designed the study and wrote the paper. T.S, A.K., and K.Y. supervised, wrote, reviewed, and edited the manuscript's final version. All authors reviewed the paper and approved its content.

Funding This review received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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

Declarations

Conflicts of interest No potential conflict of interest relevant to this review was reported.

Ethical approval Not applicable.

Consent for publication Not applicable.

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