A Primary Cardiac Osteosarcoma: Case Report and Literature Review

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Case report

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Abstract

Background: Primary cardiac osteosarcoma is an uncommon condition, which is challenging to diagnose, and rarely reported.

Case presentation: Here, we present a previously healthy 27-year-old patient referred to our hospital with a long-term fever. Echocardiography and thoracic computed tomography (CT) presented two masses in the left atrium (LA) and left ventricle (LV), and surgical excision of the masses revealed cardiac high-grade osteosarcoma. Unfortunately, the left ventricular tumor recurred three months later, and the patient was administered periodic chemotherapy. Then, chest CT showed that the left ventricle was almost occupied by the tumor and also involved the left ventricular outflow tract, the left atrial appendage mass increased significantly, and multiple metastatic small nodules appeared in both lungs. The patient is still in follow-up.

Conclusions: The prevalence of primary cardiac osteosarcoma is very low and did not involve LA and LV simultaneously. This patient was hospitalized in our hospital complaining of a long-term fever of unknown origin, which has never been reported in the previous literatures. Our case report findings suggest that primary cardiac osteosarcoma should not be ignored in the differential diagnosis of fever of unknown origin.

1. Introduction

Primary cardiac osteosarcoma is an exceptionally rare intracardiac tumor with very low prevalence[1, 2]. At present, there are only a few reports about cardiac osteosarcoma, which progresses rapidly and causes death by blocking blood circulation or directly damaging cardiomyocytes[3]. Given the rarity of this subtype, its clinicopathological features and treatment options are still unclear. Therefore, we describe a case of primary cardiac osteosarcoma of the LA and LV to assist clinical diagnosis and treatment of this disease.

2. Case Presentation

2.1 Patient Information

A 27-year-old man presented to our hospital complaining of recurrent fever, he had no previous history of illness. At the time of physical examination, the heart rate was 137/min, and his blood pressure was 125/89mmHg. Laboratory tests, including blood routine, liver enzymes, and biochemistry were in the normal range.

2.2 Clinical Findings

Cardiac auscultation revealed a systolic murmur of grade 2/6 at the border of the left sternum.

2.3 Timeline

Table 1
Timeline of the patient's diagnosis and treatment

Time	Event	Explanation	Outcome
December 27,2020	Clinic visit	Long term fever	Hospitalization
December 28,2020	Chest CT	Identify pneumonia	Cardiac masses were detected
December 29,2020	Echocardiography	Determine the location and size of the tumor	Tumor resection plans
January 6, 2021	Surgery	Diagnosis and treatment	Primary cardiac osteosarcoma
April 26, 2021	Chemotherapy	Tumor recurrence	Poor treatment efficacy

Table 1 lists all the diagnosis and treatment details of the patient.

2.4 Diagnostic Assessment

Chest CT confirmed two solid masses in LA and LV, respectively, with calcification and stenosis of the cardiac cavity (Fig. 1). Transthoracic echocardiography presented a moderate echo mass in the LA, extending to the left atrial appendage accompanied by mitral valve thickening and moderate regurgitation (Fig. 2a). An irregular moderate echo mass measuring 29x22mm in size, lobulated, was detected in the LV outflow tract (Fig. 2b), leading to severe aortic stenosis during the cardiac systole. The patient was suspected of suffering from myxomas in the cardiac cavity and subsequently underwent the two tumors resection.

2.5 Therapeutic Intervention

During surgery, a tumor of 4.5x2.5x1.5cm in size in the posterior wall of LA and left atrial appendage was detected, and involved the mitral annulus and posterior lobe, resulting in mild stenosis of the opening. The left ventricular lump, loose in texture and 6.0x4.5x2.0cm in size, was found with a broad base attached to the interventricular septum.

The presence of cartilage, neoplastic osteoid, and spindle cells of obvious cellular atypia were confirmed through histopathological examination, consistent with a high-grade sarcoma (Fig. 3).

Immunohistochemical study of tumor cells was positive for vimentin, CDK4 with a 60% positive rate of Ki-67 (Fig. 4). To further exclude the possibility of metastatic osteosarcoma, the bone scan was performed after operation, which showed no evidence of distant metastasis or any other primary tumor. All these findings confirm that the final diagnosis of osteosarcoma originated in the heart.

2.6 Follow-up and Outcomes

The patient was discharged on the 14th day after operation. Three months later, the patient complained of dyspnea during exercise and still suffering from fever, echocardiography showed local recurrence of the left ventricular tumor. Therefore, the patient received 5 cycles of chemotherapy with doxorubicin, dacarbazine, and teriprizumab. After chemotherapy, chest CT showed that the left ventricle was almost occupied by the tumor and also involved the left ventricular outflow tract, the left atrial appendage mass increased significantly, and multiple metastatic small nodules appeared in both lungs (Fig. 5), which was still in our follow-up.

3. Discussion And Conclusions

Most heart tumors are metastatic, with an incidence rate of more than 20–40 times than the primary cardiac tumors [1]. Primary cardiac tumors are rare, with a prevalence of autopsy being reported to be 0.001–0.030% [2]. Among all the primary tumors, the malignant one's account for about 25% [4]. About 95% of primary cardiac malignancies are sarcomas and osteosarcomas, and the latter accounts for less than 10% [5]. In a literature study, 45 papers concerning primary cardiac osteosarcoma were included, and a total of 53 patients were reported [6]. Given its rare occurrence, there are no standard guidelines on its etiology, pathogenesis, and treatments.

The clinical symptoms of primary cardiac osteosarcoma mainly depend on the size and anatomical location of the tumor [7]. The common symptoms include dyspnea, chest pain and syncope, mainly related to heart failure and obstruction [3]. Fever was the main complaint of the current patient when he was admitted to our hospital, characterized by persistent high fever. There was merely one reported case of fever during the disease [8], which was attributed to upper respiratory tract infection, and the temperature returned to normal when he was admitted to our hospital. We hypothesized that the current patient might be complicated with infective endocarditis. However, as the patient had been treated with antibiotics many times before admission, no bacteria were detected by blood culture. Importantly, this reminds us that the long-term fever of unknown origin or infective endocarditis can also be one of the symptoms of primary cardiac osteosarcoma, which has never been reported before.

In contrast to the metastatic ones, a majority of the primary cardiac osteosarcomas most commonly involve the LA[9]. However, only one patient with simultaneous left atrial and ventricular involvement has been reported [10]. The difference is that in our case, the two tumors in the cardiac cavity are anatomically independent of each other, indicating the double primary malignancies. The similar clinical symptoms and anatomic location lead to the confusion between primary cardiac osteosarcoma and atrial myxoma; however, some characteristics are helpful to distinguish them [11, 12], such as myxomas tend to have a short and extensive base attached to adjacent sites, pedicled, soft, and often have some hemorrhagic and necrotic areas. Osteosarcoma generally originates from the non-septal atrial wall and often predisposes to invading the pulmonary vein.

Because primary cardiac osteosarcoma is exceptionally rare, there are few studies reported on its pathogenesis. Terje Forslund [13] proposed that some genes may regulate the disease, such as aberrant

PI3K-Akt-NFkappaB pathway, and tbhs3 and erbB2 proteins overexpression. However, the death of the patient in this report did not allow any further tests. Based on this study, we plan to conduct whole gene sequencing for the current patient to further clarify the potential pathogenesis of the disease.

Osteosarcoma has a high degree of malignancy, and recurrence and metastasis are its basic characteristics [14], leading to the low survival rate of patients. The average survival time of osteosarcoma patients ranged from 3 months to 1 year [15]. Our patient had a recurrence of left ventricular tumor 3 months after the operation and is currently receiving chemotherapy.

Given the lower incidence of osteosarcoma in the LA and LV, there is no standard treatment guidelines. Complete surgical resection is considered to be the optimal therapy for the tumor [16]. Due to the low tolerance of myocardium to chemoradiotherapy, the role of chemoradiotherapy is controversial [9]. Given the previously reported case [13], a future procedure can be scheduled to detect some abnormal gene expression or molecular pathway in these patients, to develop some prospective targeted therapies.

We report a case of primary osteosarcoma in the LA and LV, and the patient had undergone complete tumor resection, and then received periodic chemotherapy owing to postoperative recurrence. This is the first case complaining of long-term fever as the main symptom on admission. The second case reported atrial and ventricular involvement simultaneously, enriching our understanding of the disease. Next, we intended to use tissue samples of the patient for gene detection to seek potential targeted therapy and provide new options for treating the disease.

In short, when confronted with difficult diseases, especially some rare conditions, we should pay attention to the unusual clinical manifestations. We should also focus on the correlations among clinical, pathological, and imaging evidences.

4. Patient Perspective

After the operation, the fever symptoms were relieved and the patients were satisfied with the surgical treatment. Unfortunately, the left ventricular tumor relapsed

and fever reappeared. After evaluation, the patient received periodic chemotherapy. At present, because the patient's heart tumor increased significantly, and the patient's body temperature still did not return to normal, but the vital signs are stable.

Abbreviations

CT

computed tomography; LA:left atrium; LV:left ventricle.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Written informed consent was obtained from the patient for publication of this case report.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

XXZ drafted the first manuscript. WLC and HXG supervised the manuscript revision and were responsible for the clinical care of the patient. All authors read and approved the final manuscript.

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Figures

Figure 1

Chest CT shows two solid masses in LA (a, white arrow) and LV (b, red arrow), respectively.

Figure 2

Echocardiography of the patient’s heart: a A moderate echo mass in the LA, extending to the left atrial appendage accompanied by mitral valve thickening and moderate regurgitation (red arrow); b An irregular moderate echo mass measuring 29x22mm in size, lobulated, was detected in the LV outflow tract (white arrow).

Figure 3

Histopathological characteristics of the patient: a highly typical osteoblasts and malignant tumor cells; b tumorous chondrogenesis; c pleomorphic tumor cells (fusiform or polygonal) (hematoxylin and eosin, magnification×200).

Figure 4

Immunohistochemical staining: the neoplasm was stained with antibodies to vimentin (a) and CDK4 (b), and a 60% positive rate of Ki-67(c).

Figure 5

Chest CT results after chemotherapy: the left atrial appendage mass increased significantly (a, white arrow) and the left ventricular outflow tract was surrounded by the tumor (b, red arrow).