Primary Left Atrial Osteosarcoma
Rare and Fatal
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Summary
Primary cardiac osteosarcomas are rare entities, mostly arising from the left atrium. Because of their rarity, few reports have described this uncommon lesion. We herein report a case of primary cardiac osteosarcoma originating from the left atrium in a 34-year-old woman, who underwent tumor debulking surgery and died 3 months after being diagnosed.

Key words: Left atrium, Cardiac tumor

Primary cardiac tumors are extremely rare with a prevalence ranging from 0.001% to 0.030% in autopsy series.1) The majority of cardiac tumors are metastatic, accounting for 20-40 times more cases than primary tumors.2) Only approximately 25% of primary cardiac tumors are malignant, and less than 10% of primary cardiac malignant tumors are osteosarcoma.3,4) Primary cardiac osteosarcomas, as one subtype of sarcomas, are much rarer than other primary sarcomas, such as angiosarcoma, leiomyosarcoma, and undifferentiated sarcoma.5) As far as it is known, there have been fewer than 40 cases reported over the last 40 years from the first case described by McConnel et al. in 1970.6,7)

Case Report
A 34-year-old woman was admitted to our department presenting with a 3-month history of progressive dyspnea and frequent expectoration. At the onset of dyspnea and expectoration episodes, she visited a regional hospital but simply received symptomatic treatment. Nevertheless, her symptoms were not alleviated. On admission, a transthoracic echocardiogram revealed a well-defined mass (57 × 32 × 28 mm) with a broad base attached to the lateral wall of the left atrium and very close to the left atrial appendage (Figure 1A-C). Transesophageal echocardiogram detected the mass, the tip of which prolapsed into the left ventricle at the mitral valve level, causing a mild functional mitral valve stenosis (Figure 1D). Three-dimensional echocardiogram reconstructed the spatial geometric shape of the mass. It was uneven and nonlobulated, suspended from the free wall of the left atrium (Figure 1E, F). Without further assessment of morphology, in combination with our prior experience, we diagnosed this mass as a cardiac myxoma, which in hindsight was a rushed conclusion, and therefore a surgical resection was scheduled.

After induction of anesthesia, median sternotomy, cardiopulmonary bypass, and aortic and bicaval cannulation, as a set of routine procedures, were performed. Intraoperatively, the findings were beyond our expectations. The mass was not shaped like a cardiac myxoma but looked more like “fish-flesh” matter. The patient underwent a tumor debulking surgery other than complete resection due to the finding that the tumor had invaded into the ventricle, which made complete resection impossible.

The tumor was detached into pieces with sharp and blunt dissection and removed from the atrium. These pieces had a smooth and irregular surface, an elastic and firm consistency, and a tannish-yellow color. Scattered hemorrhagic foci were seen in the cut sections (Supplemental Figure A).

Histopathology with hematoxylin-eosin staining of the specimen showed multiple layers of neoplastic tissue, composed of bundles of atypical and polymorphic cells with active mitosis (Supplemental Figure B). The presence of osteoid deposits encircled by the atypical spindle cells rendered a diagnosis of cardiac osteosarcoma (Supplemental Figure C, D). Immunohistochemical analysis showed the tissue was positive for SMA (Figure 3A) and negative to CD 34 (Figure 2B), desmin (Figure 2C), myogenin (Figure 2D), and S100 (Figure 2E). The proliferation index of Ki67 was greater than 65%, as shown in MIB-1 monoclonal antibody stain (Figure 2F).

Fluorine-18-fluorodeoxyglucose positron emission tomography scan (FDG/PET-CT) showed a hypermetabolic spot with a maximum standardized uptake value of 5.5, corresponding to the residual tumor in the left atrium. No other abnormal uptake was captured except for a linear hypermetabolic area on the mid-ternal incision caused by...
Figure 1. A-C: Transthoracic echocardiography showing an irregular mass in the left atrium. D: Transesophageal echocardiograph displaying that the well-defined mass attached to the atrial free wall had prolapsed through the mitral valve orifice into the left ventricle. E, F: Three-dimensional echocardiogram showing the spatial shape of the mass. LA indicates left atrium; LV, left ventricle; RA, right atrium; RV, right ventricle; AO, aorta and *, the mass.

Figure 2. Immunohistochemical analyses showing the tumor positive for SMA (A) and negative for CD34 (B), desmin (C), myogenin (D), and S100 (E). The proliferation index of Ki67 immunohistochemistry was greater than 65% (F).

Postoperative inflammation (Figure 3A-C).

99mTc-MDP single-photon emission computed tomography (99mTc-MDP SPECT), able to identify primary bone lesions or bone metastasis, only found an abnormal accumulation in the left atrium, presenting as a bright speckle in the image, suggestive of osteosarcoma, and therefore, we ruled out the possibility of bone metastasis and any bone-originating osteosarcoma (Figure 3D).
Because there was no valid evidence for tumor dissemination, adjuvant treatment was not considered necessary, and the patient was discharged home from the hospital. Periodic check-ups with echocardiography were done. During the check-ups, the patient continued to show symptoms of dyspnea, more severe than before, and the echocardiographic studies showed the residual mass had a very high growth rate and finally regained its original size less than 1 month after surgery.

The recurrent osteosarcoma contacted the posterior leaflet of the mitral valve and extended further to the left atrial appendage. The patient accompanied with her husband visited our Department of Oncology and she was administered high-dose MTX treatment. However, the growth of the osteosarcoma was not even slowed down. Therefore, after inquiring about the treatment of primary cardiac osteosarcoma through various channels, her husband drove to Beijing, to place her on a register for heart transplantation. On his way back, his wife, our patient, was transferred to our intensive unit care (ICU) due to acute pulmonary edema and died of acute mitral valve obstruction the next day, only 3 months after being diagnosed.

Discussion

Primary cardiac tumors are uncommon. Among all primary cardiac tumors, malignant tumors account for approximately 25%. Based on the review of cardiac tumors by the U.S. Armed Forces Institute of Pathology, osteosarcoma fewer than 10% of primary malignant cardiac tumors. They appear to have a predilection for location. The majority of them occurred in the left atrium and near pulmonary veins. Osteosarcoma, as a type of malignant mesenchymal neoplasm, is constituted of sheets of atypical spindle or ovoid cells, mingled with osteoid, bone, or chondroid substances. They may be predominantly osteoblastic but still possess the potentiality of chondroblastic or fibroblastic differentiation.

There are multiple imaging modalities to detect cardiac neoplasms, each with advantages in utility. The most widely used is echocardiography, as a non-invasive and portable tool, which can not only detect an intracardiac mass but also assess its valvular condition, and is thus suitable for large-scale screening. Computed tomography and cardiac magnetic resonance imaging, either alone or in combination, can provide precise information about the anatomic extension and intrinsic characteristic. FDG PET/CT, useful to determine the nature of the tumor, can fuse the high-resolution CT imaging together with functional metabolic images, which is much more valuable in selecting a curative strategy before treatment and evaluating a curative strategy during treatment and detecting recurrence after treatment. 99mTc-MDP SPECT is also very useful in detecting bone-origin osteosarcoma and bone metastasis because of its exclusive superiority in presenting images of the skeletal system.

The symptoms of cardiac osteosarcomas manifest as non-specific, usually associated with hemodynamic derangement, invasion, and embolization, such as dyspnea, syncope, and arrhythmia. An intracardiac left atrial mass attached to the lower segment of the atrium and next
to the mitral valve orifice, can protrude into the left ventricle, just like in this case, rendering obstruction of blood flow and malfunction of the valve. Meanwhile, cardiac osteosarcomas are highly invasive, and frequently infiltrate into the adjacent myocardium, resulting in arrhythmia and impaired ventricular function, and to the pericardium, with pericardial effusion. On admission, our patient also complained of expectoration and frothy sputum owing to the severe pulmonary congestion caused by the chronic obstruction at the mitral valve level.

The treatment for cardiac osteosarcoma is challenging and no consensus has been reached. If no metastasis is found, in principle, it is recommended to perform a complete resection, but sometimes things do not go smoothly as to whether the tumor can be dissected en bloc. The size and site should be included in the consideration of the surgical plan, but it is not that simple and the actual condition can be much more complicated than expected and similar to this case, the invasion was extensive, even partially into the ventricular myocardium. Therefore, we excised the tumor from its involved zone along with a part of the peripheral atrial wall and then reconstructed the remaining atrium. Note there is no surgical indication for metastasized cardiac osteosarcoma, or if a distant metastasis is identified.

Primary cardiac osteosarcomas have a high incidence of local recurrence and systemic metastasis, both contributing to a dismal prognosis. Based on previous reports, even when resected completely at initial operation, a cardiac osteosarcoma is difficult to remove completely and relapse mostly occurs within less than 1 year. In addition, metastasis can be distributed almost everywhere including skin, lung, liver, bones, brain, and adrenal glands. Because of its nature of aggressive growth, the survival time in patients with primary cardiac osteosarcoma is not too long, statistically less than 1 year and mostly within 6 months of being diagnosed, except for an exceptional case of a 50-year-old woman who survived for 108 months after the initial operation.

Conclusion

At first, we misdiagnosed the mass as a cardiac myxoma, because imaging before the operation was only performed using echocardiography that revealed nothing but some morphological characteristics of the neoplasm. During the operation, we found the tumor looked totally different from cardiac myxoma, with a solid consistency and flesh-like cutting texture. Subsequent histopathological analysis confirmed the tumor to be a cardiac osteosarcoma instead of a cardiac myxoma. The following PET-CT and 99mTc-MDP SPECT confirmed that except for the residual tumor, there were no metastases or any primary focus, and hence the diagnosis of primary cardiac osteosarcoma was established. In future, although this tumor may mimic myxomas on echocardiography imaging, subtle features, such as a broad base, attachment to the non-septal atrial wall, and location near the pulmonary veins, provided some clues that this may be a non-myxomatous tumor. Although the use of multiple modalities enhance the diagnostic sensitivity for cardiac neoplasm, there is still no imaging characteristic to identify a primary cardiac osteosarcoma. The diagnosis of osteosarcoma is more dependent on histopathologic analysis and immunohistochemistry, but these are practiced only after resection. Because of its invasion, size, site, and attachment, complete resection is impossible for most cases. Although receiving resection, patients cannot look forward to long-term survival, and the necessity for surgery becomes questionable, if a pre-operative diagnosis can be firmly established.

Disclosures

Conflict of interest: None.

References


Supplemental Files

Supplemental Figure.
Please see supplemental files; https://www.jstage.jst.co.jp/article/ihj/58/6/58_16-521/_article/supple