Primary Cardiac Leiomyosarcoma: A 27-Month Survival with Surgery and Chemotherapy

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Abstract:
The patient was a 39-year-old man hospitalized due to the presence of a cardiac mass and heart failure. Emergency tumor resection and mitral valve replacement were performed. The pathological findings of the tumor led to a diagnosis of cardiac leiomyosarcoma. After the operation, multiple metastases were found. The patient underwent three courses of chemotherapies: adriamycin, ifosfamide, dacarbazine, and mesna (MAID therapy), gemcitabine plus docetaxel, and sunitinib. During MAID therapy, the patient underwent resection of gastrointestinal metastases twice due to gastrointestinal hemorrhaging. Although he died 27 months after the initial treatment, use of multimodal therapy was effective in achieving a longer survival for the patient.

Key words: cardiac neoplasm, leiomyosarcoma, surgery, chemotherapy

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Introduction
Primary cardiac leiomyosarcoma is very rare, and it also has a poor prognosis. Although radical surgery is the best intervention for achieving a good outcome, complete surgical resection is sometimes difficult due to distant metastasis. Although in these cases, surgical resection and palliative chemotherapy may be effective, their actual effectiveness remains unclear.

Case Report
A 39-year-old man was admitted to a local hospital with effort dyspnea. Before admission, he had suffered from fatigue for 7 months and productive coughing at night for a month. A cardiac tumor was detected by echocardiography, and he was transferred to our hospital for diagnosis and treatment. His blood pressure and pulse rate at admission was 89/58 mmHg and 88/min, respectively. Fig. 1 shows the patient’s echocardiography on admission. The cardiac mass involved the left atrium, and it invaded the mitral valve. The hemodynamic abnormalities included a mitral stenosis-like appearance (peak flow velocity of mitral valve, mean mitral valve gradient and measurement of systolic pulmonary artery pressure was 3.67 m/s, 23 mmHg and 99 mmHg, respectively). Fig. 2 shows the chest enhanced computed tomography (CT) findings on admission. An extracardial expanding mass was observed. In abdominal CT, an upper abdominal mass measuring 3 cm in size was detected. Due to the patient’s indications of unstable hemodynamics, he could not receive detailed examinations, and an emergency operation was performed on the day after admission. The intraoperative findings demonstrated that a left atrial tumor had invaded the left auricle and expanded beyond the pericardium. The tumor within the left auricle was resected, and the mitral valve was replaced. Figs. 3 and 4 show the pathological findings. In a macrographic view, a white mass was observed, and Hematoxylin-Eosin staining demonstrated sheet-like spindle cells with elongated- to irregular-shaped hyperchromatic nuclei, or unusually large nuclei. Immunohistochemistry showed strong positivity for vimentin and smooth muscle actin. Thus, the tumor was diagnosed to be cardiac leiomyosarcoma. After the operation, the patient’s vital signs normalized and his general condition improved. Thereafter, he was examined for systemic metastasis by positron emission tomography-computed tomography (PET-CT). PET-CT showed multiple metastases in the stomach, small intestine, right vastus lateralis muscle, and left gluteus maximus muscle. Fig. 5 shows images obtained from double balloon en-
doscopy (DBE). DBE revealed multiple masses in the stomach, with a poly-nodular and submucosal tumor-like appearance, and in the jejunum, with a giant mass in the lumen and a submucosal tumor-like appearance. These multiple and submucosal tumor-like appearances were the typical findings of a metastatic gastrointestinal tumor. Biopsy results showed findings that were similar to the cardiac pathological findings, and multiple metastases of cardiac leiomyosarcoma were diagnosed. The patient received combination chemotherapy of adriamycin (DXR), ifosfamide (IFM), dacarbazine (DTIC), and mesna (MAID therapy every four weeks: DXR 20 mg/m²/day, day 1-3; IFM 2,500 mg/m²/day, day 1-3; DTIC 300 mg/m²/day, day 1-3; mesna 2,400 mg/m²/day, day 1-4). Although MAID therapy showed a partial response in abdominal CT as per the Response Evaluation Criteria In Solid Tumors (RECIST; version 1.0), gastrointestinal hemorrhaging occurred after 3 courses. DBE identified the small intestine metastases as the cause of hemorrhaging. Eight metastatic lesions in the small intestine were resected by open abdominal surgery. Because the hemorrhaging stopped after
surgical resection, MAID therapy was resumed. However, after nine more courses of MAID, gastrointestinal hemorrhaging occurred again. A new intra-gastric mass with bleeding was identified by upper gastrointestinal endoscopy, and it diagnosed to indicate a progression of disease. Because the size of the mass was large (50 mm), it was resected by partial gastrectomy. After recovering from surgery, the patient underwent second line chemotherapy with gemcitabine (GEM) plus docetaxel (DTX) (GEM+DTX therapy every three weeks: GEM 900 mg/m², day 1, 8; DTX 60 mg/m², day 8). Four months after the start of GEM+DTX therapy, PET-CT revealed cardiac recurrence and new metastatic bone, lung, stomach, adrenal gland, and intramuscular lesions. A chest X-ray revealed pleural effusion and an enlargement of the cardiac silhouette due to cardiac recurrence. The patient received third line chemotherapy with sunitinib. After the start of sunitinib administration, the enlargement of cardiac silhouette improved and the amount of pleural effusion decreased. However, 2 months after the start of sunitinib, he suffered from uncontrolled worsening of general fatigue and dyspnea, and cardiac recurrence and heart failure was identified as the cause of his symptoms. Although he received palliative care, he died suddenly 27 months after initial treatment.

Discussion

Primary cardiac leiomyosarcoma is very rare, and it is reported in less than 0.25% of all cardiac tumors (1) since its first description by Weir et al. in 1941 (2). It typically presents in the patient’s 40’s, with no sex predilection. Making a preoperative diagnosis of malignant cardiac tumor by echocardiography is difficult, due to difficulty in differentiating it from myxoma, the most common benign tumor of the heart. In the present case, a definitive preoperative diagnosis could not be obtained; however, surgery was urgently required to improve his symptoms and circulation dynamics. Although multiple metastases were found after surgery, sudden death due to heart failure was able to avoid.

Primary cardiac leiomyosarcomas have a poor prognosis, and the mean survival time without treatment is reported to be 6 months from the time of diagnosis (3). Primary cardiac leiomyosarcoma is usually asymptomatic until it reaches an advanced stage, and the diagnosis is often delayed until the emergence of clinical symptoms due to heart failure and embolism. Although radical surgery is the best intervention for achieving a good outcome, complete surgical resection is difficult to achieve in many cases, and local recurrence or metastasis often occurs even in cases of complete resection. In a study by Donsbeck et al. (4) with twenty-four cases of primary cardiac sarcoma (including six cases of leiomyosarcoma), complete macroscopic resection was successful in only 33% of 24 cases, and death due to local recurrence occurred in 50% of complete macroscopic resection cases.

Despite the high incidence of distant metastasis, surgical resection relieves symptoms adequately and offers palliation.
While the combination of tumor excision and chemotherapy may be effective, the actual effectiveness remains unclear due to the rarity of leiomyosarcoma cases. A few cases of palliative chemotherapy alone, or surgery followed by palliative chemotherapy have been reported, with survival of 10 to 18 months (5, 6).

Adriamycin, epirubicin, and ifosfamide are some of the key drugs associated with response rates (RRs) of more than 20 percent for chemotherapy of metastatic soft tissue sarcoma. Many different combination chemotherapies including these key drugs have been studied, and were shown to have higher RRs and a longer progression free survival (PFS) than single regimens. The combination of adriamycin, ifosfamide, dacarbazine and mesna (MAID therapy) is one of the most commonly used multi-agent regimens. A study by Antman at al. (7), demonstrated that the response rate and time to progression of MAID therapy were 34% and 4 months, respectively.

Although gemcitabine and docetaxel each have modest activity, GEM+DTX has been shown to be more effective (8, 9), and Maki et al. reported in their randomized phase II study, which included patients who had received prior chemotherapy, RRs, PFS, and the median overall survivals of GEM+DTX were 16%, 6.2 months, and 17.9 months, respectively (10).

Pazopanib is a multi-targeted orally active small molecule inhibitor of several tyrosine kinases. A worldwide randomized, double-blinded phase III study (the PALETTE trial), which compared pazopanib (800 mg daily) versus placebo in 369 patients of advanced soft tissue sarcoma, showed significantly higher median PFS (4.6 versus 1.6 months) and RRs (12.5 versus 10.7 months) in the pazopanib group (11). Based on these data, pazopanib is recognized as an important regimen for leiomyosarcoma; however, pazopanib had not been approved in Japan at the time that we treated this patient. Therefore, we used sunitinib, another multi-targeted tyrosine kinase inhibitor which shows activity against imatinib-refractory gastrointestinal stromal tumors (GIST). Although the activity of sunitinib for other types of non-GIST sarcoma has not been established, sunitinib improved the present patient’s cardiac failure and pleural effusion.

Table shows similar cases that survived for over 24

| Age (y) | Sex | Site | Size (cm) | operation | chemotherapy | radiation therapy | follow-up | outcome | references |
|---------|-----|------|----------|-----------|--------------|-------------------|-----------|--------|------------|
| 67      | ND  | RV   | ND       | radical   | No           | No                | 3y        | Alive, NED | 12         |
| 24      | M   | LA   | 7        | radical   | Yes          | Adjuvant (VCR, ACT, IFM, DXR) | Yes       | 7y      | Dead       | 13         |
| 29      | F   | LV   | 3.5      | radical   | No           | No                | 24mo      | Alive, NED | 14         |
| 25      | M   | LA   | 9        | radical   | Yes          | Adjuvant (DXR, IFM, VBL, ACT) | Yes       | 7y      | Dead       | 14         |
| 16      | M   | RA   | 10       | radical   | No           | Adjuvant (IFM, VCR, ACT, DXR) | No        | 34mo   | Alive, NED | 15         |
| 45      | M   | LA   | ND       | radical   | No           | Adjuvant (IFM, DXR) | No        | 24mo   | Dead       | 16         |
| 36      | M   | ND   | ND       | transplantation | No | NAC (DXR, IFM) | No        | 37y    | Alive, NED | 17         |
| 43      | F   | LA   | ND       | radical   | Yes          | Adjuvant (DXR, IFM) | No        | 45mo   | Dead       | 18         |
| 21      | F   | LA   | 7        | radical   | No           | Adjuvant (DXR, IFM, CDDP) | No        | 24mo   | Alive, WD | 19         |
| 3mo     | M   | RA   | 4.8      | radical   | No           | Adjuvant (IFM, VP16) | No        | 18y    | Alive, NED | 20         |
| 49      | M   | LV   | 3        | radical   | No           | No                | 3y        | Alive, NED | 21         |
| 42      | F   | LV   | 2.5      | radical   | No           | Adjuvant (DXR, DTIC, CPA) | No        | 2y     | Alive, NED | 22         |
| 3mo     | M   | RA   | 5.3      | radical   | No           | No                | 96mo      | Alive, NED | 24         |
| 33      | F   | LA   | 8        | radical   | Yes          | Adjuvant (DXR, IFM) | Yes       | 41mo   | Alive, WD | 25         |
| 56      | M   | RA   | 5        | radical   | Yes          | ND                | ND        | 42mo   | Alive, WD | 26         |
| 48      | F   | LA   | ND       | radical   | Yes          | Adjuvant (unknown) | No        | 3y     | Alive, NED | 27         |
| 47      | M   | RA   | 5        | radical   | No           | Adjuvant (DXR, IFM) | No        | 8y     | Dead       | 28         |

ND: no data, M: male, F: female, y: year, mo: month, d: day, RA: right atrium, RV: right ventricle, LA: left atrium, LV: left ventricle, NAC: neo-adjuvant chemotherapy, DXR: adriamycin, DTIC: dacarbazine, IFM: ifosfamide, VCR: vincristine, ACT: actinomycin D, VP16: etoposide, CPA: cyclophosphamide, VBL: vinblastine, CDDP: cisplatin, WD: with disease, NED: no evidence of disease.
months with the available data regarding treatment modalities and outcome (12-28). A long survival was reported 17 cases. In these cases, the rate of radical resection, cardiac reoperation, and perioperative chemotherapy were 100% (17/17), 35.3% (6/17), and 70.6% (12/17), respectively. The combination of radical surgery and chemotherapy tended to show a better outcome, and intensive therapy was also effective and improved their survival.

The present patient underwent two abdominal open surgeries for the treatment of gastrointestinal hemorrhaging due to small intestinal and gastric metastases. These operations resolved the gastrointestinal hemorrhaging, and the patient continued palliative chemotherapy. We believe that this multimodal therapy, which included one thoracic surgery, two abdominal surgeries, and three palliative chemotherapy regimens, were effective in achieving a 27-month survival period after initial treatment.

The authors state that they have no Conflict of Interest (COI).

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References
1. McAllister HA Jr. Cardiovascular pathology. Churchill Livingstone, New York, 1983.
2. Weir DR, Joncs BC Jr, Ohio C. Primary sarcoma of the heart. Am Heart J 22: 556-560, 1940.
3. Poole GV Jr, Meredith JW, Breyer RH, Mills SA. Surgical implications in malignant cardiac disease. Ann Thorac Surg 36: 484-491, 1983.
4. Donsbeck AV, Ranchere D, Coindre JM. Primary cardiac sarcomas: an immunohistochemical and grading study with long-term follow-up. Histopathology 34: 295-304, 1999.
5. Mayer F, Aebert H, Rudert M, et al. Primary malignant sarcoma of the heart and great vessels in adult patients - a single-center experience. Oncologist 12: 1134-1142, 2007.
6. Jellis C, Doyle J, Sutherland T, Gutman J, Macisaac A. Cardiac epithelioid leiomyosarcoma and the role of cardiac imaging in the differentiation of intracardiac masses. Clin Cardiol 33: E6-E9, 2010.
7. Antman K, Crowley J, Balcerzak SP, et al. An intergroup phase III randomized study of doxorubicin and dacarbazine with or without ifosfamide and mesna in advanced soft tissue and bone sarcomas. J Clin Oncol 11: 1276-1285, 1993.
8. Hensley ML, Maki R, Venkatraman E, et al. Gemicitabine and docetaxel in patients with unresectable leiomyosarcoma: Results of a phase II trial. J Clin Oncol 20: 2824-2831, 2002.
9. Bay JO, Ray-Coquard I, Fayette J, et al. Docetaxel and gemcitabine combination in 133 advanced soft-tissue sarcomas: A retrospective analysis. Int J Cancer 119: 706-711, 2006.
10. Maki RG, Watthen JK, Patel SR, et al. Randomized phase II study of gemcitabine and docetaxel compared with gemcitabine alone in patients with metastatic soft tissue sarcomas: results of sarcoma alliance for research through collaboration study 002. J Clin Oncol 25: 2755-2763, 2007.
11. van der Graaf WT, Blay JY, Chawla SP, et al. Pazopanib for metastatic soft-tissue sarcoma (PALETTE): a randomised, double-blind, placebo-controlled phase 3 trial. Lancet 379: 1879-1886, 2012.
12. Panday VR, Cramer MJ, Elbers HR, et al. Primary leiomyosarcoma of the heart presenting as obstruction to the pulmonary trunk. Am Heart J 133: 465-466, 1997.
13. Pessotto R, Silvestre G, Luciani GB, et al. Primary cardiac leiomyosarcoma: seven-year survival with combined surgical and adjuvant therapy. Int J Cardiol 60: 91-94, 1997.
14. Pins MR, Ferrell MA, Madsen JC, et al. Epithelioid and spindle-cellled leiomyosarcoma of the heart. Report of 2 cases and review of the literature. Arch Pathol Lab Med 123: 782-788, 1999.
15. Gehrmann J, Kehl HG, Diaoio R, et al. Cardiac leiomyosarcoma of the right atrium in a teenager: unusual manifestation with a lifetime history of atrial ectopic tachycardia. Pacing Clin Electrophysiol 24: 1161-1164, 2001.
16. Clarke NR, Mohiaddin RH, Westaby S, et al. Multifocal cardiac leiomyosarcoma. Diagnosis and surveillance by transoesophageal echocardiography and contrast enhanced cardiovascular magnetic resonance. Postgrad Med J 78: 492-493, 2002.
17. Uberfuhr P, Meiser B, Fuchs A, et al. Heart transplantation: an approach to treating primary cardiac sarcoma? J Heart Lung Transplant 21: 1135-1139, 2002.
18. Malyshiev M, Safiyanov A, Gladyshev I, et al. Primary left atrial leiomyosarcoma: literature review and lessons of a case. Asian Cardiovasc Thorac Ann 14: 435-440, 2006.
19. Mazzola A, Spano JP, Valente M, et al. Leiomyosarcoma of the left atrium mimicking a left atrial myxoma. J Thorac Cardiovasc Surg 131: 224-226, 2006.
20. Han P, Drachman RA, Amenta P, et al. Successful treatment of a primary cardiac leiomyosarcoma with ifosfamide and etoposide. J Pediatr Hematol Oncol 18: 314-317, 1996.
21. Dhall D, Al-Ahmadie HA, Dhall G, Shen-Schwarz S, Tickoo SK. Pediatric renal cell carcinoma with oncocytoid features occurring in a child after chemotherapy for cardiac leiomyosarcoma. Urolgy 70: 178.e13-e15, 2007.
22. Jayle CP, Christiaens LP, Ardilouze P, et al. Left-ventricleleiomysarcoma: imaging by multislices computed tomography with retrospective electrocardiogram-gated reconstruction. Thorax 62: 280, 2007.
23. Muehleke DD, Justice K. Leiomyosarcoma of the left ventricle. Ann Thorac Surg 86: 666, 2008.
24. Zhang PJ, Brooks JS, Goldblum JR, et al. Primary cardiac sarcomas: a clinicopathologic analysis of a series with follow-up information in 17 patients and emphasis on long-term survival. Hum Pathol 39: 1385-1395, 2008.
25. Strina C, Zannoni M, Parolin V, et al. Bone metastases from primary cardiac sarcoma: case report. Tumori 95: 251-253, 2009.
26. Winther C, Timmermans-Wielenga V, Daugaard S, et al. Primary cardiac tumors: a clinicopathologic evaluation of four cases. Cardiovasc Pathol 20: 63-67, 2011.
27. Ozkaynak B, Kayalar N, Mert B, et al. Left atrial leiomyosarcoma extending into the posterior mediastium and mimicking a left atrial myxoma. Heart Surg Forum 16: E309-E312, 2013.
28. Glaoui M, Benbrahim Zel, Belbaraka R, Errhiani H, Lescene A. An uncommon long-term survival case of primary cardiac leiomyosarcoma. World J Surg Oncol 12: 338, 2014.