Right Ventricle Mass Induced Coronary Artery Steal Phenomenon: A Rare Clinical Manifestation on One Leiomyosarcoma Patient

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We report a 43-year-old female with the underlying disease of retroperitoneal leiomyosarcoma and initial presentation of ST elevation myocardial infarction. Coronary angiography showed an absence of coronary artery stenosis and a huge, ill-defined cardiac mass which was fed by both the left anterior descending artery and the right coronary artery. Coronary blood flow was obviously shunted by the neovascularized cardiac tumor. Right ventricle metastatic leiomyosarcoma was diagnosed according to her clinical course, images of echocardiography and computed tomography. In conclusion, we speculated that ST-segment elevation in electrocardiogram and typical anginal symptoms can provide significant evidence for myocardial ischemia caused by coronary steal phenomenon due to a right ventricular metastatic leiomyosarcoma.

Key Words: Coronary steal phenomenon • Leiomyosarcoma • Myocardial infarction

CASE PRESENTATION

A 43-year-old female presented to our facility with a medical history of retroperitoneal leiomyosarcoma status post surgical resection. Multiple metastasis (including lung and intra-abdomen) were noted approximately three years after the first surgery, so the patient underwent several cycles of chemotherapy and radiotherapy. Upon her current admission, she had severe vomiting for two days and she presented to our emergency department due to sudden onset of chest tightness and palpitation. The vital signs were blood pressure 120/75 mmHg, pulse rate 102 beats per minute, respiratory rate 25 per minute and body temperature 37 °C. Physical examination showed regular heart beat with a grade III/VI systolic murmur over the left 2nd to 3rd intercostal sternal border. The patient’s electrocardiogram (ECG) testing showed new onset of ST elevation on leads V1-4 (Figure 1A). Several risk factors of coronary artery disease, including hypertension, obesity (body mass index > 30) and a premature familial history of coronary artery disease were noted. ST elevation myocardial infarction could not be ruled out. We arranged for coronary angiography, which showed no significant coronary stenotic lesions. However, a huge, ill-defined myocardial mass was fed by both the left anterior descending artery and right coronary artery. The coronary blood flow was shunted for neovascularization of the metastatic tumor (Figure 1C & 1D). Echocardiography revealed one huge tumor over the right ventricle with the involvement of the right ventricle outflow tract and pulmonary artery (Figure 2A & 2B). The thoracic computed tomography revealed progressive lung metastasis and one inhomogeneous soft tissue mass 4 cm × 3 cm over the right ventricle which was compatible with the echocardiographic findings (Figure 2C). Aggressive hydration was...
given immediately, and ST elevation recovered one day later (Figure 1B). Cardiac enzymes were within normal level during the hospitalization. Due to her surgical risk and wide myocardium involvement, this patient was eventually transferred to the oncology department for further chemotherapy and radiotherapy. Her clinical symptoms improved after adjuvant chemotherapy.

DISCUSSION

Metastatic cardiac tumors are much more common than those of primary cardiac origin, with the most common primary lesions with cardiac metastasis being bronchogenic carcinoma, breast cancer, lymphoma and malignant melanoma. Primary origin from soft tissue...
sarcoma is very rare.² Takenaka et al. has reported that among cases with cardiac metastasis, leiomyosarcoma is the predominant histological type arising from large blood supply. This can explain why leiomyosarcoma can grow easily in the heart and vessels.³ Previous autopsy studies have suggested that the left ventricle is most often the focus of metastatic tumors because of its level of vascularity.⁴ Conversely, the right ventricle involvement of metastatic leiomyosarcoma is extremely rare, with Palmieri et al. being the only previously reported case.⁵ In our case, the patient presented with typical chest pain and ECG mimicking ST elevation myocardial infarction. Coronary angiography showed normal coronary arteries and a huge mass with abnormal neovascularization. Echocardiography confirmed the patient’s right ventricular tumor. To diagnose metastatic cardiac tumors, echocardiography should be performed routinely.³ Cardiac cross-sectional imaging, including computed tomography and magnetic resonance imaging, can also be considered in complicated cases for which echocardiographic data is not conclusive.⁶

Neovascularization is necessary for the development and proliferation of the tumors. Angiogenesis from the coronary artery may lead to a coronary steal phenomenon which has previously been reported in patients with atrial myxoma.⁷ We hypothesize that myocardial ischemia may be induced by the blood flow shunting from the normal coronary artery to the neovascularized tumor. This myocardial ischemia may cause angina pectoris and ST segment change of ECG, which results from coronary steal phenomenon.

Radical resection of metastatic cardiac leiomyosarcoma remains challenging due to its location, infiltrative growth, large size and incomplete clear margin. Although surgery only represents a palliative strategy, it should be recommended for potentially life-threatening complications. Adjuvant chemotherapy and/or radiotherapy can also improve survival in a few patients, but is rarely curative.⁸

Although metastatic cardiac tumor mimicking acute coronary syndrome has been reported in the literature, the mechanism and pathophysiology has not yet been clearly defined.⁹,⁵ In our case, the absence of coronary artery stenosis was diagnosed by coronary angiography. ST-segment elevation in precordial leads of ECG and typical anginal symptoms can provide significant evidence of myocardial ischemia caused by the coronary steal phenomenon. Hypovolemia status with tachycardia was presented initially which might lead to insufficient preload, reduced diastolic compliance and increased coronary demand. These exacerbating factors could further reduce coronary blood flow. If underlying disease of large coronary shunting from metastatic tumor was associated, this so-called coronary steal phenomenon might lead to clinically relevant ischemia. In addition, ST segment elevation and clinical symptoms of angina could be recovered after aggressive hydration.

In conclusion, we reported this case with clinical evidence of coronary steal phenomenon by a metastatic right ventricle leiomyosarcoma presenting with mimicking ST-segment elevation myocardial infarction. This case could remind physicians that ST elevation in ECG has many causes, including the coronary steal syndrome. Consequently, physicians should review a variety of possible causes before performing coronary angiography.

ACKNOWLEDGMENTS

None.

CONFLICT OF INTEREST

None declared.

REFERENCES

