A rare cardiac haemangioma in the right ventricle diagnosed accurately using $^{18}$F-fluorodeoxyglucose-positron emission tomography

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Abstract

A right ventricular cardiac tumour was incidentally detected in a 61-year-old man during a preoperative examination for coronary artery bypass grafting (CABG). Findings on computed tomography and magnetic resonance imaging suggested the differential diagnoses of myxoma, haemangioma and haemangiosarcoma, and it was difficult to identify whether the tumour was benign or malignant. $^{18}$F-fluorodeoxyglucose-positron emission tomography strongly suggested a benign tumour. We enucleated the tumour, because an intraoperative frozen section also strongly suggested a benign origin. After resection, CABG under cardiopulmonary bypass was performed. Histopathological and immunohistochemical analysis indicated a cavernous haemangioma without evidence of malignant tissue. The patient has survived 20 months after surgery with no evidence of tumour recurrence.

Keywords: Haemangioma • Cavernous • Heart ventricles • Positron emission tomography

INTRODUCTION

Cardiac haemangiomas are very rare, benign tumours that occur at an incidence of 2–10% of all cardiac benign tumours [1–4]. Most cardiac haemangiomas are asymptomatic, although symptoms such as arrhythmias, congestive heart failure, embolic episodes, myocardial ischaemia and sudden death can occur depending on the size and location of the tumour.

Cardiac haemangiomas can arise from any layer of the heart (endocardium, myocardium, epicardium and pericardium), and develop in all of the cardiac chambers [1–3]. Most common sites are the anterior wall of the right ventricle and the lateral wall of the left ventricle [2]. The natural history of cardiac haemangiomas is unknown. However, after complete resection, the prognosis is more favourable than that after the resection of haemangiosarcoma. Therefore, it is important to confirm tumour characteristics preoperatively and perform complete resection [1–3]. Recently, $^{18}$F-fluorodeoxyglucose-positron emission tomography (FDG-PET) combined with computed tomography (CT) has proven very useful for preoperative differentiation of benign and malignant tumours [2, 4, 5]. Here we present a case of a cavernous haemangioma in the right ventricle, which was strongly suggested to be benign on FDG-PET. The tumour was resected completely without cardiac reconstruction.

CASE REPORT

A 61-year-old man was referred to our hospital for coronary artery bypass grafting (CABG). He had type two diabetes mellitus under control with medication, hyperlipidaemia and chronic kidney disease. A cardiac murmur was not detected during a routine physical examination. He had no chest pain, no visible cutaneous-vascular lesions and no signs of congestive heart failure. Transthoracic and transoesophageal echocardiography revealed a large sessile mass in the right ventricle but the other chambers showed no involvement (Fig. 1A). The cardiac valves were normal with only a trace of tricuspid regurgitation, and left ventricular size and function were normal. CT revealed a relatively heterogeneous mass (35 × 55 mm) in the right ventricle (Fig. 1B). Magnetic resonance imaging (MRI) revealed a hyperintensity in the tumour on T2-weighted images (Fig. 1C). FDG-PET showed increased $^{18}$F-FDG uptake in the tumour, the maximum standardized uptake value (SUV_{max}) was 4.0, strongly suggesting a benign tumour (Fig. 1D). Coronary arteriography revealed three-vessel coronary disease, along with the enhancement of the blood supply to the tumour, known as ‘tumour blush’ (Fig. 1E). A median sternotomy was performed, and the left internal thoracic artery and great saphenous vein were harvested for CABG. After aortic and bicaval cannulation, cardioplectic...
arrest was achieved using antegrade cold blood cardioplegia. After right atriotomy, the tumour was found to be smooth, and not attached to the tricuspid valve. The exact boundary of the tumour was clear; therefore, we enucleated the tumour completely, leaving the outer myocardial layer intact. The resected plane was treated with an argon beam coagulator. Analysis of a frozen section led to the diagnosis of a benign vascular tumour. After tumour resection, a routine quintuple

Figure 1: (A) Transthoracic echocardiography showing a large sessile mass in the right ventricle without involving other chambers and tricuspid valve (arrow). (B) Computed tomography showing a relatively heterogeneous mass (35 × 55 mm) in the right ventricle (arrow). (C) Magnetic resonance imaging showing the tumour attached to the free wall of the right ventricle (arrow) and hyperintensity on a T2-weighed image. (D) 18F-Fluorodeoxyglucose-positron emission tomography (FDG-PET) showing increased 18F-FDG uptake in the tumour (arrow). (E) Right coronary angiography showing the blood supply to the tumour characterized by a tumour blush (arrow).
bypass was performed. Histopathological examination of the tumour revealed multiple vascular-like structures and dilated vessels. Some parts of the tumour showed papillary endothelial hyperplasia with a fibromyxoid stroma. Cells lining the vessels showed positive staining with antibodies against CD31 and CD34, which supported their endothelial origin. Histological findings were consistent with a cavernous-type haemangioma. Our patient has survived 20 months after surgery, and the latest echocardiogram shows no evidence of a recurrence.

**DISCUSSION**

Primary cardiac tumours are rare, and considered to represent 2–10% of benign cardiac tumours [1–4]. The natural history of cardiac haemangiomas is unclear because they are most often diagnosed post-mortem. Cardiac haemangiomas are classified histologically into the following types: capillary type with small capillary-like vessels, cavernous type with multiple dilated thin-walled vessels, and arterio-venous type with dysplastic arteries and veins. Most haemangiomas exhibit overlapping features with interspersed fibrous tissue [1–4]. Our patient had multiple vascular-like structures and dilated vessels suggestive of a cavernous-type haemangioma. Cardiac haemangiomas can arise from any layer of the heart (endocardium, myocardium, epicardium and pericardium) and develop in all of the cardiac chambers [1–3]. Most lesions occur on the anterior wall of the right ventricle and the lateral wall of the left ventricle [2].

Echocardiography is usually the initial imaging modality, and CT and MRI are also useful for evaluating extracardiac lesions and myocardial involvement. However, using these techniques, it is difficult to determine accurately whether the tumours are benign or malignant. FDG–PET combined with CT has been recently shown to be more useful for determining the characteristics of cardiac tumours [2, 4, 5]. Kambiz et al. advocated using FDG–PET to diagnose malignancies with a cut-off SUV max of 3.5. According to their report, malignant cardiac tumours typically exhibit high 18F-FDG uptake, and their SUV max is 5–16 [5]. In our case, the SUV max of 4.0 suggested a benign tumour.

**CONCLUSION**

Haemangiomas are rare benign cardiac tumours that occur most frequently in the right side of the heart. It is frequently difficult to distinguish them from the malignant tumours such as angiosarcomas and haemangiosarcomas. There are many reports of cardiac haemangiomas, but it is rare that the tumour is diagnosed benign with FDG–PET preoperatively. We show here that FDG–PET is useful preoperatively to rule out a malignant origin in such tumours. Because prognosis is favourable for most patients with haemangiomas, it is important to evaluate the characteristics of the tumour with the highest possible accuracy, especially because cardiac reconstruction, which is required for wide excision, presents a complex challenge.

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**REFERENCES**