CASE REPORT

Hibernating myocardium caused by isolated, radiation induced left main stem coronary artery stenosis

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Abstract

A 45 year old man presented with a five week history of worsening exertional dyspnoea and orthopnoea. He had also noted mild, bilateral ankle swelling. The patient had been diagnosed with stage III Hodgkin's lymphoma in 1968 at the age of 21. During the same year he underwent total nodal irradiation followed by chemotherapy in 1971. He had remained entirely asymptomatic over the course of the next 24 years with no evidence of relapse. Cardiac catheterisation undertaken soon after admission revealed a tight left main stem stenosis with a left dominant system. Left ventriculogram showed severe, global hypokinesia, and raised left ventricular end diastolic pressure (22 mm Hg). Urgent coronary artery bypass graft surgery was carried out. He made an uncomplicated recovery and his condition improved sufficiently to allow discharge eight days following the procedure. His heart failure slowly resolved and repeat transthoracic echocardiogram performed six months after surgery showed an unequivocal improvement in left ventricular function. Left ventricular ejection fraction continued to improve and increased from 23% at two months to 42% at two years. He currently remains entirely asymptomatic off all medication.

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Radiation to the heart can lead to the development of conduction and valvar abnormalities, restrictive cardiomyopathy, pericarditis, and pericardial effusion.[1] The development of coronary arterial disease following radiotherapy is also recognised and can potentially be a significant clinical problem. The precise mechanism responsible for radiation induced coronary arterial disease is not clearly defined but is thought to relate to damage to the vascular endothelium, leading to significant fibrosis (radiation arteritis).[1 2] It has also been suggested that this process is potentiated by concomitant hypercholesterolaemia and cardiotoxic chemotherapeutic agents.[1] Myocardial hibernation is an increasingly recognised phenomenon, first described in humans by Rahimtoola[3] It exists when myocardial contractile dysfunction shows significant improvement following successful revascularisation. Reduced resting perfusion with associated loss of intracellular contractile protein and glycogen accumulation contribute to the pathophysiology of this process, which is potentially reversible although recovery can take months. The relevance of reversible myocardial hibernation has gained increasing clinical acceptance in recent years.

Case report

We report the case of a man diagnosed with stage III Hodgkin's lymphoma in 1968 at the age of 21. During the same year he underwent total nodal irradiation followed by MOPP chemotherapy (mustine, vincristine, procarbizine, and prednisolone) in 1971. He remained entirely asymptomatic over the next 24 years with no evidence of relapse. He presented at the age of 45 with a five week history of worsening exertional dyspnoea and orthopnoea. He had also noted mild, bilateral ankle swelling. He was a smoker (five cigars a day) and a recent random total cholesterol was raised at 6.8 mmol/l. He took no regular medication, his alcohol intake was 15 units a week.

On examination he was orthopnoeic, in severe congestive cardiac failure with an elevated jugular venous pressure, ankle oedema, a third heart sound, and inspiratory crackles to the mid-zones of both lungs. Chest radiography showed interstitial oedema and upper lobe diversion with normal cardiac size and contour. His resting electrocardiogram was normal. A transthoracic echocardiogram showed only mild left ventricular dilatation (left ventricular internal diameter in systole (LVIDs) 5.2 cm, left ventricular internal diameter in diastole (LVIDd) 6.0 cm) but globally impaired systolic function, with a calculated ejection fraction of 13%. There was no pericardial collection and no significant valvar

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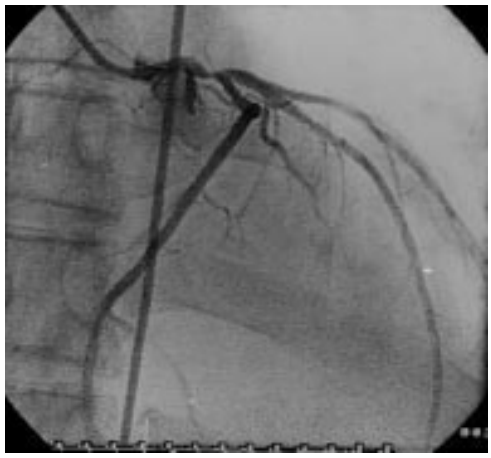

Figure 1 Coronary angiography showing a tight left main stem stenosis with a left dominant system.

lesion identified. A cardiomyopathy screen (serum ferritin, serum angiotensin converting enzyme, and virology titres) was negative. Cardiac catheterisation undertaken soon after admission revealed a tight left main stem stenosis with a left dominant system (fig 1). There was no other angiographic evidence of coronary arterial disease. The left ventriculogram showed severe, global hypokinesia, and left ventricular end diastolic pressure was raised at 22 mm Hg.

Urgent coronary artery bypass graft surgery was carried out with saphenous vein grafts to the left descending artery and the posterior descending branch of the circumflex artery. The patient made an uncomplicated recovery from the operation and his condition improved sufficiently to allow discharge eight days following the procedure. His heart failure slowly resolved and a repeat transthoracic echocardiogram performed six months after surgery showed an unequivocal improvement in left ventricular function (ejection fraction 24%, LVIDs 3.8 cm, LVIDd 5.0 cm).

Left ventricular ejection fraction continued to improve and increased from 23% at two months to 42% at two years, measured by gated pool imaging. He currently remains entirely asymptomatic off all medication.

Discussion

The patient presented with severe left ventricular dysfunction caused by isolated left main stem stenosis 26 years after mediastinal irradiation for Hodgkin's disease. His left ventricular function improved with coronary bypass surgery.

The documented incidence of significant, isolated left main coronary artery stenosis is between 0.07% and 1.0% of patients with coronary artery disease.[4] Radiation induced coronary arterial disease was first reported in 1957[5] but a number of series have now clearly established the significance of this condition.[1 2] The proximal right main and left anterior descending coronary arteries lie anteriorly in the mediastinum, receive the maximum radiation dose, and are therefore the most commonly identified sites of stenoses.[2] Interestingly, there was no angiographic evidence of coronary artery disease at these sites in our patient.

Previous studies have shown that patients with isolated left main coronary artery stenosis generally present with preserved left ventricular function and normal wall motion.[4] Our patient presented with severe left ventricular dysfunction that reversed, albeit slowly, after surgical revascularisation. This would lead us to believe that there was significant hibernating myocardium. Myocardial hibernation manifests as persistent contractile dysfunction resulting from reduced coronary artery blood flow that is reversible by restoring perfusion. It is believed that to survive, myocardial cells downregulate contraction to match reduced blood supply. Improvement of myocardial function by restoring blood flow has clear clinical implications. The time course for restoration of left ventricular function in our case matches previous clinical data.[6]

Given the progression made in radiation techniques and increasing use of this modality in treating malignant disease it is important to recognise its potential cardiac complications. Radiation induced coronary artery disease is one such complication and this should be recognised by both radiotherapists and cardiologists. Equally, the understanding that significant coronary artery disease leading to reduced myocardial function may be reversible is important.

This case illustrates myocardial hibernation, an increasingly recognised and significant cardiac phenomenon, caused by isolated left main coronary artery stenosis, a rare angiographic finding in a patient who had previously undergone chest irradiation, a rare cause of coronary arterial disease.

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