

Takotsubo cardiomyopathy following radioiodine therapy for toxic multinodular goitre

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ABSTRACT

We report on a 73-year-old man with a toxic multinodular goitre, which was treated with radioiodine therapy (I-131) without pretreatment with an antithyroid drug. Four weeks later he presented with rapidly progressive dyspnoea and a significant increase in free thyroxin. The electrocardiogram showed ST-segment elevation, and echocardiography demonstrated apical akinesia and a left ventricular ejection fraction of only 25%. However, direct coronary catheterisation showed no evidence of coronary artery disease. Left ventricular angiography showed apical ballooning consistent with the diagnosis of takotsubo cardiomyopathy. Following treatment of the cardiomyopathy and thyrotoxicosis, he experienced a complete recovery. To the best of our knowledge, this is the first report of a takotsubo cardiomyopathy associated with thyrotoxicosis resulting from radiation thyroiditis induced by radioiodine. Three other cases of takotsubo cardiomyopathy associated with Graves' disease have been described in literature.

KEYWORDS

Heart failure, radioiodine therapy, takotsubo cardiomyopathy, toxic multinodular goitre

INTRODUCTION

Takotsubo cardiomyopathy, also called stress-induced cardiomyopathy, consists of reversible apical or midventricular left ventricular dysfunction with sparing of the basal segments, without significant epicardial coronary artery stenosis. This entity is named after the round-bottomed narrow-necked Japanese fishing pot used for trapping octopus, because of the peculiar left ventricle apical ballooning evident on left ventriculogram.

What was known on this topic?

Takotsubo cardiomyopathy consists of reversible left ventricular dysfunction with characteristic apical ballooning, without significant epicardial coronary artery stenosis. It is triggered by an acute medical illness or intense emotional or physical stress. Three cases of takotsubo cardiomyopathy associated with Graves' hyperthyroidism have been reported.

What does this add?

To the best of our knowledge, this is the first report of a takotsubo cardiomyopathy provoked by thyrotoxicosis resulting from radiation thyroiditis induced by radioiodine. We suggest determination of thyroid function in all patients with takotsubo cardiomyopathy.

It is typically triggered by an acute medical illness such as sepsis,^{1,2} exacerbation of a pre-existing condition, or by intense emotional or physical stress, and predominantly affects women.^{3,4} Patients who survive the acute episode typically recover normal ventricular function within one to four weeks. Here, we report a patient with a takotsubo cardiomyopathy associated with thyrotoxicosis resulting from radiation thyroiditis induced by radioiodine.

CASE REPORT

A 73-year-old man with a history of prostatic carcinoma and toxic multinodular goitre, which was treated with radioiodine therapy (iodine-131) five years ago, was now admitted for rapidly progressive dyspnoea. Four weeks before admission

he was retreated with iodine-131 in another hospital for recurrent hyperthyroidism (free thyroxin (FT₄) 34 pmol/l (10 to 22); thyroid-stimulating hormone (TSH) <0.1 mIU/l (0.35 to 5.0)) due to toxic multinodular struma (confirmed by thyroid scintigraphy). There was no preceding treatment with an antithyroid drug. On presentation in the emergency room, he had no chest pain, palpitations, diarrhoea, or change in weight. During the last weeks he had been more easily irritated. His blood pressure was 155/85 mmHg, with a pulse rate of 127 beats/min. An enlarged thyroid with multiple nodules of varying sizes was observed. Examination of the lungs revealed diffuse rales at both bases. Furthermore, he had mild oedema of the lower extremities and fine tremor of the hands. The electrocardiogram showed a sinus tachycardia with ST-segment elevation in the anterior precordial leads and T-wave inversion in the lateral leads (*figure 1A*). His blood tests showed an elevated troponin of 2.92 µg/l (0.00 to 0.10), a depressed TSH of <0.1 mIU/l, and a significant increase in FT₄ to 55 pmol/l, probably as a result of radiation thyroiditis by radioiodine. Transthoracic echocardiography (TTE) showed simultaneous apical akinesia and a hyperkinetic basal area with a substantially reduced left ventricular ejection fraction (LVEF) of 25% (*figure 1B-E*). Direct coronary catheterisation showed no evidence of coronary artery disease, but left

ventricular angiography revealed apical ballooning consistent with the diagnosis of takotsubo cardiomyopathy.

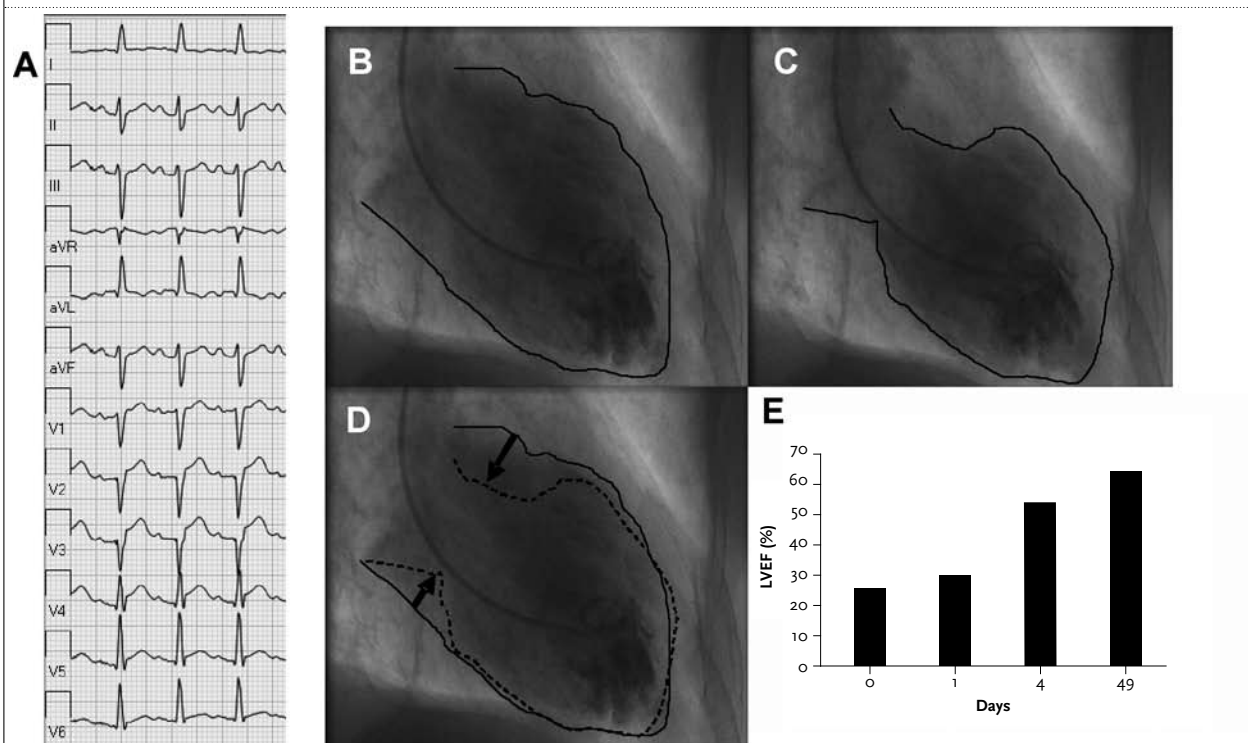
He was treated with diuretics, an angiotensin-converting enzyme inhibitor, and low-molecular-weight heparin. The thyrotoxicosis was treated according to recently published guidelines,⁵ with propylthiouracil and hydrocortisone, both inhibitors of the peripheral conversion of thyroxin to triiodothyronine. After 24 hours his condition had improved markedly and propranolol was started. Repeat echocardiography after four days showed significant improvement of the LVEF to 57% with only mild hypokinesia of the apical segments (*figure 1E*). Maximal CK release was 201 U/l (0 to 170).

At outpatient follow-up after seven weeks, all cardiac segments had normal contractility and the LVEF was 65% (*figure 1E*). At that time the electrocardiogram had normalised. He experienced a complete recovery with normal activity.

DISCUSSION

Thyrotoxicosis is associated with an increased risk of atrial fibrillation and the high cardiac output can lead to

Figure 1. Electrocardiogram at presentation showing sinus tachycardia with ST-segment elevation in the anterior precordial leads and T-wave inversion in the lateral leads (A), left ventriculogram at presentation demonstrating apical akinesia of a takotsubo pattern (B-D) and serial echocardiographic assessment of the left ventricular ejection fraction (E)



Panel B shows the appearance of the left ventricle during diastole and panel C during systole. In panel D a projection of diastole and systole is shown. Echocardiography was performed on admission; on hospital days 1 and 4; and at outpatient follow-up on day 49.

worsening of heart failure or angina pectoris.^{6,7} In addition, three cases of takotsubo cardiomyopathy associated with Graves' hyperthyroidism have been described in literature.⁸⁻¹⁰ To the best of our knowledge, this is the first report of a takotsubo cardiomyopathy provoked by thyrotoxicosis resulting from radiation thyroiditis induced by radioiodine.

The pathogenesis of takotsubo cardiomyopathy is still unclear, but coronary artery spasm, myocarditis, and catecholamine-induced microvascular dysfunction and myocardial toxicity may be involved. The apex may be more vulnerable to sudden catecholamine surges due to greater β -adrenergic receptor density and/or increased myocardial responsiveness to adenylyate stimulation.¹¹ Thyroid hormone modulates the transcription of multiple genes and also has extranuclear action in cardiac myocytes leading to various cardiovascular effects similar to catecholamine-mediated stimulation of β -adrenergic receptors.⁷ Evidence that β -adrenergic receptors contribute to the cardiovascular effects of hyperthyroidism includes increased expression of β -adrenergic receptors in thyrotoxicosis and significant improvement of cardiovascular symptoms in thyrotoxicosis by β -blockade. However, a recent study showed that these effects of hyperthyroidism are largely independent of β -adrenergic stimulation.¹²

CONCLUSION

We present a patient with takotsubo cardiomyopathy following radioiodine therapy for toxic multinodular struma. Pretreatment with an antithyroid drug to deplete thyroid hormone stores before administration of radioiodine could have prevented the thyrotoxicosis and takotsubo cardiomyopathy in this patient. Various signs and symptoms in cardiomyopathy and thyrotoxicosis are similar, which implies that hyperthyroidism in takotsubo cardiomyopathy may be underreported. We suggest determination of thyroid function in all patients presenting with takotsubo cardiomyopathy.

NOTE

Part of this report was presented as an oral presentation at the Nederlandse Internisten Dagen, 23-4-2009.

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