CASE REPORT

Graves' thyrotoxicosis and coronary artery spasm

R A Chudleigh, J S Davies

Postgrad Med J 2007;**83**:e5 (<http://www.postgradmedj.com/cgi/content/full/83/985/e5>). doi: 10.1136/pgmj.2007.062299

Thyrotoxicosis occurs in 2% of females.¹ Cardiac complications include arrhythmias and cardiomyopathy; coronary artery spasm is also recognised, although it has rarely been reported to cause myocardial infarction.

Diagnosis of coronary artery spasm depends on a good history and electrocardiographic findings. The transient nature and unpredictable occurrence of spasm can make this difficult. Ergonovine administered during angiography will provoke diagnostic coronary artery narrowing in up to 90% of cases of true coronary artery spasm.² When coronary artery spasm occurs during angiography, administration of sublingual or intracoronary nitrate will relieve spasm in the majority of cases.³

We report two subjects who developed acute myocardial infarction associated with thyrotoxicosis. Further evaluation suggested coronary artery spasm as the mechanism of myocardial ischaemia.

CASE 1

A 36-year-old woman presented with a 48 h history of chest pain, together with progressive left sided weakness. Her history included Graves' thyrotoxicosis which had been treated with radioactive iodine 6 months previously.

The examination revealed sinus tachycardia with a blood pressure of 120/70 mm Hg. A smooth goitre with bruit, tremor and thyroid eye signs were noted. There was a left hemiparesis with an extensor plantar response.

Electrocardiography (ECG) revealed anterior Q waves and lateral ST depression together with T wave inversion. Investigations including cholesterol and glucose were normal. Admission troponin T was raised at 2.43 µg/l (<0.04 µg/l) consistent with a recent myocardial infarction. Undetectable thyroid stimulating hormone (TSH) and elevation of free thyroxine (TSH <0.02 mU/l (normal range 0.35–5.50 mU/l), free T₄ 120 pmol/l (normal range 9.8 to 23.1 pmol/l)) confirmed hyperthyroidism; TSH receptor antibodies were also positive. Emergency head computed tomographic scan confirmed a right cortical infarction.

Treatment with propylthiouracil 150 mg three times daily and propranolol 80 mg three times daily was commenced along with conventional cardiac treatment. Echocardiography demonstrated globally impaired left ventricular function and an apical thrombus. Coronary angiography demonstrated significant left main stem stenosis. Warfarin was commenced on day 10.

Restoration of euthyroidism produced resolution of chest pain and considerable improvement of the left hemiparesis. Once euthyroid, repeat angiography and echocardiography revealed complete resolution of the previously recognised left main stem stenosis and normal left ventricular function with dissolution of the apical thrombus. Further radioactive iodine therapy (800 mBq) was administered 6 weeks after discharge. The patient has been free of symptoms of coronary artery disease since ensuring strict euthyroidism.

CASE 2

A 59-year-old woman presented with central chest pain, inferior ST segment elevation and a troponin T concentration

of 0.11 µg/l (normal <0.04 µg/l); a diagnosis of acute inferior myocardial infarction was made. Thrombolysis produced resolution of the chest pain and ECG abnormalities.

At presentation, there were no symptoms suggestive of thyrotoxicosis, although a goitre was noted. Thyrotoxicosis was confirmed by TSH <0.02 mU/l and free T₄ of 46.2 pmol/l; TSH receptor antibodies were positive. Carbimazole 40 mg daily was commenced with diltiazem 60 mg three times daily and conventional cardiac treatment. After 48 h further painless inferior ST segment elevation occurred and the patient was transferred for rescue angioplasty.

Angiography revealed normal coronary arteries and echocardiography demonstrated mild inferior hypokinesia.

A diagnosis of acute myocardial infarction caused by coronary artery spasm was made. The patient made a good recovery and was discharged on carbimazole 40 mg daily before radioactive iodine therapy. Since restoration of euthyroidism, the patient has remained free of pain.

DISCUSSION

This report illustrates two cases of acute myocardial infarction caused by coronary artery spasm precipitated by Graves' thyrotoxicosis. Coronary artery spasm is the most plausible explanation because in the first subject resolution of the left main stem stenosis found at initial angiography is supportive, and in the second subject the normal angiographic appearance is again suggestive.

A Korean study of 6923 subjects undergoing coronary angiography for evaluation of chest pain found the incidence of coronary artery spasm to be 5%. In a subgroup of females under 50 years old with documented coronary artery spasm, the incidence of hyperthyroidism was 29%.⁴ Worryingly, these subjects, like our cases, presented with severe myocardial ischaemia or life threatening ventricular tachyarrhythmias.

Much speculation exists regarding the exact mechanism for coronary spasm in thyrotoxicosis. In vitro arterial studies have demonstrated enhanced contractility in response to catecholamines.⁵ Similarly, stimulation of sympathetic α-adrenergic receptors on coronary arteries leads to vasoconstriction.⁶ The hyperthyroid state is associated with enhanced sympatho-adrenal activity due to increased adrenergic receptor sensitivity and increased receptor numbers.⁷ It seems plausible that these

Learning points

- Coronary artery spasm associated with thyrotoxicosis must be considered in young females presenting with ischaemic chest pain without conventional cardiac risk factors.
- Myocardial ischaemia in this setting is severe and life threatening
- Restoration of euthyroidism is a priority

mechanisms underlie the association of coronary artery spasm and thyrotoxicosis.

In our cases, propranolol was used to attenuate adrenergic drive and achieve rate control in the first case, and diltiazem in the second. A theoretical benefit of diltiazem may be due to the beneficial effects of calcium antagonists on relief of coronary arterial spasm⁶ and the neutral effect on coronary α -adrenergic receptors, stimulation of which may exacerbate spasm.⁶

Restoration of euthyroidism was achieved with thionamides, producing resolution of chest pain and normalisation of angiographic and echocardiographic appearances. Reports in patients with coronary artery spasm associated with thyrotoxicosis have shown that once euthyroid, patients become free of angina.⁴ Our first case illustrates that a relapse of thyrotoxicosis exposes patients to the risks associated with coronary artery spasm; hence the need to ensure euthyroidism. Therefore, we elected to use early definitive treatment. A single dose of radioactive iodine controls thyrotoxicosis in approximately 90% of cases.⁸

Our report describes two cases of myocardial infarction caused by coronary artery spasm in association with Graves' thyrotoxicosis. The importance of recognising this rare association, particularly with regard to preventing further episodes through maintaining strict euthyroidism in such patients, is clear.

Authors' affiliations

R A Chudleigh, J S Davies, Department of Endocrinology, University Hospital of Wales, Cardiff, UK

Competing interests: None

Correspondence to: Dr Richard Chudleigh, Diabetes Research Unit, First Floor, Academic Centre, Llandough Hospital, Cardiff CF64 2XX, UK; rachudleigh@hotmail.com

Received 8 June 2007

Accepted 20 August 2007

REFERENCES

- 1 **Weetman AP**. *Oxford textbook of medicine*. Oxford University Press, 2004.
- 2 **Cipriano RC**, Guthaner DF, Orlick AE, *et al*. The effects of ergonovine malate on coronary artery size. *Circulation* 1979;**59**:82–9.
- 3 **Abrams J**. Nitroglycerine and long acting nitrates. *N Engl J Med* 1980;**302**:1234–7.
- 4 **Choi Y-H**, Chung JH, Bae SW, *et al*. Severe coronary artery spasm can be associated with hyperthyroidism. *Coron Artery Dis* 2005;**16**:135–9.
- 5 **Shepherd JT**, Vanhoulte PM. Mechanisms responsible for coronary vasospasm. *J Am Coll Cardiol* 1986;**8**(1 Suppl A):50A–4A.
- 6 **Rothman MT**, Khan B. Coronary artery spasm. *Br J Clin Pract* 1991;**45**:129–34.
- 7 **Hammond HK**, White FC, Buxton ILO, *et al*. Increased myocardial beta receptors and adrenergic responses in hyperthyroid pigs. *Am J Physiol* 1987;**36**:1031–9.
- 8 **Franklyn JA**, Daykin J, Droic Z, *et al*. Long-term follow-up of treatment of thyrotoxicosis by three different methods. *Clin Endocrinol* 1991;**34**:71–6.