

## Cardiac tamponade due to hypothyroidism: a case cluster report

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This study reports on three patients who were seen at Tygerberg Hospital within a short period of six months, with a new diagnosis of biochemically severe primary hypothyroidism. Pericardial effusion was suspected on clinical and X-ray findings and confirmed with echocardiography in all cases. All had evidence of pericardial tamponade based on echocardiographic criteria. Pericardiocentesis was performed on all patients and other causes of pericardial effusions were excluded. Although infrequently described, hypothyroidism needs to be considered in patients presenting with unexplained large pericardial effusions and cardiac tamponade.

**Keywords:** hypothyroidism, pericardial effusion

### Case 1

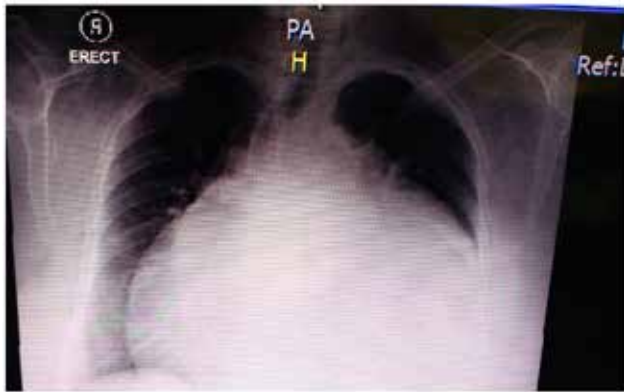
A 58-year-old woman was seen by an orthopaedic surgeon for assessment of a traumatic left knee injury. Hypothyroidism was suspected on clinical grounds and was confirmed biochemically: thyroid stimulating hormone (TSH) 34.35 mIU/l (0.35–4.50) and free thyroxine (FT4) 3.5 pmol/l (10.3–21.9). Our clinical findings confirmed overt hypothyroidism with a bradycardia (54 bpm), a hoarse voice, yellow-tinged skin and delayed relaxation of deep tendon reflexes. Cardiac examination revealed an elevated jugular venous pressure (JVP), soft heart sounds and lower limb pitting oedema. There were no clinical features of cardiac tamponade. ECG confirmed sinus bradycardia and small QRS complexes. The chest X-ray (CXR) revealed an enlarged cardiac silhouette, compatible with a pericardial effusion. Transthoracic echocardiogram (TTE) confirmed a large pericardial effusion of 4 cm measured at end-diastole, but due to technical difficulties echocardiographic features of tamponade could not be commented on. She was initiated on 50 µg thyroxine daily. While in the ward she had two episodes of haemodynamic instability with acute-onset shortness of breath, a drop in blood pressure and decreased oxygen saturation. The ECG remained unchanged and she remained bradycardic. In view of recent trauma, immobilisation and a swollen left leg she was investigated for a possible pulmonary embolism, but this was excluded. Repeat echocardiogram at the time of the second episode of haemodynamic instability now showed features of cardiac tamponade. Clinically pulsus paradoxus of 15 mmHg was demonstrated. A therapeutic pericardiocentesis was performed and 500 ml of yellow fluid was aspirated, which on testing was an exudate (protein 43 g/l, lactate dehydrogenase (LDH) 232 U/l). Tuberculosis (TB) was excluded on the basis of the CXR, normal pericardial fluid adenosine deaminase (ADA) of 7.9 U/l and negative TB cultures on the pericardial fluid. After the pericardiocentesis she remained asymptomatic and haemodynamically stable. Her thyroxine dose was increased and she was discharged and at follow-up had no recurrence of the effusion.

### Case 2

A 52-year-old female patient presented to our emergency unit (EU) seeking medical help for recent-onset shortness of breath.

She was formerly from the Eastern Cape and known to have hypertension on treatment. A recent screen for HIV was negative. She had experienced dyspnoea for two weeks, which was assessed as New York Heart Association (NYHA) grade 2 on presentation. She denied orthopnoea and paroxysmal nocturnal dyspnoea, but described intermittent pleuritic-type chest pain. There was no history of thyroid pathology. On initial examination she was normotensive with a pulse rate of 70 bpm and tachypnoeic with a respiratory rate of 24/minute. She was clinically hypothyroid with delayed relaxation of her deep tendon reflexes. Hypothyroidism was confirmed biochemically with TSH 40.77 mIU/l and free T4 4.1 pmol/l. Cardiovascular examination revealed a raised JVP with soft heart sounds and bilateral peripheral pitting oedema. A pulsus paradoxus of 12 mmHg was demonstrated. The cardiac silhouette was enlarged on CXR (Figure 1) and the lung fields were clear. ECG revealed a sinus rhythm with low-voltage QRS complexes and electrical alternans (Figure 2). TTE confirmed the presence of a large pericardial effusion measuring > 5 cm at the apex at end-diastole (Figure 3) with evidence of imminent cardiac tamponade. Emergency pericardiocentesis removed two litres of clear yellow fluid. Pericardial fluid analysis revealed an exudate with protein 75 g/l, LDH 210.0 U/l as well as a normal ADA of 9.4 U/l. Microbial (including mycobacterial) growth was absent and there was no malignancy on cytological evaluation.

The patient was initiated on 75 µg thyroxine, which was gradually increased during follow-up. Four months after initial presentation the echocardiographic resolution of the pericardial effusion was sub-optimal and required a second elective pericardiocentesis to exclude a possible infective cause. Pericardial fluid analysis revealed an exudate with normal ADA and once again no bacterial (including mycobacterial) growth. The patient was still biochemically hypothyroid, and this was attributed partially to sub-therapeutic dosages of T4, as well as poor adherence to therapy. No alternative aetiologies for the pericardial effusion could be identified and the patient did not receive any additional medication such as anti-TB drugs. The effusion showed near-complete resolution on follow up at eight months; she is currently asymptomatic and biochemically euthyroid.



**Figure 1:** PA Chest x-ray demonstrating enlarged cardiac shadow with globular appearance.



**Figure 2:** ECG demonstrating electrical alternans and low-voltage QRS complexes.

### Case 3

A 70-year-old male presented to the EU with a background medical history of essential hypertension and osteoarthritis. He complained of exertional dyspnoea (NYHA Grade 3), which had progressively worsened over the preceding three weeks. He also reported central, poorly localised chest discomfort that radiated to his back. He was HIV negative and he had no prior history of tuberculosis or recent TB contacts. He did have a history of longstanding constipation. On examination he was bradycardic (52 bpm), with a respiratory rate of 18 breaths per minute and a blood pressure of 145/90 mmHg. He had a raised JVP and soft heart sounds on auscultation. The CXR revealed a marked increase in cardio-thoracic ratio with a globular cardiac shadow. Apart from marked delay in the relaxation phase of his deep tendon reflexes, the rest of the examination was normal. ECG confirmed sinus bradycardia, low-voltage QRS complexes and electrical alternans in standard lead II. TTE confirmed a 3.5 cm pericardial effusion with apparent diastolic right ventricular (RV) collapse, suggesting early tamponade. Subsequently a pericardiocentesis was performed and two litres of golden-brown, shimmering fluid was aspirated. Hypothyroidism was confirmed biochemically: TSH 29.82 mIU/l and free T4 2.5 pmol/l. Pericardial fluid analysis revealed an exudate with protein 61 g/l, LDH 249.0 U/l. ADA was normal at 14.4 U/l. Microbial growth (including mycobacterial) was absent and there were no malignant cells on cytology. The patient was initiated on 75 µg thyroxine.

Three months after his initial presentation the patient was euthyroid with no evidence of a recurrent pericardial effusion.

### Discussion

Pericardial effusion is a fairly common condition with a wide range of aetiologies, e.g. tuberculosis, malignancy, viral aetiologies and serositis as part of an auto-immune disease such as systemic lupus. Large pericardial effusions are decidedly unusual in hypothyroidism and cardiac tamponade is a very rare

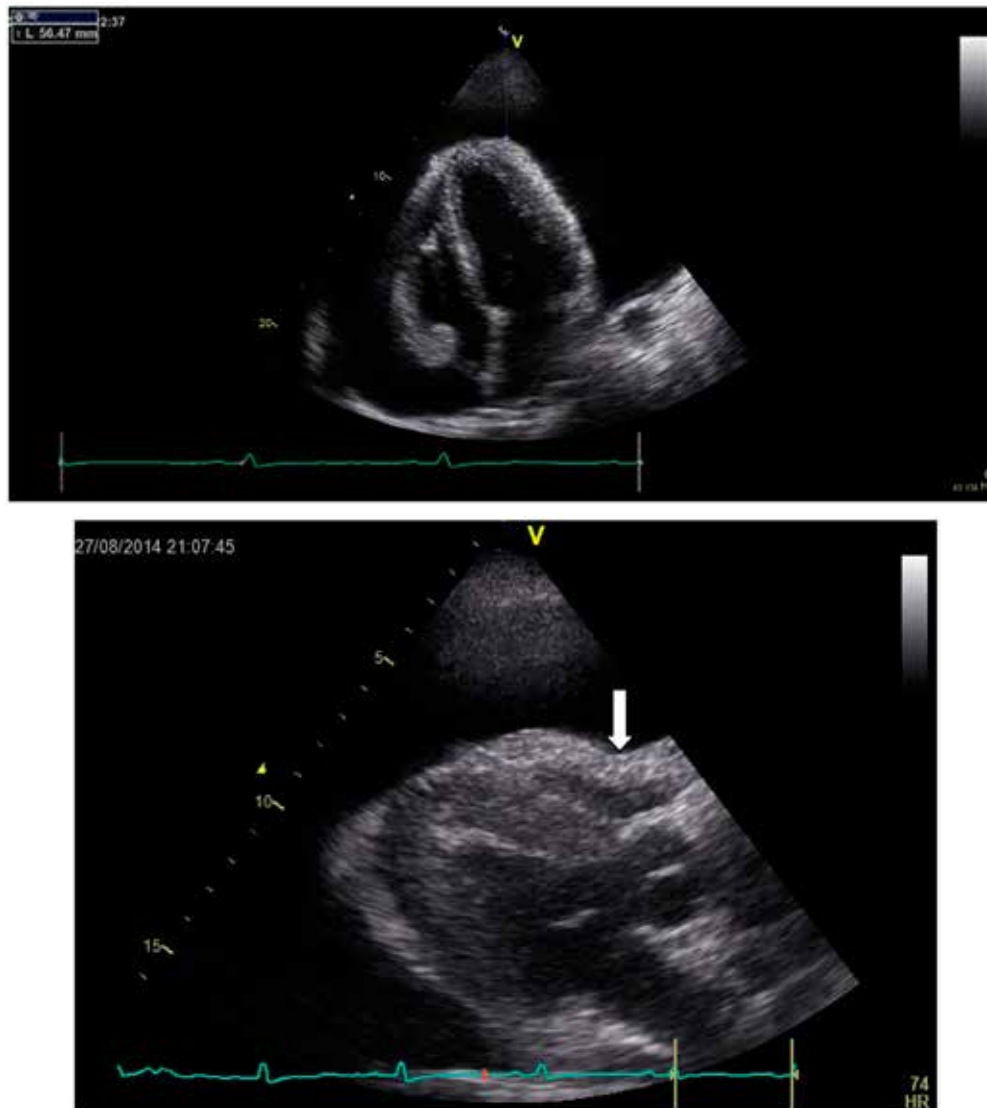
presentation of hypothyroidism. Here we report on three newly diagnosed and significantly hypothyroid patients presenting with large pericardial effusions, within months of each other. All of them required pericardiocentesis for tamponade.

Pericardial effusions are well described in hypothyroidism, with prevalence ranging from 3% in mild disease up to 80% in overt hypothyroidism.<sup>1</sup> Most of these effusions are small and not clinically significant, but infrequently large effusions may be a presenting feature in patients with hypothyroidism. In our local clinical setting the diagnosis of pericardial effusion being due to hypothyroidism (even in a hypothyroid patient) remains a diagnosis of exclusion, as other causes are far more commonly seen. In particular, tuberculous pericarditis has to be excluded given the high prevalence of the disease in the Western Cape.

Hypothyroid pericardial effusions large enough to cause haemodynamic instability are extremely rare; the incidentally discovered, haemodynamically insignificant pericardial effusion is usually the norm. Chronic stretching of the pericardium permits relaxation of elastin fibres, which are interspersed within the layers of collagen in the normal pericardium.<sup>2</sup> In hypothyroidism it is suggested that the pericardial fluid accumulates at such a slow rate that the distensibility of the pericardial sac compensates for the increase in volume and intra-pericardial pressure. The degree and duration of hypothyroidism seem to be the main determinants of the amount of fluid that accumulates in the pericardial sac.<sup>3</sup> In general the rapidity of fluid accumulation in the pericardial space is a greater factor in the development of clinically detectable cardiac tamponade than the absolute volume. In rapidly accumulating effusions, the non-compliant parietal pericardium causes intra-pericardial pressure to rise rapidly and exceed that of the low-pressure right-sided cardiac chambers, with ensuing cardiac tamponade. The term 'Gold Paint Effusion' has been used to describe the golden-brown shimmering appearance of the pericardial fluid in hypothyroidism as seen in case 3. The precipitation of cholesterol crystals is thought to be responsible.<sup>4</sup>

Classic clinical signs of pericardial tamponade (Beck's triad) include elevation in JVP, hypotension and soft heart sounds. This triad was originally described in traumatic pericardial haemorrhage, and need not be present in medical patients, whose effusions often accumulate gradually, with evidence of pericardial tamponade only present on echocardiography. The full clinical triad is also only present in a minority of cases of acute cardiac tamponade, but is considered pathognomonic if present.<sup>5</sup> In addition, tachycardia is usually present in an attempt to maintain cardiac output.

Thus, cardiac tamponade is best considered as a spectrum of severity of cardiac compression, leading to decreased filling of



**Figure 3:** (a) Apical four-chamber TTE view demonstrating a large circumferential pericardial effusion measuring 5.6 cm at the apex at end-diastole. (b) Parasternal long-axis view in the same patient revealing early diastolic collapse of the right ventricular outflow tract (arrow).

the heart and its various consequences.<sup>6</sup> Echocardiographic features such as early diastolic collapse of the right ventricle, as well as collapse of the right atrium, are sensitive and specific signs that appear relatively early in the course and often precede the clinical findings.<sup>7</sup> Right atrial collapse is an oversensitive finding as it is a thin-walled, low-pressure chamber that often becomes compromised before the clinical onset of tamponade. In a large prospective study, where clinical tamponade was the reference standard, the absence of any chamber collapse on TTE had a high negative predictive value (92%), whereas the positive predictive value was lower (58%).<sup>8</sup> Pericardial tamponade thus remains a clinical diagnosis with the hallmark sign being a pulsus paradoxus > 10 mmHg during tidal volume inspiration. The value of TTE is to confirm the presence of an effusion, the haemodynamic effects thereof and the safest route for needle aspiration.

Some points from these cases are worth emphasising. All three cases had a bradycardia (or normal heart rate) despite having a significant pericardial effusion. An interesting observation is that the second patient initially did not have a sinus bradycardia like the first case. Her initial pulse rate of 70 probably reflects a 'blunted tachycardic response' to her haemodynamic state (tamponade), which was affected by her metabolic state of

hypothyroidism. In a recent publication by Wang *et al.* the heart rates of patients as a result of hypothyroidism were also found to be significantly lower than control patients with cardiac tamponade ( $80.75 \pm 13.45$  bpm versus  $112.75 \pm 12.87$  bpm,  $p < 0.01$ ).<sup>9</sup> The mechanism of bradycardia in cases of tamponade due to hypothyroidism as opposed to the tachycardia encountered in other conditions is explained by a decrease in sympathetic activity despite the decrease in cardiac output.<sup>10</sup>

All three cases had an exudative pericardial effusion. The mechanism proposed for the exudative nature of pericardial fluid in hypothyroidism is extravasation of mucopolysaccharides into the pericardial space, coupled with increased capillary permeability, decreased lymphatic drainage, and increased retention of salt and water.<sup>11</sup>

Drainage of large effusions due to hypothyroidism depends on the haemodynamic state of the patient. All patients with tamponade require urgent drainage. Various authors have noted recurrence after drainage, as in our second case. Whether initially drained or not, continuous treatment with thyroid replacement usually leads to resolution of the effusion within 2–12 months.<sup>12</sup>

## Conclusion

The clinical features of hypothyroidism can be subtle and the diagnosis is often delayed. A haemodynamically insignificant pericardial effusion and unremarkable clinical symptoms are not infrequently seen in this setting. Therefore, hypothyroidism should be ruled out in all patients with an unexplained pericardial effusion. The corollary is that, in hypothyroid patients, other more common causes of a pericardial effusion should be excluded. In patients with a large pericardial effusion due to hypothyroidism cardiac tamponade may be present without significant tachycardia.

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