CASE REPORT

Thyroid storm following suicide attempt by hanging

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SUMMARY

A 19-year-old woman with asphyxiation complicated by cardiac arrest, following an unsuccessful suicide attempt by hanging, developed an uncommon complication of trauma-induced thyroid storm. She was initially admitted to the intensive care unit intubated and mechanically ventilated for postcardiac arrest management. Investigation of thyroid storm was pursued after the patient was noted to be persistently hypertensive, tachycardic and agitated despite high levels of sedation. Thyroid function tests confirmed the clinical suspicion of progressive thyrotoxicosis, with associated imaging consistent with thyroid inflammation secondary to band-like traumatic pressure to the lower half of the thyroid gland. Treatment with β -blockers and a thionamide resulted in the eventual resolution of her thyroid storm state and normalisation of her thyroid function. We conclude that traumatically induced thyroid storm should be considered in all hypermetabolic patients following blunt neck injuries including hanging, and that traditional treatment of hyperthyroidism can be successfully applied.

BACKGROUND

Hyperthyroidism and thyroid storm can lead to significant complications particularly in a critically ill patient if not diagnosed or treated in an appropriate fashion. Most often a precipitating event such as infection, surgery or medications provokes this state of hyperthyroidism. Traumatic insults, especially those focused around the neck, have been reported to precipitate hyperthyroidism and even thyroid storm.^{1–5} The blunt traumatic nature of hanging can result in microscopic changes to the thyroid gland indicative of inflammation, as well as elevated levels of thyroid hormones as seen in post-mortem examinations.^{6,7}

Here we describe the first report of thyroid storm after a suicide attempt by hanging. The diagnosis was supported by clinical signs of thyroid storm, confirmed by laboratory investigations and radiological evidence of band-like trauma to the thyroid gland. Therefore, thyroid storm should be considered in all hanging victims that show physiological evidence of hyperthyroidism.

CASE PRESENTATION

A 19-year-old woman was admitted to the intensive care unit (ICU) following a suicide attempt by hanging that was complicated by postasphyxiation cardiac arrest. She was estimated to have been hanging for up to 10 min prior to being removed from the ligature around her neck that had been prepared from a scarf (based on the review of her last cell phone text messaging times to her

boyfriend). She was found pulseless; however, she had return of spontaneous circulation after 10 min of cardiopulmonary resuscitation by emergency responders involving cardiac compressions and one defibrillation for a ventricular dysrhythmia.

Collateral medical history revealed a previous suicide attempt by polypharmacy overdose along with polysubstance abuse including marijuana and amphetamines. Postrecovery review of systems did not reveal any symptoms to suggest hyperthyroidism prior to presentation. She was not taking any regular medications and had no known drug allergies. There was no family history of autoimmune disorders or hyperthyroid conditions.

Initial physical examination in the emergency department following resuscitation for out of hospital cardiac arrest revealed an unresponsive, tachycardic, hypertensive woman with an erythematous injury on the anterior neck ([figure 1](#)). No evidence of proptosis or a palpable goitre on head and neck examination was found. As treatment for her cardiac arrest the patient underwent therapeutic hypothermia to 33°C (91.4°F) for 24 h using an intravascular cooling device.

Despite hypothermia, sedation and paralysis her tachycardia and hypertension persisted. After rewarming to eutermic body temperature her symptoms began to include severe agitation and hyperthermia. She had reasonable neurological recovery over the next several days to allow consideration of extubation; however, she had persistent agitated delirium and hyperthermia as well as hypertension and tachycardia that prevented her from being successfully extubated.

INVESTIGATIONS

Laboratory tests obtained at presentation in the emergency department revealed a low thyroid stimulating hormone (TSH) (<0.01 mIU/L). Free T3 and T4 were initially within normal limits and slightly elevated respectively, but both values rose progressively to beyond twice the normal limit within 2 weeks ([table 1](#)). TSH levels remained undetectable (<0.01 mIU/L). Alternative causes of hyperthyroidism were investigated and none were found. Specifically TSH receptor antibodies were within normal clinical limits, and her β -human chorionic gonadotropin (hCG) was normal.

CT of the head and neck demonstrated a diffusely enlarged thyroid gland with mildly lobulated appearance and slightly heterogeneous density consistent with traumatic thyroid injury. The isthmus was prominently thickened ([figure 2](#)). An ultrasound was ordered to further characterise the gland and confirmed the enlargement of the lower lobes and isthmus (measuring 1.1 cm in thickness). The

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Figure 1 Anterior neck injury.

echotexture was heterogeneous. The superior aspects of both thyroid lobes were normal (figure 3).

DIFFERENTIAL DIAGNOSIS

Alternative diagnoses such as thromboembolism and drug toxicity were ruled out with appropriate imaging and laboratory investigations. Hypoxic encephalopathy was likely contributing to her agitated delirium but was not thought to be an explanation for her ongoing tachycardia, hypertension and hyperthermia. Significant hypoxic brain injury as a cause was ruled out by serial CT imaging of the brain that did not show radiographic injury.

TREATMENT

Once the diagnosis of thyroid storm was confirmed, β -blocker therapy using propranolol was initiated for symptomatic control of her hypertension, tachycardia and agitation. Consultation from an endocrinology specialist as a second opinion was also sought and they also supported the diagnosis of hyperthyroidism. Based on their opinion methimazole was also initiated. With treatment her agitated delirium improved and her hypermetabolic syndrome resolved. She was successfully extubated and went on to have a favourable neurological recovery. Prior to discharge from ICU she was fully conversant and mobilising with no major neurological deficits noted. Cognitive testing and further rehabilitation were prescribed. While on the neuro-rehabilitation unit she was evaluated by psychiatry with a full assessment of her mental health and the causative reasons for her suicide attempt were explored.⁸ Based on this assessment it was felt that she was at lower risk for harming herself again.

Table 1 Biochemical laboratory values suggesting hyperthyroidism. TSH, thyroid stimulating hormone

Post admit day	TSH Normal (0.2–4.0 mIU/L)	Free T3 Normal (3.5–6.5 pmol/L)	Free T4 Normal (10–25 pmol/L)
1	<0.01	Not Checked	Not Checked
5	<0.01	5.5	28.6
14	<0.01	12.1	54.4
18	<0.01	10.1	67.9
25	<0.01	Not Checked	46.2

Figure 2 CT scan: enlarged inferior aspect of thyroid gland (denoted by black arrow).

OUTCOME AND FOLLOW-UP

Symptomatic control of thyroid storm was achieved early on after the initiation of β -blocker therapy. Methimazole was successful in normalising her laboratory abnormalities during a lengthy stay on the neurorehabilitation unit.

DISCUSSION

Death by suicidal hanging is thought to be a result of direct neurological injury, mechanical constriction of the neck vessels or cardiac arrest caused by stimulation of the vasoactive centres of the great vessels.⁹ If a patient survives the initial insult, the clinical assessment shifts to searching for structural injuries that may have resulted from the traumatic event. The neck is a fixed structure containing the trachea, oesophagus, spinal cord and vital vessels, along with the thyroid gland. Traumatic injuries to the neck, blunt and penetrating, have previously been shown

Figure 3 Ultrasound: enlarged isthmus (denoted by black arrow).

to cause thyroid storm and specifically hanging has been shown to cause microscopic changes of the thyroid gland in post-mortem analysis.^{6 7} From this we can conclude that hanging is consistent with a mechanism of injury that can directly result in traumatically induced thyroid storm. We present the first published case report of hanging induced thyroid storm.

Thyroid storm is a clinical diagnosis suggested by tachycardia, fever, agitation and gastrointestinal upset along with the typical physical examination findings of hyperthyroidism. Untreated thyroid storm can result in significant morbidity and mortality.¹⁰ The hypermetabolic state induced by elevated thyroid hormone levels, particularly in a patient with a potential traumatic brain injury, could be potentially catastrophic. In the case presented there was clinical, biochemical and radiological evidence of a hyperthyroid state. The management should be multidisciplinary and include the care of an endocrinologist. Primary treatment consists of β -blockers to control the signs and symptoms along with a thionamide to inhibit additional formation of thyroid hormones. In our case, the patient responded to stand-

ard care with β -blockers initially and the initiation of methimazole. This helped resolve her hypermetabolic syndrome and hyperactive agitation allowing her successful extubation.

In conclusion, non-lethal hanging can cause direct injury to the thyroid gland and result in thyroid storm. This is a clinically significant diagnosis with potentially severe consequences if not diagnosed and treated promptly, and thus should be considered in all patients with unexplained hypermetabolism. Traumatically induced thyroid storm should respond to standard therapy for hyperthyroidism.

Contributors JMS, BB and KP have contributed to the collection of data, writing and approval of the final submitted version.

Competing interests None.

Patient consent Obtained.

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Learning points

- Thyroid storm is an important consideration in hypermetabolic patients following blunt neck trauma.
- Suicidal attempt by hanging places the thyroid gland at risk for traumatically induced thyroid storm.
- Critically ill patients, in particular those with traumatic brain injuries, can suffer significant complications if hyperthyroidism is not diagnosed or treated appropriately.
- Response to standard hyperthyroid medication is efficacious in our experience with traumatically induced thyroid storm.

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