Hypothyroid-induced acute compartment syndrome in all extremities

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Abstract

Acute compartment syndrome (ACS) is an uncommon complication of uncontrolled hypothyroidism. If unrecognized, this can lead to ischemia, necrosis and potential limb loss. A 49-year-old female presented with the sudden onset of bilateral lower and upper extremity swelling and pain. The lower extremity anterior compartments were painful and tense. The extensor surface of the upper extremities exhibited swelling and pain. Motor function was intact, however, limited due to pain. Bilateral lower extremity fasciotomies were performed. Postoperative Day 1, upper extremity motor function decreased significantly and paresthesias occurred. She therefore underwent bilateral forearm fasciotomies. The pathogenesis of hypothyroidism-induced compartment syndrome is unclear. Thyroid-stimulating hormone-induced fibroblast activation results in increased glycosaminoglycan deposition. The primary glycosaminoglycan in hypothyroid myxedematous changes is hyaluronic acid, which binds water causing edema. This increases vascular permeability, extravasation of proteins and impaired lymphatic drainage. These contribute to increased intra-compartmental pressure and subsequent ACS.

INTRODUCTION

Acute compartment syndrome (ACS) is an uncommon complication of uncontrolled hypothyroidism. If unrecognized and left untreated, can lead to ischemia, necrosis and potential need for amputation [1]. To our knowledge, we present the first reported case of hypothyroid-induced compartment syndrome in all four extremities.

CASE REPORT

A 49-year-old female presented with the sudden onset of bilateral lower and upper extremity swelling and pain. Several days after the onset of symptoms she was evaluated in the emergency department. She initially was started on oral antibiotics for presumed cellulitis and sent home. Her symptoms persisted, necessitating the use of a wheel chair for mobility, prompting her to return to the emergency department. Pertinent past history involves the patient discontinuing levothyroxine 3 months prior. She denied any trauma, excessive exercise/muscle use or alcohol consumption. She had noticed an increasing hoarseness to her voice.

Physical examination demonstrated bilateral pretibial myxedema with similar skin changes to the extensor surface of the forearms. The lower extremity anterior compartments were painful and tense. Posterior compartments were soft and non-tender. Paresthesias were present. Dorsiflexion was absent on the right lower extremity and weak on the left. There was pain with passive motion bilaterally. Pulses were equal and symmetric. The extensor surface of the upper extremities exhibited swelling and pain. Sensory was intact. Motor function was intact, however, limited due to pain. Pulses were equal and
symmetric. Laboratory values were as follows: Thyroid-stimulating hormone (TSH) 164.73 uIU/ml (0.4–5 uIU/ml), creatine kinase (CK) 13 977 IU/l (25–200 IU/l) and myoglobin 602 ng/ml (0–115 ng/ml).

Given her presentation, bilateral lower extremity fasciotomies were performed. This revealed nonviable muscle in the right anterior and lateral compartments and viable muscle in the left. Postoperative Day 1, upper extremity motor function decreased significantly and paresthesias occurred. She therefore underwent bilateral forearm fasciotomies. This revealed viable muscle in the dorsal compartments on the right and ischemic changes to the left forearm. Postoperatively, the CK levels and sensation returned to baseline. The right lower extremity was left with a foot drop.

DISCUSSION

Bilateral compartment syndrome secondary to hypothyroidism is exceedingly rare, and typically found unilaterally [1]. In our PubMed review of the literature, we have found three cases of ACS attributed to hypothyroidism [1–3]. Thacker et al. reported on a 40-year-old hypothyroid male who developed bilateral anterior tibial compartment syndrome (ATCS). He underwent fasciotomy to decompress the anterior tibial compartments [3]. In the report by Hsu et al., a 33-year-old female patient with undiagnosed hypothyroidism developed unilateral left lower extremity compartment syndrome, and underwent four-compartment fasciotomy [2]. Hariri et al. reported a 60-year-old male patient who was noncompliant with levothyroxine and developed bilateral lower extremity anterior compartment syndrome, relieved by four-compartment fasciotomy [1]. A further case by Ramadhan et al. reported on a patient that developed rhabdomyolysis and common peroneal nerve compression after thyroid hormone withdrawal in preparation for thyroid ablation [4]. Through our review, this is the only case of a hypothyroid patient developing compartment syndrome necessitating surgical intervention in all four extremities.

Hypothyroidism can lead to numerous complications involving the muscle [4]. Manifestations of myopathy secondary to hypothyroidism include myalgias, rhabdomyolysis, myxedema, pseudohypertrophy and ACS [4]. Bilateral ATCS occurs in <10% of reported ATCS cases [5]. The causes of compartment syndrome can be classified as causes that either increase compartment contents, such as trauma and edema, or restrict compartment volume, such as ill-fitted orthopedic casts [1, 2, 5]. The most common cause of compartment syndrome is trauma, due to fractures, crush or vascular injuries, or severe burns [6]. Spontaneous compartment syndrome can be seen, generally secondary to diabetes mellitus or hypothyroidism among other causes [6]. The bilateral presentation of ACS points to a systemic etiology [1]. Clinical findings such as pretibial myxedema, the discontinuing usage of her thyroid medication, the change in the patients voice, as well as the laboratory findings all point to hypothyroidism as the cause of the patients ACS.

Compartment syndrome develops when the intra-compartmental pressure (ICP) increases until it impedes tissue perfusion [6]. As pressure increases, ischemia and subsequent necrosis occur [1, 6]. In patients with hypothyroidism, the volume needed to observe ischemic changes may be much less. Experimental animal models have demonstrated 40% less volume needed to increase ICP [3].

The pathogenesis of hypothyroidism-induced compartment syndrome is unclear, but several theories exist. TSH-induced fibroblast activation results in increased glycosaminoglycan synthesis and deposition in the epidermis, dermis, smooth muscles and skeletal muscle [1, 2, 4]. T3 and T4 deficiencies also inhibit degradation of glycosaminoglycans [2, 4]. The primary glycosaminoglycan in hypothyroid myxedematous changes is hyaluronic acid, which binds water to cause edema [2, 4]. This can also lead to increased vascular permeability, extravasation of plasma proteins into the interstitial space, and impaired lymphatic drainage [2, 4, 5]. All of these factors can contribute to increased ICP and subsequent ACS. In some cases, compartment syndrome secondary to hypothyroidism may be caused by ‘pseudohypertrophy’ of the muscle itself, also known as Hoffman’s syndrome. About 1% of myxedema cases are caused by muscle hypertrophy [2, 3, 5].

Contributing to the patient’s compartment syndrome was also likely rhabdomyolysis secondary to hypothyroidism. In rhabdomyolysis, the CK levels are generally >1500 IU/l [5]. This is consistent with the patient’s acute elevation of CK (13 977 IU/l). However, rhabdomyolysis-induced hypothyroidism generally occurs alongside precipitating factors like trauma or statin use, which are absent in this patient’s case [5–6].

This is a rare case of compartment syndrome in all four extremities, secondary to myxedematous changes of hypothyroidism. ACS typically affects the anterior and lateral compartments [2], as seen in our patient. Early recognition, whether from trauma, burns, medications or the rare cause of hypothyroidism is paramount. Delay in diagnosis and treatment can lead to lifelong disability from foot drop, paresthesias or limb loss.

CONFLICT OF INTEREST STATEMENT

None declared.

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