Volkmann Ischemic Contracture Due to Traditional Practice
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Abstract
An 11-year-old boy presented with three days’ history of blunt trauma to the left shoulder due to a fall to the ground. The boy was taken to the traditional practitioner, who applied a very tight bandage over a piece of cartoon on the upper left humerus, which resulted in progressive pain and swelling of the whole left upper limb and impairment of movement and sensation. The tight bandage was removed after 48 h and fasciotomy was performed at Aljamhuri Hospital in Taiz, Yemen. The child was brought to our hospital after the family was informed about the need for left forearm amputation. We performed four sessions of debridement of the dead muscles and soft tissues of the flexor and extensor compartments of the left upper limb. After three months, the left upper limb healed with fixed flexor contracture of the elbow and wrist joint. Manipulation and release of adhesions and subsequent skin grafting was performed and the elbow joint was kept in extension, the wrist in the neutral position, and the interphalangeal joints in flexion. Although the limb was saved, its aesthetic appearance was retained, and some sensation was achieved, the lost motor function of the forearm (including the hand) was irreversible.

Key Words
Compartment syndrome • Volkmann ischemic contracture • Fasciotomy • Debridement • C-reacting protein

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Introduction
Compartment syndrome (CS) results from increased pressure within a specific anatomical region. It can affect any part of the body, including the abdomen and extremities, and may lead to organ failure [1]. Different causes of it and methods of diagnosis have been identified, and the great advantage of prevention is well documented and highlighted in the literature. Currently, the most effective treatment for established compartment syndrome is surgical decompression [2]. One serious consequence of CS affecting extremities is Volkmann ischemic contracture (VIC). This may be congenital or acquired due to trauma or the application of a tight tourniquet, splint or cast around the affected limb [3]. Supracondylar humerus fracture is associated with CS; about 8% of these severely displaced fractures are characterized by vascular complications, and urgent anatomical reduction is needed to avoid CS [4]. VIC is a rare problem in developed countries due to the presence of an advanced health infrastructure and prevention facilities based on early detection and treatment of the underlying cause. However, the picture is different in developing nations, where VIC can still result in loss of limb function due to the presence of an advanced health infrastructure and prevention facilities based on early detection and treatment of the underlying cause. However, the picture is different in developing nations, where VIC can still result in loss of limb function due to the completely avoidable pathology. The strategy for managing CS and its consequences (VIC) has seen significant progression in recent years. Different approaches have been shown to be effective and approved for CS treatment.

In this work, we report a case in which we were involved in part of the management. The aim is to show the impact of the poor knowledge of traditional practitioners, especially in rural areas of Yemen. We also discuss what can be done to treat an established Volkmann ischemic contracture.

Case Report
An 11-year-old boy sustained a blunt trauma to the left shoulder by falling to the ground in a village near Taiz, Yemen. Because of traditional beliefs, the family...
took the boy to the traditional practitioner, who manipulated the left shoulder, which was suspected of being dislocated, and applied a very tight bandage over pieces of wood and cartoon. This was kept on for two days before the child developed severe pain and swelling of the affected limb, but this was explained by the traditional practitioner as being expected after such trauma. The child was then taken to a government hospital, where the bandage was removed and fasciotomy was performed, and the family was told about the need for left forearm amputation. The parents refused the proposed amputation, and the child was brought to our hospital on the third day following the trauma. On examination, his temperature was 37.9 °C, his pulse rate was 105 min⁻¹, and his blood pressure was 100/55 mmHg. Local examination revealed ecchymosis at the site of the bandage, swollen whole left upper limb, loss of sensation and paralysis. Radial pulsation was present but weak.

Investigations showed: hemoglobin: 9.0 g/dl, white cell count (WCC): 13,000 mm⁻³, C-reactive protein (CRP): 57 iu/l, blood urea: 32 mg/100 ml, creatinine: 1.5 mg/100 ml. X-ray of the left upper limb revealed no fracture or dislocation.

Four sessions of wound debridement including excision of dead muscles were performed. In the first session, the wound was bandaged lightly (not circumferentially) and nursed in a raised position. The patient received a broad-spectrum antibiotic and two units of blood transfusion. The second session of wound excision was performed one week later. The patient was discharged from hospital after ten days, and the third and the fourth sessions were performed as day cases two and four weeks later, respectively. Three months later, the patient developed flexor contracture of the left elbow and wrist joint. Manipulation under anesthesia was performed for both joints with release of dense fibrosis and subsequent skin grafting to cover the cubital fossa. Unfortunately, in spite of improvement in the sensation of the left upper limb, there was no obvious motor function after six months. One year later, there was no movement but the sensation was progressively improving, and by that time the boy had almost complete sensation of radial distribution, although median and ulnar nerve sensation had only recovered partially.

**Discussion**

Increased pressure within potential spaces or compartments of the body, such as the abdomen, chest, brain, orbit, and the extremities may result in CS. The main pathophysiological change is interference with the blood supply by whatever causes it. Different etiologies have been defined, including trauma, infection, inflammation, prolonged surgeries in certain fixed positions, and other less frequent causes. Because the arterial supply of the arm is unique, as the collateral circulation is particularly good [5], gangrene or critical ischemia is rare in the upper limb. However, it is crucial to diagnose CS at an early stage and to eliminate its preventable complications.

Compartment syndrome of the upper limb can result in different degrees of tissue damage, ranging from temporary impairment to total loss of function of bones, muscles, nerves, skin and soft tissues. The muscle undergoes infarction with the formation of muscle sequestrum; this is followed by a central area of necrosis with subsequent fibrosis, which leads to shortening of the muscle and deformity.

Nerves in the area of the vascular ischemia also undergo ischemic paralysis, which becomes irreversible if the occlusion is prolonged. If the occlusion is not relieved for more than 12 h, the skin and other soft tissues also undergo necrosis, resulting in sloughing or gangrene [6], as in our case (Figures 1 to 4).

In the congenital type, the baby usually has bluish discoloration of the affected limb or unilateral well-demarcated necrotic plaque, wrist edema, bullae over fingers, and flaccid paralysis at wrist [7]. A relatively small number of such cases have been published.

The commonest type of upper limb CS to be acquired usually results from trauma, such as supracondylar fracture of humerus or iatrogenic injuries such as from an overdone tourniquet, a tight cast or traditional bandage, or even careless modern surgical practice. Both sexes and all age groups can be affected. The comatose multiply injured patient, the patient under anesthesia, the very young patient, delayed presentation, and the patient with spasticity are all at high risk of developing CS and subsequent VIC [8]. The clinical findings of pain, swelling, paresthesia, paralysis, pallor and pulselessness are consistent with poor blood supply.

Blood examination will reveal evidence of acute inflammatory responses (WCC and CRP), anemia in the majority of cases, and sometimes impairment of renal function due to myoglobin deposition in the renal tubules. In our patient, the renal function was not affected, while all inflammatory indicators were raised.

The most important factor influencing the outcome of compartment syndrome is the presentation time; therefore, a low threshold for surgical exploration and fasciotomy is advocated when acute compartment syndrome is suspected on clinical grounds [9]. However, there was no correlation between the time from diagnosis to fasciotomy and residual deficits. A time as