

SHORT REPORT

Upper Arm Compartment Syndrome Secondary to Intramuscular Cocaine and Heroin Injection

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Compartment syndrome threatens the viability of a limb. We present a case of upper arm compartment syndrome secondary to an intramuscular injection of cocaine and heroin. Timely diagnosis and surgical intervention avoided extensive muscle necrosis and morbidity. This complication has not been previously reported and highlights a condition which should be considered in intravenous drug abusers presenting with arm pain.

Keywords: *Compartment syndrome; Upper arm; Substance abuse; Cocaine; Heroin; Citric acid.*

Introduction

Compartment syndrome is a condition in which increased intra-compartmental pressure results in compromised tissue perfusion and ultimately threatens the viability of the limb. It is well recognized in the lower limb but occurs infrequently in the upper limb. Intravenous drug users present to vascular surgery departments with complications secondary to venous and arterial injections, such as pseudoaneurysms and venous thrombosis. We present a case in which inadvertent intramuscular injection resulted in an isolated biceps compartment syndrome.

Report

A 43 year old man with a longstanding history of intravenous drug abuse was admitted with an acutely swollen right upper arm. Two days prior to admission he had injected his right upper arm with a mixture of heroin, crack cocaine and citric acid. On this occasion he encountered marked resistance on administration of the injection and developed swelling and paraesthesia which had failed to resolve. His previous

medical history included; bilateral ligated common femoral arteries secondary to pseudo-aneurysms, asthma, and recurrent admissions with pneumonia.

On examination he had a tense, tender swelling involving the anterior aspect of his right upper arm. There was no demonstrable transmitted pulsation within the arm and radial and ulnar pulses were palpable. His arm was held fixed in flexion at the elbow with a limited range of active movement. Additional passive extension was not possible due to pain. Full power and range of movement was intact at the wrist and hand. Laboratory investigations were unremarkable with the exception of a raised white cell count of $14.9 \times 10^9/L$. An urgent ultrasound scan of the upper limb demonstrated normal flow within the brachial artery and deep veins with no evidence of a pseudo-aneurysm. The biceps was extremely oedematous with minimal blood flow on power Doppler imaging (Fig. 1). Compartment pressures were measured at 60 mmHg in the upper arm and 8 mmHg in the forearm. With the combination of pain, limited extension, ultrasound findings and elevated pressure, a diagnosis of compartment syndrome was made. He was commenced on intravenous broad spectrum antibiotics and underwent an emergency anterior compartment fasciotomy (Fig. 2). He had an uneventful post operative course and the wound was managed with a Vacuum Assisted Closure[®] device (KCI Medical Products, Dorset, UK). Microbiology specimens did not grow any

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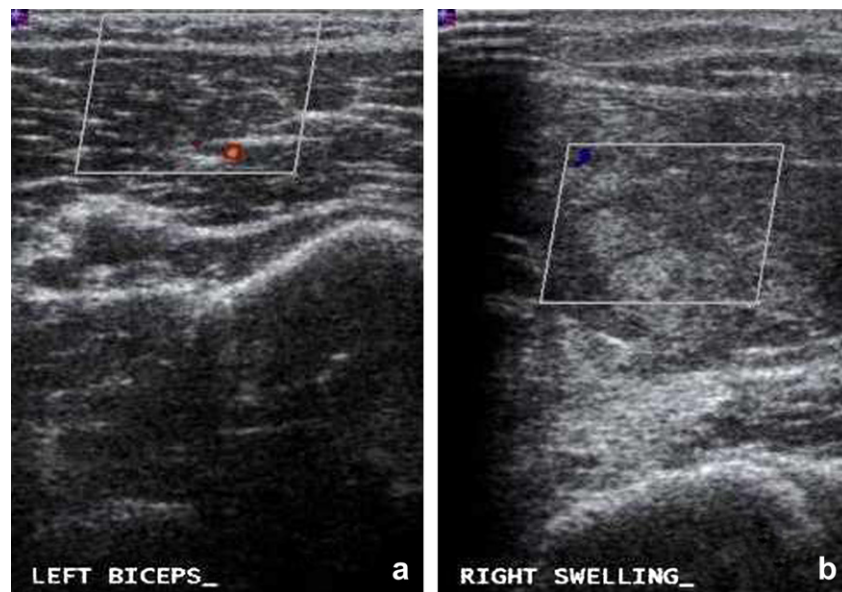


Fig. 1. Ultrasound image of the upper arms demonstrating normal flow within the left biceps (a) compared with compromised flow on the right (b).

pathogens and histology confirmed an acute myositis with focal muscle fibre necrosis.



Fig. 2. Intra-operative photograph. The anterior compartment has been incised, revealing a pale, oedematous but viable biceps brachii.

Discussion

The compartments of the upper arm are less confined than the forearm and due to the muscle attachments to the shoulder girdle the upper arm is less susceptible to the effects of elevated pressures. Compartment syndrome involving the upper limb is infrequent and predominately occurs as a result of trauma. Reported cases of biceps compartment syndrome are rare and include those secondary to non-invasive blood pressure monitoring¹ and rupture of biceps brachii.²

Compartment syndrome in this case occurred in the absence of vascular or skeletal injury. The majority of heroin and alkaloid (crack) cocaine is insoluble in water. Their conversion to a soluble, injectable form is achieved by the addition of an acid, in this case citrate.³ Other commonly used additives include lemon juice, ascorbic acid and vinegar. Along with the well documented systemic complications of substance abuse, the local sequelae include vessel injury, abscess formation and in rare cases necrotising fasciitis.⁴ It is therefore recommended that adequate specimens are sent to microbiology and appropriate broad spectrum antibiotics are commenced.

Myotoxicity as a result of local anaesthetic injection has been previously reported. Extensive tissue necrosis has occurred at solutions of lower pH and there is

also a reduction in phagocytic activity. The ongoing presence of necrotic muscle further delays regeneration.⁵ We propose in this case the administration of a local anaesthetic (alkaloid cocaine) which had been excessively acidified led to the development of acute myositis of the biceps brachii with ensuing compartment syndrome.

This mechanism is in contrast to previous reports of compartment syndrome and upper limb ischaemia as a direct result of intra-arterial injection.⁶

Conclusion

We believe this is the first report of a compartment syndrome secondary to intramuscular injection of cocaine, heroin, and citric acid. When treating intravenous drug users a detailed history must be taken in order to establish the constituents of the injection solution. This information along with clinical findings and a high index of suspicion should highlight the possibility of compartment syndrome affecting the upper arm. Prompt treatment with fasciotomy

reduces the risk of extensive muscle injury and further morbidity.

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