Acute compartment syndrome and regional anaesthesia – a case report

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Abstract

We describe the case of an adult 19 year old male with a fractured right radius. The patient underwent a revision open reduction and internal fixation due to mal-alignment under combined general anaesthesia and supraclavicular brachial plexus block. Postoperatively the patient developed disproportionately intense pain despite an otherwise fully functioning sensory and motor block. The limb was swollen, tender and there was loss of radial pulse. Upon re-exploration a large haematoma was evacuated, a bleeding vessel being the causative factor. There were no further sequellae. The hallmark of this case report is the presence of out-of-proportion pain with an odd distribution in the forearm in the presence of a dense and fully established nerve block. Acute compartment syndrome was diagnosed based on classical signs and symptoms within two hours of block performance. Appropriate treatment lead to satisfactory outcome.

Keywords: acute compartment syndrome, supraclavicular brachial plexus block, upper limb trauma, regional anaesthesia

Introduction

Acute compartment syndrome is a serious complication, usually of long bone fractures, and is associated with significant morbidity and mortality. This phenomenon occurs when pressures within a fascial compartment rise, leading to vascular compromise, local hypoxia and irreversible tissue damage. The compartments most frequently at risk are fascial compartments of the forearm [1] or leg [2].

Case report

We describe the case of a 19 year old ASA I, male, who was scheduled to undergo revision open reduction internal fixation of his right radius. He sustained a mid shaft fracture of the radius during a sport activity 12 days earlier. Due to mal-alignment of the radial plate after the initial open reduction internal fixation, he was scheduled for revision surgery. For reasons of patient comfort during a potentially long surgery, it was planned to provide combined general and regional anaesthesia.

An ultrasound guided supraclavicular brachial plexus block was performed prior to induction of general anaesthesia. Ten milliliters each of 2% lidocaine/adrenaline and 0.5% bupivacaine were deposited around the plexus. General anaesthesia was induced with fentanyl and propofol, and maintained with sevoflurane in an oxygen/air mixture. There was no response to surgical stimulus and the surgery proceeded uneventfully. Perioperatively no other analgesia was administered. At the end of surgery the patient was transferred to the recovery room. All vital parameters were stable and the patient showed no signs of discomfort. Twenty minutes after extubation, the patient complained of pain along the lateral border of the forearm, which escalated over the following 20 minutes. The patient described the pain as dull and persistent, located on the ventral aspect of the forearm and deep inside the fingers. There was sparing of the palm, the
dorsal aspect of the forearm and hand. Intravenous paracetamol 1 g, diclofenac 75 mg and morphine 10 mg was administered with no relief. Two hours post block performance the pain intensity was reported as 10/10 on a Verbal Rating Scale in spite of a demonstrably dense sensory and motor block.

The cast was examined, and was not deemed tight. The cast was however removed for full examination. The forearm was tender to touch, swollen and tense when compared to the contralateral side. There was no palpable radial pulse but the ulnar pulse was present. An immediate Doppler examination confirmed loss of radial pulse and the presence of ulnar pulse. The fingers were pale with prolonged capillary refill time. The patient was immediately moved to the operating theatre for re-exploration. General anaesthesia was induced as before. Wound exploration revealed a large haematoma. A bleeding vessel was subsequently identified and haemostasis secured. The wound was not closed, sterile occlusive dressings were applied and the patient was transferred to the recovery room. Surveillance with Doppler ultrasound confirmed the presence of both radial and ulnar pulses.

Six hours following the initial block performance, the patient’s upper limb showed signs of block resolution with partial restoration of motor function. At this point the patient described the pain, sharp in character, around the wound area but denied the pain pattern described earlier. The patient returned to the operating room two days later for delayed wound closure.

In summary, the time to clinical presentation was 20 minutes following emergence from anaesthesia, the decision of re-exploration was immediate and the time from diagnosis to definitive surgery was less than 30 minutes. Upon follow up there were no further sequellae.

**Discussion**

The use of regional anaesthesia in patients at risk of acute compartment syndrome is controversial. It is thought that the provision of analgesia, in particular regional anaesthesia, may mask the presence of acute compartment syndrome and place the patient at an unacceptably high risk of serious morbidity. The hallmark of this case is the presence of forearm pain, despite a dense, functioning sensory and motor brachial plexus block. The clinical scenario emerged within 60 minutes of emergence from general anaesthesia, with fully appreciable acute compartment syndrome in less than two hours from block initiation. The pattern of pain was unusual and originated at the lateral border of the forearm and then spread to the fingers only. The pain reported was out of proportion with that expected postoperatively despite an established neural blockade and no relief was obtained from intravenous analgesia. On examination, the limb was swollen, tender on palpation and passive movement, without a palpable radial pulse. The rapid rise in forearm compartment pressure, due to occult bleeding, lead to increasing pain intensity in a time dependent manner. This prompted clinical examination of the limb and the correct diagnosis of acute compartment syndrome in the presence of a functioning nerve block. Other important features of our case report included the presence of early signs of absent radial pulse and delayed capillary refill time, which are generally considered as late signs of acute compartment syndrome [3].

Eighteen percent of acute compartment syndromes occur in the forearm [4]. Fractures of the forearm involving the diaphysis and distal radius, male gender and age less than 35 years are identified risk factors for acute compartment syndrome in the forearm [5, 6]. Acute compartment syndrome can develop during surgery, in the immediate post op period or up to 72 hours into the postoperative period. The gold standard for diagnosis of acute compartment syndrome is the measurement of intra-compartmental pressures. In the settings where this tool has been utilised, a difference of less than 30 mmHg between the intra-compartmental and diastolic pressures has been successfully used to make a conclusive diagnosis [3, 7]. Lack of robust level 1 type evidence has rendered the classical signs and symptoms (i.e. six P’s of Pain, Pallor, Pulselessness, Paresthesia, Paralysis and Perishingly Cold) unreliable. Pain out of proportion with escalating analgesic requirements may be missed or underestimated in the setting of a functional regional anaesthetic technique. To date there has been no reported case of acute compartment syndrome after a single shot peripheral nerve block for upper limb surgery. There has been one case report of acute compartment syndrome with continuous infraclavicular catheter for surgical treatment of a complex distal humerus fracture [8]. There have been five reported cases of acute compartment syndrome with peripheral nerve blocks in the lower limb. Three of them were associated with single shot peripheral nerve blockade: a 3-in-1 block for intramedullary nailing of tibial fracture [9], an ankle block for revision foot arthroplasty for rheumatoid arthritis [10] and a femoral nerve block for intramedullary nailing of femur shaft fracture [11]. The other two case reports were associated with continuous peripheral nerve blocks; continuous sciatic and femoral nerve blocks for distal femoral and proximal tibial osteotomies [12] and a continuous popliteal catheter for left calcaneal lengthening osteotomy and percutaneous Achilles tendon lengthening [13].

The case report by Hyder et al. [9] of compartment syndrome following tibial nail surgery described evolving
symptoms of leg pain and altered sensation in the foot. The patient in this case report received a 3-in-1 block (high volume femoral nerve block). The femoral nerve, obturator nerve and lateral cutaneous nerve of the thigh do not provide motor or sensory function to the leg or the foot, thereby somewhat invalidating the assertions made in this paper. In the case report by Cometa et al. [12] breakthrough pain in the presence of a functioning block was not relieved despite restarting the local anaesthetic infusion, suggesting an underlying pathology rather than analgesic failure.

In all of these six cases the local anaesthetic used was either bupivacaine or ropivacaine. However, the most consistent feature in all these cases was the presence of pain, which was out of proportion in the presence of a functioning nerve block, and escalating requirements of analgesics. A review of 33 paediatric cases conducted at a single paediatric centre stated that escalating analgesic requirements preceded the classic acute compartment syndrome symptoms by more than seven hours [14]. The earliest diagnosis of an acute compartment syndrome in these six case reports was four hours post operatively with development of pain in the presence of a working nerve block. Interestingly, in a review by Mar et al. [15] of all cases of acute compartment syndrome with established regional anaesthetic techniques, the authors concluded that pain was present in most case reports but had been ignored in the presence of a working regional block.

Mannion et al. made sensible and practical recommendations in their review article [16]. The type of local anaesthetic, concentration and volume of local anaesthetic, use of adjuvants and selective nerve blockade should be seriously considered in high-risk patients. Development of a robust, valid, user-friendly and reliable limb surveillance system for those at high risk of developing acute compartment syndrome is of utmost importance. The use of devices to measure compartmental pressures combined with early detection, a high index of suspicion in ‘at risk’ cases and the involvement of senior decision makers may limit the attendant morbidity.

**Conclusion**

We conclude that acute compartment syndrome can present with classical symptoms in spite of a functioning brachial plexus block following upper limb trauma surgery.

**Conflict of interest / Financial Disclosure**

Nothing to declare
fragmentelor osoase. Pacientul a fost operat în anestezie combinată generală și bloc de plex brahial în abord supraclavicular. Postoperator, pacientul a prezentat o durere disproporționată de intensă în ciuda unui bloc anestezic, motor și senzitiv deplin instalat. La inspecție, antebrațul era edemațiat, sensibil și s-a constatat absența pulsului radial. La reexplorarea chirurgicală a fost evacuat un hematom voluminos rezultat prin hemostază primară incompletă. Evoluția ulterioră a fost fără sechele. Particularitatea acestui caz este dată de prezența durerii disproporționate cu distribuție ciudată la nivelul antebrațului în prezența unui bloc anestezic complet instalat. Sindromul de compartiment a fost diagnosticat pe baza semnelor și simptomelor clinice în decurs de două ore de la administrarea blocului. Tratamentul corespunzător a condus la un rezultat satisfăcător.

**Cuvinte cheie:** sindrom de compartiment, bloc supraclavicular de plex brahial, traumatisme de membru superior, anestezie regională