Case Report

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Compartment syndrome of forearm and hand as complication of prone position during neurosurgery operation

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Abstract

We present a case of compartment syndrome (CS) after neurosurgical operation where patient was 6 hours in prone position with forearm and hand beneath his chest.

Clinical signs were confirmed with measuring of intra-compartmal pressure (ICP), and fasciotomy of forearm and hand were performed. After 3 months of rehabilitation all movements and strength in hand and fingers were come back.

CS is a rare complication, but if unrecognized and untreated it can seriously damage extremities. Measuring of ICP is a simple and reliable diagnostic procedure in unclear cases and prompt fasciotomy is a salvage procedure with good results.

Key words:
Compartment syndrome; Forearm; Fasciotomy

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Case report

A 39-year-old man underwent laminectomy at C5-7 and posterior cervical decompressive fusion under general anesthesia in the prone position for six hours. During the operation, the right hand of the patient was positioned beneath his chest. Immediately after emergence from anesthesia, the patient reported severe pain of the right forearm and hand, but the pain resolved after analgesic treatment.

Initially, the radial artery pulse of the right hand was palpable, but six hours later, the patient developed severe edema of the forearm and hand, accompanied by severe pain resistant to analgesia treatment. Shortly afterwards, physical examination showed paresthesia and paralysis of the hand. The fingers were in semiflection, the patient could not do any voluntary movement, and passive movement of the hand or fingers provoked severe pain in the hand.

Based on these signs, compartment syndrome (CS) was suspected and this diagnosis was confirmed by measuring increased intra-compartmental pressure (ICP; 42 mmHg) in the thenar muscles (Fig.1).

The patient had emergency fasciotomy of the forearm and hand for compartment decompression (Fig.2). Intraoperative findings included marked swelling of the thenar muscles, absence of reaction to electrostimulation and markedly reduced bleeding, while other muscles of the forearm and hand were swollen, but had preserved reaction to electrostimulation and bleeding. Motility of all fingers except the thumb recovered immediately after fasciotomy, whereas thumb motility with limited amplitude recovered 24 hours later. The fasciotomy incisions were left open and were covered with gauze for eight days, waiting for edema to resolve.

After eight days, the ventral incision was closed with stitches, whereas the dorsal wound was covered with Thiersch's skin graft (Fig.2). Complete recovery of wounds and finger function was achieved after one month, whereas thumb movements recovered in all directions but with mildly decreased strength and amplitude. However, complete recovery of all fingers, including the thumb, was achieved after two months of rehabilitation.

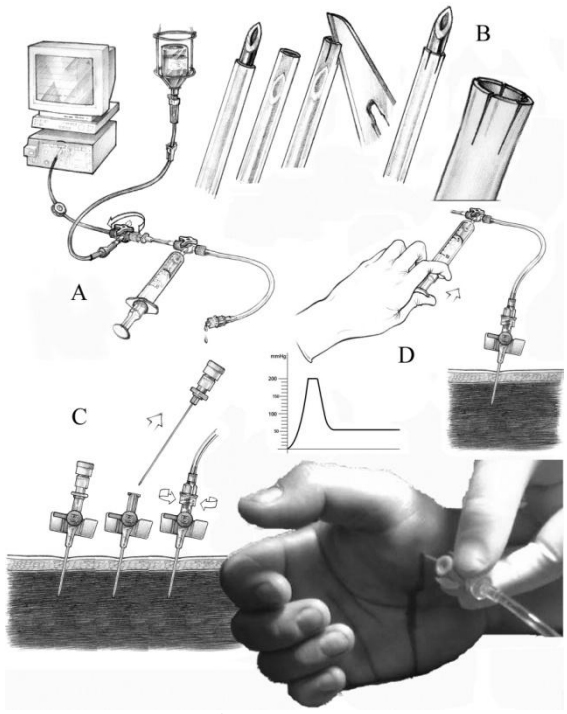

Figure 1. (A) System for ICP measurement with anesthesia monitor, and transducer; system set filled with saline and intravenous cannula. **(B)** Modified slite-catheter constructed from intravenous cannula. **(C)** Position of the catheter in muscle tissue. **(D)** Connection with system and graphic example of ICP value. Photo of catheter positioned in thenar muscles in right lower part of figure.

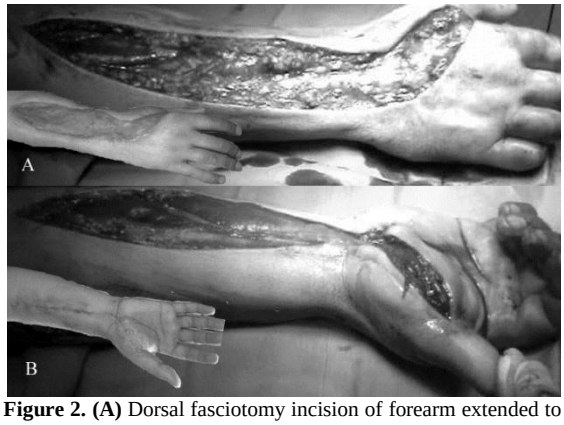

Figure 2. (A) Dorsal fasciotomy incision of forearm extended to hand (skin defect covered with Thiersch's skin graft after eight days, small photo). **(B)** Ventral fasciotomy extended to thenar (skin closed with stitches after eight days, small photo).

Discussion

CS is defined as a condition of elevated interstitial pressure inside closed osteofascial spaces with compromised microcirculation and ischemia of neuromuscular tissues. CS is frequently caused with prolonged ischemia with late revascularization, bone fractures with hematomas in muscle compartments, Crush syndrome, prolonged compression on extremities in unsual positions in unconscious drug abusers, extreme exercise, mannitol extravasation in an anesthetized patient, brachial artery cannulation, or prolonged operation in the prone position [1-6].

Big muscles of the lower limbs are more frequently involved in CS than hand muscles. CS can be the result of iatrogenic injuries, such as continuous pressure on the involved limb in patients undergoing surgery in special positions. The clinical presentation of CS includes severe pain, edema, muscle weakness, loss of sensation, pallor, and tightness in the involved limb. CS needs to be differentiated from injury to the artery, vein or nerves, bone fracture, muscle injury or soft tissue infections (phlegmon, thrombophlebitis and osteomyelitis). Although diminished pulse was in the past considered sign of CS, this actually never happens as ICP must exceed systolic arterial pressure [1-3]. Special consideration for CS diagnosis is needed in patients where clinical evaluation is difficult, such as in children, uncooperative patients, comatose or anesthetized patients, and patients with nerve deficits.

Prompt recognition of CS in the immediate postoperative period is essential for preventing muscle and nerve necrosis. Interstitial pressure measurement is an easy and reliable method for CS diagnosis. Based on previous studies, normal ICP is considered as 4 ± 4 mmHg [7-9]. Compartment pressure exceeding 30 mmHg and lasting longer than six to eight hours are associated with neuromuscular tissue necrosis and chronic functional defects, including sensory deficit, motor weakness and contractures [7, 8]. Unfortunately, limb amputation is inevitable if extensive muscle necrosis develops in cases where revascularization was delayed (after 12 hours of CS duration)[1-3].

There are several techniques for ICP measurement [7, 8, 10, 11]. In the present case we used the modified slite-catheter (Fig.1) which – based on previously published cases [1-3] – proved to be practical. This catheter can be made under sterile conditions from a 1.1 mm diameter cannula, by making four small cuts on the cannula top. These small cuts prevent blockage of the cannula by muscle tissue and provide capillary spaces for free passage of fluid from the interstitial space to the measuring system. We used a Datex-Engstrom anesthesia monitor (GE Healthcare, USA) for arterial pressure measurement.

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Advantages of this technique include simplicity, no need for additional equipment, and feasibility in any intensive care unit or small hospital, so that there is no need for involvement of experienced surgeons [1-3]. ICP > 30 mmHg is indication for immediate decompression with fasciotomy. Fasciotomy allows acutely swollen muscles to bulge through the divided fascia, thereby relieving the pressure on the neurovascular bundle.

In our case, the patient was positioned prone for more than six hours, with hand and forearm under the pressure of his chest. Although the proper position of the hand should be under the abdomen, the hand was accidentally moved beneath chest and under its pressure. Therefore, meticulous attention to proper positioning is essential in order to avoid pressure on limbs during long surgical procedures.

Conclusion

Misguided positioning of the hand position beneath the chest, instead of beneath the abdomen during prolonged procedures in the prone position may result in CS. Meticulous attention to patient positioning is recommended in patients undergoing surgery in the prone position, in an attempt to minimize the risk of patient injury. When there is clinical suspicion, interstitial pressure measurement is a safe and precise method for diagnosing CS, and prompt fasciotomy is limb saving in cases of confirmed compartment syndrome.

Competing interests

The authors declare that this study was not financially supported by any funds and that there are no conflicts of interests regarding to the content of this article.

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