Rhabdomyolysis complicating non-invasive blood pressure measurement

Sir,

A 48-year-old man with difficulty in micturition, diagnosed as stricture urethra, was scheduled for anastomotic urethroplasty. The patient had sustained pelvic fracture following blunt injury to the abdomen 1 year before the day of surgery. His pre-operative assessment revealed an ASA grade I patient weighing around 76 kg. The airway assessment was a Mallampatti of class III. His blood investigations, ECG and chest X-ray were normal. On the day of surgery, the patient was kept fasting and oral diazepam 10 mg and metoclopramide10 mg were given as pre-medication. A general anaesthetic along with an epidural was planned. The patient was brought to the operation room (OR) and connected to monitors – a pulse oximeter, non-invasive blood pressure monitor (NIBP) and ECG. The epidural was sited at the lumbar level L3-L4 and confirmed with a test dose of 3 mL 2% injection lignocaine with 15 μg injection adrenaline. The patient was then induced with injection thiopentone sodium 250 mg and injection fentanyl 100 μg. Injection vecuronium 7 mg was used for intubation. Anaesthesia was maintained with isoflurane 2% in air and oxygen mixture. Analgesia was maintained with 0.25% bupivacaine through the epidural and morphine 5 mg intravenously. The surgery lasted for 6 h as the procedure became complicated and there was increased bleeding. The blood loss was around 1 L, which was replaced with colloids and blood. The patient was haemodynamically stable. At the end of the surgery, the patient was extubated fully awake. On awakening, the patient complained of severe pain in the right upper limb where the blood pressure cuff was placed. The blood pressure was measured every 3 min during the 6-hour surgery. The patient could not lift the arm, but there was no numbness in the limb. The peripheral pulses in the limb were palpable.

To alleviate the pain, injection fentanyl 50 μg was given intravenously along with morphine 5 mg, but the pain did not seem to subside. There was a drop in blood pressure 15 min after extubation to 70 mmHg systolic. The patient was given vasopressors and fluids to treat the hypotension. An arterial blood gas sample was sent, which showed a mild metabolic acidosis pH of 7.32 bicarbonate of 18 and lactate of 3.8. The patient was shifted to a high-dependency unit (HDU) for further monitoring. In the HDU, a Doppler was done to rule out a vascular cause for the pain, and it was normal. A 12-lead ECG was done, which showed no new changes from the pre-operative findings. Because the pain still persisted, an enzyme profile was done consisting of creatine phosphokinase (CPK), CPKMB and troponin T. The CPK was 13, 074, CPK MB 194.7 and troponin T10.86. The patient was suspected to have developed crush syndrome and was treated according to the crush protocol. Injection Mannitol was given along with sodium bicarbonate infusion with monitoring of urine pH. The patient was kept in the HDU for 3 days and the CPK was followed-up everyday, which decreased from initial values of 9273, 3780 to 1576 on the third day. The urine pH also increased to 7.8 when the infusion was stopped on the third post-operative day. He was later shifted to the ward and discharged after 6 days of hospital stay.

DISCUSSION

The ASA on the standards of basic monitoring in anaesthesia recommends all patient receiving anaesthesia should have arterial blood pressure and heart rate monitored at least every 5 min. The automated NIBP is a valuable monitor in this aspect.[1] The monitor can be set at frequent and regular intervals for blood pressure measurement. The principle by

which the blood pressure is measured is oscillometry. In this method, the variations in cuff pressure due to the arterial pulsations during cuff deflation are sensed by the monitor to determine the blood pressure.[2]

This simple, useful monitor has been shown to be associated with some rare complications.[2] These include pain, petechiae, ecchymoses, limb oedema, venous stasis and thrombophlebitis, peripheral neuropathy and even compartment syndrome.[3-5] The occurrence of the above-mentioned complications has been associated with prolonged periods of excessively frequent cycles of cuff inflation/deflation. Patients with pre-existing peripheral neuropathies, arterial or venous insufficiency, diabetes mellitus, impaired limb perfusion and on anticoagulant or thrombolytic therapy are more susceptible.[3-7] The anaesthetist should be aware of this and avoid prolonged use in these high-risk groups. Other contributing factors are cuff misplacement across a joint or repeated blood pressure measurement in the presence of an artifact-producing condition such as involuntary muscle tremors and irregular cardiac rhythms. In the latter conditions, the machine fails to read correctly in the first instance and it reinflates maintaining pressure for 180 s. Thus, the duration of each inflation along with the prolonged and frequent use are important determinants of the complications.[8] Skin and tissue compression due to cuff inflation can lead to skin irritation and bruising. Moreover, there is venous pooling and congestion due to prolonged use and frequent blood pressure determinations. Excessive venous pressures can lead to tissue ischaemia and nerve damage. Compressive nerve damage can be avoided, especially the radial, by placing the cuff high on the arm, away from the elbow joint, to avoid the most superficial portion of radial nerve.[9]

There are many well-documented complications of prolonged tourniquet use. Rhabdomyolysis with renal failure and compartment syndrome have been reported after tourniquet duration of more than 4 h, and also with shorter inflation times (45–120 min).[10] Rhabdomyolysis is defined as the release of the cellular contents after damage to skeletal muscle, and has a variable clinical presentation. Pyrexia and tachycardia develop and patients often complain of pain, tenderness, oedema and haemorrhage of the limb.[11]

Devbhandari *et al*.[12] have given some suggestions for proper use of the NIBP device, as follows: (1) avoid wrapping the cuff tightly, (2) avoid applying the cuff across a joint, bony prominence or superficial nerve, (3) periodically inspect and alternate the cuff site, (4) carefully control the blood pressure, (5) select the maximum cycle time with satisfactory monitoring, (6) keep device alarms enabled, (7) consider the possibility of a device malfunction and (8) consider use of a thin layer of padding between the BP cuff and the skin. A thin cotton layer significantly reduced cuff-related trauma and there was no significant effect on systolic, mean and diastolic arterial blood pressure.

In our case, blood pressure was measured every 3 min for 6 h. The prolonged and frequent use caused ischaemic pain and muscle damage, evidenced by the rise in CPK. As the surgical time duration was prolonged, the NIBP cuff was acting like a pneumatic tourniquet. In our patient, the other causes of crush syndrome have been ruled out and also the blunt injury could not be a cause as the insult had occurred 1 year before.

In conclusion, although the NIBP monitor is useful and mandatory during anaesthesia, the anaesthetist should be aware of the complications associated with frequent prolonged use and its limitations. They can either alternate between the limbs or switch to invasive monitoring wherever appropriate.

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