Caudal Anesthesia Complicated by Intraosseous Injection in a Patient with Ankylosing Spondylitis

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Intraosseous needle puncture is a complication of caudal epidural anesthesia. No specific techniques (needle type or size) or patient characteristics have been associated with an increased risk of this occurrence, but advanced age and thin body habitus may be factors. This report describes an attempt at caudal block with bupivacaine in a patient with ankylosing spondylitis that resulted in an apparent intraosseous puncture and injection.

REPORT OF A CASE

A 29-year-old, 47-kg man with advanced ankylosing spondylitis required surgery for excision of an anal fistula. His thoracic and lumbar spines were rigidly fused, and the cervical spine was fixed in flexion. There was no history of aortic regurgitation or a cardiac conduction abnormality. Hemoglobin was 11.4 g/dl with no other abnormality in routine laboratory values. Because of the nature of the operation and the potential for airway and pulmonary problems, regional anesthesia was selected. His vertebral abnormalities made spinal or lumbar epidural anesthesia particularly difficult, so caudal anesthesia was planned.

The patient was premedicated with morphine sulfate 6 mg and scopolamine 0.3 mg IM, and he arrived in the operating room with an arterial blood pressure of 130/90 mmHg. After the usual preparation of the skin, a 19-g needle was inserted into the sacral hiatus without difficulty and was noted to be firmly fixed. Aspiration of the syringe showed no blood or cerebrospinal fluid. After an uneventful test dose of 4 ml bupivacaine 0.5% without epinephrine, 16 ml of this drug was injected slowly through the needle, with no blood noted on intermittent aspiration. Three minutes later the patient complained of lightheadedness, systolic arterial blood pressure decreased to 80 mmHg, and a generalized tonic-clonic seizure followed. Immediate treatment consisted of ventilation with 100% O2 via a mask, thiopental 250 mg IV, and ephedrine 20 mg IV. The seizure stopped within 60 s. There were no signs of residual cardiac toxicity. Systolic arterial blood pressure was 135 mmHg, heart rhythm was sinus tachycardia at 120 beats/min without dysrhythmias. Shortly thereafter the patient began spontaneous ventilation. He was awake and responsive 25 mins after the onset of the seizure.

A neurologic examination following this episode was unchanged from the preoperative status. No sensory or motor blockade was found. It was elected to complete the case under general anesthesia, which was performed with nitrous oxide, isoflurane, and oxygen via a mask. Ninety minutes after the seizure, the patient arrived in the recovery room awake and responsive, with normal vital signs and ECG.

DISCUSSION

Intraosseous puncture is a rare complication of caudal anesthesia and was first reported in 1971 in a 52-year-old 80-kg man. Needle aspiration (18-g) produced blood later shown to be pure bone marrow. Another report described four attempted caudal blocks with bone marrow aspiration in each case. No local anesthetic was injected into the sacral marrow space in any of these cases. Direct injection of lidocaine into the sacral bone marrow of goats had an effect on drug blood levels similar to direct IV injection. The viscous consistency of bone marrow may make aspiration considerably slower than aspiration of blood from a vein, and therefore the aspiration test may not always be successful in detecting intraosseous needle position. This occurrence may account for at least some toxic reactions to local anesthetics following unsuccessful aspiration when performing caudal anesthesia.

The presence of ankylosing spondylitis (AS) adds another factor to the likelihood of intraosseous injection in this case. A typical autopsy report described remarkable softness of the vertebrae in a patient with AS. A recent series found moderate to severe osteoporosis in 29 out of 50 AS patients, and an increased incidence and severity of osteoporosis was associated with longer duration and severity of AS. A needle may be passed through bone with ease in such a patient. In our patient, we believe that an intraosseous rather than an intravascular injection of bupivacaine occurred because of the following: 1) the test dose was negative; 2) no blood could be aspirated through a 19-g needle; 3) the needle was firmly fixed; and 4) onset of symptoms began 3 min after injection and not immediately. The absence of cardiac dysrhythmias also suggests that blood levels did not reach the threshold for cardiac toxicity, i.e., some degree of local anesthetic absorption or dispersal occurred along with direct venous sinus uptake, although no block was achieved. In fact, bupivacaine-induced seizures associated with a 35% decrease in cardiac output and no dysrhythmias have been reported at low plasma concentrations in human volunteers. This situation may be analogous to uptake from marrow, in which case the speed of uptake may be intermediate between tissue absorption and direct intravascular injection.
While addition of epinephrine 1:200,000 to local anesthetic solutions is not yet routine during caudal anesthesia, the detection of intravascular injection would be facilitated by the resulting abrupt increases in heart rate. The role of epinephrine in the detection of intraosseous local anesthetic injection has not been studied. However, because drug uptake from the marrow space is relatively rapid,1 the use of epinephrine in local anesthetic solutions may be of use in the detection of intraosseous needle position. The use of epinephrine in our case might have alerted us of an intraosseous insertion.

Marrow punctures during caudal anesthesia have been reported in both normal adults and infants.2 The likelihood of accidental intraosseous injection of local anesthetics may be increased in patients with predisposing conditions, and we have described such a case in a patient with ankylosing spondylitis. The presence of AS may increase the risk of intraosseous puncture due to the marked osteoporosis found in many such patients. Although inclusion of epinephrine in local anesthetic test doses may increase the likelihood of detecting intraosseous needle placement, there is presently no scientific evidence to prove this. Because convulsions in patients with ankylosing spondylitis may cause severe trauma, this author now believes that caudal anesthesia is contraindicated for these patients. For patients in whom caudal anesthesia is to be performed, failure to aspirate bone marrow should be considered an unreliable test for intraosseous needle position. The routine inclusion of epinephrine in local anesthetic solutions may be an important way to detect intraosseous injection and may therefore decrease the risk of local anesthetic toxicity in all patients receiving caudal anesthesia.

REFERENCES

Acceleration of Epinephrine Absorption by Lidocaine

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To obtain optimal local hemostasis in patients undergoing surgery, cutaneous infiltration of a dilute solution of epinephrine often is performed. Use of epinephrine with an inhaled anesthetic such as halothane is known to cause cardiac dysrhythmias. Limiting the dose of epinephrine1 and use of dextran for suppression of the absorption of epinephrine2 has helped to make this a safe practice. Also, Johnstone et al.3 suggested that lidocaine used together with epinephrine might reduce the incidence of cardiac dysrhythmias.

A small amount of epinephrine can be added to anesthetic solutions to prolong the analgesia and reduce the potential danger of systemic toxic reactions. Although the suppressive action of epinephrine on absorption of a locally administered anesthetic has been demonstrated,4–6 the effect of the local anesthetic on the absorption of the epinephrine has not been studied. We, therefore, measured the plasma level of epinephrine following its injection.

MATERIALS AND METHODS

After obtaining approval of the Committee for the Protection of Human Subjects and informed consent, we studied 40 ASA I and II adult patients who were scheduled for elective craniotomy. Halothane 4% in 100% oxygen or halothane 2.5% mixed with 50% nitrous oxide in oxygen was inhaled via a semiclosed system for 10 min.