Subcutaneous Paravertebral Block for Renal Colic

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WE report the successful treatment of renal colic using a paravertebral subcutaneous injection of local anesthetic. The mechanism for this analgesia is unclear, but it is possibly best explained by Melzack and Wall’s “gate theory” of pain. The chief limitation of this therapy is its short duration.

Case Report

A 26-yr-old woman, with an intrauterine pregnancy at 29 6⁄7 weeks’ gestation, presented to the emergency room of The Milton S. Hershey Medical Center reporting severe pain in the right flank. Abdominal ultrasound did not show a renal or ureteral calculus, but delayed contrast filling of the right urinary collecting system was consistent with right ureteral obstruction. The patient was admitted to the obstetrics ward for pain control and observation, with plans to perform percutaneous nephrostomy if the ureteral obstruction did not resolve.

Despite administration of 150 mg meperidine and 8 mg morphine intravenously over a 4-h period, the patient reported persistent severe pain, prompting consultation with the Acute Pain Management Service. The Acute Pain Management Service performed a subcutaneous paravertebral block in the following manner. The patient was placed in the left lateral decubitus position. Using the inferior angle of the scapula and the iliac crest as landmarks for T7 and L4 spinal levels, respectively, the T10 and L2 spinous processes were identified. After sterile preparation of the skin, a continuous subcutaneous weal of 2% lidocaine (6 ml) was created 4 cm to the right of midline, extending between T10 and L2 using a ½-in 25-gauge needle (fig. 1).

Before the injection, the patient reported her pain as 10 of 10 according to the visual analog scale (VAS). Five minutes after the injection, the pain was 2 of 10, and 5 min later it was 0 of 10. The patient was pain free for 2 h. Pain gradually returned, and the block was repeated when the pain score reached 7 of 10. For the second block, 6 ml bupivacaine, 0.25%, was infiltrated. Again the pain score decreased to 0 of 10 for 2 h. When the pain score reached 6 of 10, intravenous meperidine (75 mg) was administered to the patient. Two hours later, with a pain score of 1 or 2 of 10, the patient was brought to the radiology department for percutaneous nephrostomy, which was unsuccessful because of an inability to access the renal pelvis. Then, the patient was brought to the operating room for cystoscopy with ureteroscopy and ureteral stent placement during spinal anesthesia. The next day the patient was discharged free of pain with the ureteral stent in place.

Discussion

We have presented a short-lived but simple, inexpensive, low-risk, and effective technique for treating pain associated with renal colic. In the United States, standard treatment for renal colic pain is administration of intravenous opioid or ketorolac. Side effects of nausea, pruritus, and smooth muscle spasm limit the usefulness of opioids, and the renal and gastrointestinal side effects of ketorolac are unacceptable in some patients. Alternatively, neuraxial blockade using an epidural catheter provides excellent continuous analgesia and has the advantage of the possible use of the catheter for surgical anesthesia if a stone must be extracted or destroyed. The small but real risk associated with placement of an epidural catheter and the side effects of epidural analgesia must be considered because 64% of pregnant patients with renal colic pass stones spontaneously. Although the pain relief after each paravertebral injection was superior to that provided by opioids and although the injection had no side effects, the relief lasted only 2 h. This short therapeutic effect was a limitation of the technique in this patient, but permanent results are obtained in some patients in whom pain is caused by ureteral spasm. The proposed mechanism for this long-lasting effect is the relief of pain-induced ureteral spasm and subsequent passage of the ureteral stone.

The mechanism whereby subcutaneous infiltration of local anesthetic blocks the pain of ureteral colic is unknown. Although the neural structure that carries the nociceptive information of renal colic from the kidney or ureter to the spinal cord and thence to the brain has not been defined clearly, the sensory innervation of the kidney and ureter occurs via diffusely organized renal, testicular (ovarian), and hypogastric plexuses. Afferent fibers travel with the sympathetic nerves and enter the spinal cord at the T10–L2 spinal nerves. It is difficult to conceive of a mechanism whereby this neural pathway could be blocked directly by local anesthetic that infiltrated the paravertebral subcutaneous tissue. More complicated neural circuitry must be postulated to account for the therapeutic success of the block. The duration and quality of the pain relief achieved by infiltration of 2% lidocaine and 0.25% bupivacaine were indistinguishable. If we had administered very different doses of local anesthetic, we would be able to comment on the probable mechanism of action of the drug when used in this manner. However, evidence from other studies shows that subcutaneous infiltration of water relieved renal colic, myofascial pain, and back pain during labor.

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Subcutaneous infiltration field block for treatment of renal colic, as used in this patient, was described in the Soviet medical literature6,10 and is part of the standard medical practice in Russia. These descriptions report equally successful results using saline or local anesthetic infiltration. Indeed, acupuncture using needle insertion points in the paraspinal lower thoracic and upper lumbar area has been reported to control renal colic.11,12 In addition to having centuries’ worth of evidence that supports the findings of its effectiveness for the treatment of renal colic, acupuncture in this application is supported by the “gate theory” of pain.13 According to this theory, dermatomal activity in primary afferent fibers generated by performing the block or by inserting acupuncture needles would stimulate inhibitory circuits in the superficial laminae of the dorsal horn. These inhibitory neurons would prevent the transmission of nociceptive primary afferent activity from these dermatomes (the C fibers) to either local reflex arcs or ascending pain pathways. This case report supports the investigation findings regarding the effectiveness of alternative therapies for the short-term relief of renal colic pain.

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References

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Life-threatening Upper Airway Obstruction after Tongue Base Surgery
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ANESTHESIOLOGISTS are faced with myriad surgical procedures designed to alleviate sleep-disordered breathing in patients with obstructive sleep apnea (OSA). The main concern in caring for these patients is the potential difficult airway in many of these patients and also the comorbidities caused by OSA. We report a case of immediate postoperative airway obstruction that necessitated emergency cricothyrotomy after performance of a relatively new procedure called tongue suspension or tongue base surgery.1

Case Report
The patient is a 48-yr-old man who presented to the operating room for tongue suspension for OSA. The patient underwent laser surgery...
6 weeks previously to reduce redundant pharyngeal tissues. This was accomplished without improvement of his symptoms.

The patient had used a continuous positive airway pressure mask at home without relief of symptoms. The patient had a history of hypertension and gastroesophageal reflux disease (GERD). He weighed 155 kg and was 70 in tall. Airway examination consisted of a Mallampati I, which showed good range of motion of his cervical spine and adequate thyromental distance. The patient was taken to the operating room, and standard monitors were applied. In the operating room, 2 mg midazolam was administered to the patient in 1-mg aliquots. His right naris was anesthetized with 4 ml cocaine, 4%. Then, an induction of 150 mg propofol was administered, followed by 140 mg succinylcholine. A 7.0 wire-reinforced tube was passed easily through the right naris, but the vocal cords could not be identified using a Macintosh No. 3 blade. Oxygen saturation decreased to 90%, and mask ventilation with jaw thrust and an oral airway was difficult to perform. A Miller No. 3 was inserted into his mouth and a grade 1 visualization of the vocal cords was achieved. An 8.0 endotracheal tube was passed through his mouth and then past the vocal cords. At the request of the surgeon, the wire-reinforced tube was reinserted into the right naris and passed through the vocal cords as the 8.0 endotracheal tube was removed.

Afterward, the patient underwent tongue suspension surgery. The surgery was uneventful. At the conclusion of surgery, administration of the anesthetic agent (isoflurane) was discontinued. The patient was returned to spontaneous ventilation, and then was reversed with neostigmine and glycopyrolate. Negative inspiratory force of the patient was greater than 40 cm H2O, tidal volume was greater than 500 ml, PaO2 of 91 at 60% oxygen. Oxygenation improved the next morning; PaO2 was 106 at 40% oxygen.

Two days later, the patient was brought to the operating room for direct laryngoscopy and possible oral intubation. The examination showed a markedly swollen epiglottis and redundant supraglottic tissues. The vocal cords were not viewable. The decision was made to perform tracheostomy with cricothyrotomy. Hospital course was uneventful and the patient was discharged on the eighth postoperative day. Two weeks later, the tracheostomy was closed. Significant subjective improvement was seen in the sleep apnea, and the patient no longer required the use of a continuous positive airway pressure mask.

**Discussion**

Surgical correction of OSA using uvulopalatopharyngoplasty has shown a high failure rate.2 Several surgical techniques are available for the treatment of OSA that are directed at relieving the tongue base collapse. These include midline glossectomy, mandibular advancement, limited mandibular osteotomies with genioglossal advancement, and hyoid bone suspension. These surgical approaches are available because 80% of patients with OSA have an obstruction at the retropalatal segment of the mouth, and 50% of these patients also have an obstruction at the retroglossal segment.5 The technique of using a suspension screw to support the base of the tongue was first presented at the American Academy of Otolaryngology-Head and Neck Surgery annual meeting in 1998.4

The technique of tongue advancement or tongue base stabilization involves the use of a soft tissue-to-bone anchor inserted intraorally in the mandible with an attached suture that is passed through the tongue. The suture loop causes traction on the tongue base (fig. 1). By pulling the tongue forward and creating a small indentation at the base of the tongue, this technique might be used as part of a multimodal attempt at alleviating the symptoms of OSA in patients in whom a significant portion of disease was caused by tongue displacement. Initial results of the procedure have been positive. In a recent study,5 16 patients underwent the procedure. Two patients had short-term complications related to pain and infection, and the procedure was reversed. These patients were excluded from the data analysis. Of the 14 other patients, varying rates of improvement in snoring were seen, and a statistically significant decrease of 53% in mean respiratory distress index was noted in all patients. However, this study had a short follow-up time of 6 months, and patients with severe obesity, as was the case with our patient, were excluded from the study. There were no cases of postoperative airway compromise.

Possible causes of airway obstruction in the current patient include soft tissue obstruction, laryngospasm, a foreign body, or an allergic reaction. Laryngospasm was not a possibility because before direct laryngoscopy and after cricothyrotomy neuromuscular blocking agents were administered to the patient, which should have
relieved laryngospasm. Also, no foreign body was found. The swollen tissues might have been caused by an allergic reaction, but the patient had no other symptoms indicating an allergic reaction. The fact that the airway was manipulated during tongue suspension would indicate that this was the cause of the airway swelling in the current patient.

In conclusion, the anesthesiologist is faced with many procedures directed at relieving airway obstruction in patients with OSA. We report a case in which performance of a new procedure directed at alleviating the obstruction at the tongue base resulted in immediate postoperative life-threatening airway obstruction, necessitating emergency cricothyrotomy. Anesthesiologists must be prepared to deal with potential airway obstruction in patients with OSA and take measures to safeguard the airway. These methods might include delayed extubation, use of an endotracheal tube changer, or otolaryngologist standby for possible establishment of an emergency surgical airway.

References

Case Report
A 78-yr-old woman with a history of degenerative joint disease was scheduled to undergo left total hip replacement. Medical history was positive for hypertension, mild mitral regurgitation, paroxysmal atrial fibrillation, chronic active hepatitis, and hypothyroidism. The patient had no history of diabetes and no preexisting neuropathy. She received an L3-L4 spinal anesthetic, which consisted of 15 mg isobaric bupivacaine, 0.5%, and 25 μg fentanyl. The surgical procedure was uneventful. The patient received 3 mg midazolam and 150 μg fentanyl intravenously during the 3-h procedure. At completion of the surgical procedure, a left fascia iliaca compartment block was performed, as described by Dalens et al.,1 to block the femoral and the lateral femoral cutaneous nerves. The injection is administered approximately 1 cm below the inguinal ligament, at the junction of the lateral third and the medial two thirds of a line that joins the pubic spine to the anterior superior iliac spine (fig. 1A). After the short bevel needle traverses the skin, two “pops” are felt. The first corresponds to the fascia lata, the second to the fascia iliaca (fig. 1B). A loss of resistance then is experienced. Forty milliliters of bupivacaine, 0.5%, was injected without untoward effects. The patient was admitted to the postanesthesia care unit.

After resolution of the spinal anesthetic, the anterior, medial, and lateral aspects of the left thigh remained anesthetized, indicating a successful fascia iliaca compartment block. The patient reported mild left hip pain (visual analog scale score, 2 or 3) that was controlled readily using oral analgesics.

Twenty-four hours later, the patient continued to exhibit complete anesthesia over the anterior thigh. No hypoesthesia was found in the areas innervated by the lateral femoral cutaneous nerve (i.e., lateral aspect of the thigh) or by the obturator nerve (i.e., medial aspect of the knee.) Motor strength of the quadriceps muscle seemed to be decreased; however, accurate evaluation was hindered by postoperative pain. No decrease was noted in muscular strength of the adductor muscle group. There was no tight dressing or hematoma. Hypoesthesia resolved over the ensuing week, with complete resolution occurring on the eighth postoperative day. Because of the rapid resolution of the neuropathy, a neurologist was not consulted.

Discussion
Numerous advantages have been attributed to regional versus general anesthesia for lower limb surgery, includ-
ing prolonged postoperative pain control. However, there is controversy whether performing regional anesthesia is safe in an anesthetized adult patient (in the current case, we performed a fascia iliaca compartment block in a patient during spinal anesthesia) and whether the benefits outweigh the risks, as they do in pediatric anesthesia.5

Results of numerous studies have supported the belief that pain or paresthesia during needle placement or injection is a warning sign of potential nerve damage.6,7 Use of a peripheral nerve stimulator permits the induction of regional anesthesia in an anesthetized patient. It does not eliminate the risk of anesthesia-related nerve damage.8,9 Moreover, it is unnecessary to perform a fascia iliaca compartment block.3

There are reports of neurologic complications after femoral nerve blockade, but none to our knowledge after fascia iliaca compartment block. Dalens et al.1 described the use of this block in children, followed by subsequent reports of its use in adults.10 In addition, a continuous catheter technique has been used to provide prolonged postoperative analgesia.5 When using a nerve block for postoperative analgesia after total hip replacement, a fascia iliaca compartment block provides more reliable blockade of the lateral femoral cutaneous nerve than does a three-in-one block. This results in more effective analgesia in the area of the skin incision.10

The point of needle insertion should be distant from the course of the femoral nerve; therefore, we performed a fascia iliaca compartment block rather than a femoral nerve block in an anesthetized patient. The needle insertion point is approximately midway between the femoral artery and the anterior superior iliac spine, i.e., approximately 4 cm lateral to the artery in an average-sized person. It is our practice to identify these two landmarks (and hence the position of the femoral nerve immediately lateral to the femoral artery) as a safeguard to avoid inadvertent insertion of the needle in the direction of the nerve. The width of the femoral nerve at this level is 9–4 mm,11 which makes it unlikely but not impossible5 that the needle is inserted into the lateral aspect of the nerve.

The femoral nerve is derived from the dorsal branches of the second, third, and fourth lumbar ventral rami. It descends initially within the substance of the psoas muscle, emerges from its lower lateral border, and descends to enter the thigh deep into the inguinal ligament, in the groove between the psoas and the iliacus muscles, immediately lateral to the femoral artery. The fascia iliaca separates the nerve from the femoral vessels. Slightly before or at the entrance to the femoral triangle, the femoral nerve separates into numerous branches that supply the muscles and skin of the anterior thigh, knee, and hip joints.12 Some of the branches of the femoral nerve to the sartorius muscle and neighboring skin depart from the main trunk of the nerve as it emerges under the inguinal ligament.11

We believe that there are three explanations for the transient neuropathy experienced by the patient: (1) incorrect identification of the point of needle insertion, (2) a normal anatomic variation, leading to unanticipated needle contact with the nerve, or (3) related to the surgery rather than the anesthesia. Incorrect identification is unlikely because the landmarks were identified easily (inguinal ligament, femoral artery, and anterior superior iliac spine) and clearly marked before block performance. Postoperative neuropathies associated with hip surgery have been reported; however, usually these involve the sciatic rather than the femoral nerve.13,14 This case is a reminder that, although we chose a fascia iliaca compartment block to limit the risk of nerve damage, injury still may occur.

References

Propofol has been used in the intensive care population as a short-acting sedative hypnotic agent administered easily by continuous intravenous infusion. At sedative dose rates (10–50 μg·kg⁻¹·min⁻¹), it has the advantage of rapid elimination despite prolonged administration, thereby allowing neurologic examinations at frequent intervals and facilitating the weaning of the patient from ventilatory support. Doses necessary for electroencephalographic burst suppression (100–
200 µg · kg⁻¹ · min⁻¹) use substantial volumes of propofol, but still offer rapid neurologic examination after discontinuation. At the University of Mississippi School of Medicine, we have not experienced hemodynamic or metabolic derangement associated with use of the Diprivan brand of propofol.

Several difficulties have occurred with the use of propofol, both in the United States and abroad. Initially, there was significant concern regarding its lipid emulsion preparation and ability to support bacterial growth. After extensive education of healthcare professionals about the safe handling of propofol and performing the aseptic technique, this is less of an issue. The nature of the emulsion also has produced numerous reports of pain during injection and patient discomfort, which again has largely been resolved by addition of lidocaine and other local anesthetics by practitioners to the solution before administration. Most recently, the new preparation of propofol by Baxter has been criticized because of the use of sulfite preservative, which may pose a risk of allergic reactions in susceptible patients. This preparation has the advantage, however, of lower cost than the Diprivan brand in many markets and has been chosen by some hospital pharmacies on this basis. Propofol was criticized widely in the United Kingdom and Canada in the late 1990s as a sedative for children in the intensive care unit. Despite some studies that showed the safety of propofol, numerous reports of unexplained metabolic and lactic acidosis and cardiovascular collapse were published. As a result, propofol sedation of children in the intensive care unit was associated with these complications. The children described were aged 3–12 yr. The use of propofol infusion for the sedation of children in the intensive care unit is controversial.

Diprivan brand of propofol emulsion has a pH of 7.5–8.0, whereas the Baxter formulation has a pH of 4.5–6.4. In the current case, the patient’s clinical change after discontinuation of the Baxter solution suggests that this formulation caused her metabolic acidosis. Contributing factors may have been hypothermia, mild hypovolemia, and administration of the greater, neuroprotective dose of propofol rather than the lesser dose used for routine sedation. We estimate that, at a electroencephalographic burst suppression dose of 150 µg · kg⁻¹ · min⁻¹, the patient received approximately 3,000 ml propofol over 48 h. In the current case, lactate concentration measurements were not obtained until relatively late in the patient’s course, decreasing their diagnostic value. Similarly, pulmonary artery catheterization was not performed until the patient was moribund, but central venous pressure values obtained earlier suggested adequate vascular volume and cardiac performance. It is interesting to speculate about the formulation of propofol used in the children described in the UK case reports. It is reasonable to assume that an exogenous acid load would be tolerated more poorly in a pediatric population and would present the clinical picture described, but the actual formulation used in the UK cases is unclear. The acid load received from an unbuffered solution is usually insignificant, but may contribute to metabolic acidosis and multiple other factors, such as hypothermia and hypovolemia, in a critically ill patient. This is the first case report of metabolic acidosis associated with propofol infusion in an adult. In summary, we present a case in which severe metabolic acidosis developed in an adult patient after the initiation of an infusion of a new brand of propofol. The acidosis resolved after discontinuation of the infusion.

References