Caudal anesthesia in a patient with peritonitis: Is it safe??

ABSTRACT

Neuraxial anesthesia combined with general anesthesia has become a widely accepted method of providing effective postoperative analgesia and decreasing intraoperative anesthetic needs in the pediatric population. In clinical practice, there still appears to be hesitancy for the use of a neuraxial technique (spinal or epidural) in patients at risk for bacteremia or with an on-going systemic infection. However, evidence-based medicine lacks any data to support an increase in the risk of infectious complications following neuraxial anesthesia. We present two pediatric patients with intra-abdominal infectious processes who received caudal epidural blockade for postoperative operative analgesia. The use of neuraxial techniques in patients at risk for bacteremia is reviewed, evidence-based medicine regarding the risks of infection discussed, and the potential favorable effects of neuraxial blockade on the neurohumoral response to sepsis and the systemic inflammatory responses presented.

Key words: Caudal anesthesia; pediatrics; peritonitis

Introduction

The first reports of the use caudal epidural anesthesia in children were published in 1933 followed by its use in neonates in 1950.[1,2] Widespread clinical use developed in the 1970's and 1980's as the interest in regional anesthesia increased, partially driven by the need to improve the techniques available for the postoperative pain control in children. The placement technique remains one of the safest procedures performed in children with both retrospective audits and prospective studies showing favorable results with no long term sequelae.[3-6] There is not a single case of an epidural abscess, epidural hematoma, or paraplegia after a single-shot caudal block in the world's literature.[7] However, in clinical practice there still appears hesitancy for the use of a neuraxial technique (spinal, epidural or caudal) in patients at risk for bacteremia. We present two pediatric patients, aged 4 years and 22 months, who presented to the operating room for laparoscopic surgery to treat an intra-abdominal process. In addition to general anesthesia, a single-shot caudal block was performed for perioperative analgesia. The use of neuraxial techniques in patients at risk for bacteremia is reviewed, evidence-based medicine regarding the risks of infection discussed, and the potential favorable effects of neuraxial blockade on the neurohumoral response to sepsis and the systemic inflammatory responses (SIRS) presented.

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Case Reports

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Case 1

The patient was a 4-year-old, 18.3 kg girl who presented with 2-day history of right lower quadrant abdominal pain and fever associated with nausea and vomiting. Abdominal ultrasound showed features suggestive of perforated appendicitis and an abscess. Preoperative laboratory evaluation including complete blood count was within normal range except for slight anemia. She was scheduled for laparoscopic appendectomy and abscess drainage. Following the induction of general anesthesia and prior to the start of the surgical procedure, a single-shot, caudal epidural injection was performed using a 22 gauge needle with 13 mL of 0.2% ropivacaine and 0.7 mg of preservative-free morphine. Intraoperatively, 40 μg (2 μg/kg) of intravenous fentanyl was the only opioid administered. Perforated appendicitis with massive fibrinous adhesions, multiple abscesses, and fecaliths were found during the surgical procedure. The surgical procedure was completed without complications, her trachea was extubated in the operating room, and she was transferred to the postanesthesia care unit (PACU). During the PACU stay, her pain was assessed at 0 using the FLACC score. On postoperative day (POD) 1, a nurse-controlled analgesia (NCA) with morphine was started for postoperative pain management along with adjuvant therapy including acetaminophen and ketorolac. Per os (PO) intake was started on POD 2 and she had a bowel movement on POD 4. Her postoperative course was complicated by urinary retention requiring catheterization and atelectasis. She was discharged home on POD 9.

Case 2

The patient was a 22-month-old, 13.1 kg boy with a 1 day history of fussiness, abdominal pain, and with fever. Abdominal ultrasound showed features suggestive of appendicitis. A computerized tomography scan of the abdomen confirmed the diagnosis of perforated appendicitis. Preoperative laboratory evaluation including complete blood count, electrolytes, and renal function were within normal range except for a white blood cell count of 23,800/μL. The patient was scheduled for a laparoscopic appendectomy and abdominal irrigation. Following the induction of general anesthesia, a single-shot caudal epidural injection was performed using a 22 gauge needle with 12 mL of 0.2% ropivacaine and 25 μg of clonidine. Intraoperatively, 1 mg (75 μg/kg) of intravenous morphine and ketorolac (0.5 mg/kg) were administered as part of the intraoperative anesthetic. During the surgical procedure, a significant amount of purulent fluid and adhesions were found along with peritonitis. The surgical procedure was completed without complications, his trachea was extubated in the operating room, and he was transferred to the PACU. His pain was assessed as 1 using the FLACC score and NCA with intravenous morphine infusion was started upon transfer to the inpatient ward. Postoperatively, intravenous acetaminophen and ketorolac were administered to provide adjuvant analgesia. The patient started PO intake on POD 2 and had a bowel movement on POD 3. The remainder of his postoperative course was uncomplicated and he was discharged home on POD 4.

Discussion

Regional anesthesia combined with general anesthesia has become a widely accepted method of providing effective postoperative analgesia and decreasing intraoperative anesthetic needs in the pediatric population. The epidural administration of local anesthetics and opioid, alone or in combination, has been shown to provide effective analgesia following major surgical procedures including laparotomy or thoracotomy. Despite such efficacy, there must always be a consideration to the potential adverse effects of such techniques. With any invasive procedure, the potential for infectious complications must be considered. Although these complications are exceedingly rare with single-shot techniques, there may be hesitancy to access the neuraxial space in patients with proven or suspected bacteremia. Despite this, there is no evidence-based medicine to suggest that systemic infections increase the risk of infectious complications of regional anesthesia.

Given the clinically proven advantages of epidural analgesia, there has also been an increased interest in its applications in the management of pain and other symptoms associated with bacterial peritonitis in adult patients.[8,9] In many patients requiring intensive care after emergency laparotomy, peritonitis leads not only to pain, but also paralytic ileus, delayed enteral nutrition, and prolonged hospitalization. It carries a high mortality due to systemic sepsis from translocation of bacteria and endotoxins from the intestinal lumen to the systemic blood circulation with the development of bacteremia, endotoxemia, or a SIRS.[10] The effect of epidural blockade on survival rates in animal and humans during shock states has shown mixed results. Although not uniformly beneficial, it has been suggested that in addition to providing effective intraoperative anesthesia and postoperative analgesia, neuraxial analgesia may have a therapeutic benefit, improving outcomes after laparotomy in adults.[8,11-18] Epidural blockade has been shown to increase intestinal blood flow, increase gastric intramucosal pH and mucosal perfusion, and enhance intestinal motility.[19-22] In a double-blinded, prospective, randomized study comparing intravenous morphine with epidural bupivacaine in 21 adult patients with peritonitis and adynamic small bowel following abdominal surgery, epidural analgesia resulted in improved gastric mucosal perfusion and the ultrasound appearance of the small bowel, while both groups showed persistently delayed gastric outflow throughout the study period.[8] In another study, mean times to postoperative passage of first flatus and stools, resumption of oral feeding, ambulation, and hospital discharge were significantly shorter in patients who received general anesthesia with thoracic epidural blockade compared to patients who received only general anesthesia.[23]

Epidural analgesia can also obtund the surgical stress response by blockade of visceral nociceptive and nonnociceptive afferent fibers.[24] It may additionally interrupt the reflex inhibition of gastrointestinal motility caused by intra-abdominal trauma.[25] The opioid sparing component of epidural analgesia may also contribute to reduced ileus.[26] Other reported advantages related to epidural blockade include prevention of leucocyte endothelium interaction during intestinal hypoperfusion and protection against bacterial translocation during splanchnic ischemia, which may in turn decrease morbidity and mortality in septic patients by inhibiting the SIRS.[27-29] Improvement of pulmonary function has been also noted.[30]

Although these postoperative benefits of the epidural blockade are well established, there may be concerns regarding the potential cardiovascular changes induced by the sympathetic blockade following neuraxial anesthesia, especially in compromised patients with sepsis or SIRS. Spackman *et al*. has reported decreased gastric intramucosal pH suggestive of ischemia in patients.[8] Therefore, any decrease in perfusion related to hemodynamic instability caused by neuraxial blockade may further increase the potential for end-organ and mucosal ischemia. However, it has been demonstrated that there is no impairment of hemodynamic function beyond the changes caused by sepsis following segmental thoracic blockade with 0.125% bupivacaine in an endotoxemic animal model.[31] In addition, an earlier clinical trial noted that if mean arterial pressure is maintained at >60 mmHg by the administration of vasoactive agents along with central venous pressure-guided fluid therapy, splanchnic blood flow is maintained despite the use of a thoracic epidural blockade.[32]

Perhaps the greatest theoretical concern regarding the use of neuraxial anesthesia in the presence of bacteremia is the spread of the infection to the intrathecal or epidural space resulting in meningitis or epidural abscess. In the absence of co-existing bacteremia, the incidence of serious central neuraxial infections including arachnoiditis, meningitis, or abscess after spinal or epidural anesthesia is exceedingly rare.[33] In a study regarding the neurological complications of neuraxial blockade in a very large cohort of patients from Sweden (1,260,000 spinals and 450,000 epidurals), there were only 29 cases of meningitis and 13 cases of epidural abscess.[34] These findings indicate that the incidence of in-hospital central nervous system infection after the administration of neuraxial anesthesia is exceedingly low. However, once it happens, the consequences of the neurological complications resulting from infection can be devastating.

Although there are limited data on which to make a conclusive statement regarding the incidence of central nervous system infection after neuraxial anesthesia in the presence of systemic infection, Kotzé *et al*. reported no infectious complication following thoracic epidural placement in 46 pediatric patients with empyema.[35] The American Society of Regional Anesthesia states in their recommendations that patients with evidence of systemic infection may safely undergo spinal anesthesia, provided appropriate antibiotic therapy has been initiated with a positive response to the therapy before dural puncture, while placement of an indwelling epidural catheter in these patients remains controversial.[36] In addition, although it cannot be simply compatible with our cases, lumbar puncture is a part of the standard diagnostic protocol for sepsis workup in neonates and infants with presumed infections.[37,38] Although an enormous number of diagnostic lumbar punctures are performed with traumatic lumbar punctures (contamination) occurring in 10-30% of these, there remain a limited number of cases of meningitis in this population. It is generally concluded that these resulted from the associated bacteremia and not from inoculation of the cerebrospinal fluid during a lumbar puncture. It is generally concluded that lumbar puncture-induced meningitis is rare enough to be clinically insignificant.[39-41]

The most important controllable factor in the prevention of epidural blockade-related infectious complication is the sterility of the site and equipment during placement which is already a part of our standard practice. Prolonged duration of epidural catheterization is a known risk factor for infectious complications following epidural block.[42,43] Based on the assumption that the catheter itself might act as a nidus for infection via blood-borne spread, indwelling epidural catheter in a patient with systemic sepsis potentially involves a higher risk of the epidural abscess formation. However, the hypothesis of hematogenous seeding of the catheter remains unproven, and the true incidence remains low.[44-46] However, the high incidence of coagulopathy, thrombocytopenia, and platelet dysfunction in critically ill patients leads to justifiable concerns about the risk of epidural hematoma formation. As such, preoperative evaluation of platelet count and coagulation function appears warranted prior to neuraxial anesthesia. Although the platelet count was normal in both of our patients, we did not obtain routine coagulation function (prothrombin time, partial thromboplastin time, and international normalized ratio). However, we have added this to our standard preoperative evaluation given the frequent use of regional anesthesia in our practice. Even though the coagulation function and platelet count are within the normal range at the time of epidural catheter insertion, coagulation function may change after catheter placement. Therefore, it may be prudent to ensure normal coagulation function prior to catheter removal.

Albeit no definitive conclusions can be derived from anecdotal experience with two patients, we believe that the review of the evidence-based medicine does not provide evidence to suggest that neuraxial analgesia is contraindicated in the presence of bacteremia, systemic infections or SIRS. Most importantly, the risks are likely lowest with a single-shot technique using the caudal approach. The urinary retention experienced by our first patient may have been related to the use of epidural morphine, suggesting that the benefits of such adjuncts should be weighed after their potential adverse effect profile. In addition to analgesia, the literature has reported other potential advantages including hastening the resolution of ileus, depressing SIRS, and blunting the stress response.

Our case report is anecdotal and does not represent a large prospective cohort. As such, we cannot make any conclusive statements on safety and the incidence of potential adverse effects including epidural abscess. However, given the clinical and animal data, we would suggest that these techniques are efficacious in this tenuous population. The use of single-shot technique using the caudal approach needs further investigation in a prospective and controlled manner in order to adequately assess the risk in this particular patient population. Overall, the decision to employ neuraxial analgesia should carefully weigh the potential benefits against the risks involved in the patient with a systemic infection. Moreover, there should be close follow-up and maintenance of a high index of suspicion for infectious complications and hematoma formation with the prompt recognition of symptoms should they occur.

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Conflicts of interest

There are no conflicts of interest.

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