Title: Is a thoracic epidural the best option for postoperative analgesia in an adolescent undergoing pectus excavatum repair?

Moderators: Karen Boretsky MD

Institution: Children’s Hospital Of Boston; Boston Massachusetts

Objectives:

1. Review the pathophysiology of pectus excavatum deformities and discuss the surgical implications of repair.
2. Discuss the general evidence based safety of epidural analgesia in pediatric patients.
3. Discuss the risks and benefits of thoracic epidural analgesia in patients undergoing pectus excavatum repair.
4. Discuss alternative methods of analgesia.
   a. Paravertebral nerve blocks
   b. PCA opioids
   c. Wound infusion catheters
5. Review local anesthetic dosing considerations guidelines.

Case history:
A healthy 16 year old was scheduled for a Nuss procedure for repair of pectus excavatum. The patient was most concerned about postoperative pain control (POPC) because his twin had had a pectus repair six months prior and he had PCA morphine for his POPC which resulted in excruciating pain for about a week and severe PONV. The family wanted to know about potential alternative methods for POPC.

Questions:
What is pectus excavatum? What is the etiology? Why/when does it need to be corrected? What is/are the surgical techniques for correction and what is involved? How much pain do you anticipate? What is the nature of the pain?

Case history and physical examination (continued):
Patient is a tall thin adolescent who appears shy and self-conscious. He is on no medications other than motrin for a knee sprain and has no drug allergies. Previous surgeries include BMT’s x 2 without event. Vital signs were within normal limits including SpO2 97% on room air. Cardiac and lung examination were normal.

Questions:
Is there any special testing/lab work you require/request? Do you need a CXR? PFT’s? What is the pulmonary involvement in pectus? How is his pulmonary status? Would you like other pulmonary studies? What is the cardiac involvement in pectus? How is his cardiac status? Do you want an ECHO? Are NSAIDS relevant?

**Preoperative studies:**
All labs and studies were unremarkable.

**Questions:**
What are the general risks of epidural anesthesia? What are the specific risks of thoracic epidural anesthesia? What are the specific risks of thoracic epidural for patients undergoing a NUSS procedure for pectus repair? What risks and possible complication should be disclosed to the patient (and his parents)? Would you mention paraplegia as a possible complication? How do you present these complications?
What are some of the other options for controlling the pain postoperatively? Is PCA an option and how does it work? Dosing, risks, benefits?
Discuss paravertebral nerve blocks as a technique for controlling pain postoperatively. How do they work? Dosing risks, benefits?
Discuss wound infusion catheters as an alternative for post operative pain management. How do they work? Dosing, risks, benefits?

**Case progression:**
The patient and his family choose to have bilateral paravertebral perineural catheters inserted.

**Questions:**
So what is your plan for analgesia and sedation for perineural catheter insertion? Local vs. sedation (MAC) vs. general anesthesia? Do we need any special monitoring/medications? (what would you use?)
What techniques are available for paravertebral nerve block insertion? Would you use an ultrasound guided technique? Do you need an ultrasound? At what level would you insert the catheters?

**Intraoperative care:**
The patient was positioned was positioned sloppy lateral and the nerve block catheters were inserted under sedation using an ultrasound guided lateral approach to the paravertebral space. The patient suddenly became light-headed with a heart rate of 45. The catheters are already in. How do you respond? What is the differential dx? What vasoactive medications would you consider using for this patient? What is the likely etiology? Would you cancel the case?

Your patient’s heart rate recovers and you allow the surgeon to proceed with the procedure. Would you bolus the nerve blocks? If yes, how would you bolus them?
General anesthesia is induced and the airway secured. The case proceeds uneventfully. Would you run a continuous infusion through the catheters for the case? What, if any, other analgesic medications would you administer before emergence? What is multimodal analgesia?

**Postoperative care: PACU**
Your patient is extubated in the operating room at the end of surgery and is transferred to PACU. In PACU he is restless, irritable, confused and hypertensive. What do you do? Is it pain? How do you decide? After an hour, the patient is responsive and coherent and complaining of 4/10 pain. What does this mean? How do you evaluate pain? Are the nerve blocks not working? What would you do? What kind of pain is likely but what is the variety?

**Discussion:**

Pectus Excavatum is the most common congenital chest wall deformity and it is likely hereditary in nature. Abnormal growth of the sternal cartilages causes the sternum to appear sunken or, on some occasions, rotate to one side and it may worsen as the child grows. Patients can experience limitations in exercise capacity as the result of decreased room in the thorax and restriction of the lungs and heart.

Several approaches to surgical correction exist, the Ravich procedure and the Nuss procedure with the Nuss being, by far, the most common. The Nuss procedure consist of slipping a bar under the sternum and rotating it in a fashion that puts outward pressure on the sternum causing the inward deformity to correct. A thoracoscopic approach is usually used with pneumothorax and bleeding being the most commonly seen complications.

Pain following the Nuss Procedure is severe and difficult to control. Pain stems from multiple etiologies including outward pressure from the Nuss bar, incisional pain, muscle spasms, and release of inflammatory mediators from the primary surgical insult. Historically, the bias in the literature has been to rely on the use of thoracic epidural catheters as the mainstay of a multimodal protocol which includes muscle relaxants, opioids, and NSAIDs. Thoracic epidurals, however, are not without risk and infrequent neurologic events have been documented in the literature. However, in a recent 10 year review of 1,215 Nuss Procedures at an institution where Nuss procedures are commonly performed, two cases of lower extremity paralysis were reported in patients receiving thoracic epidurals for an unprecedented incidence of 1/600 patients. Unfortunately, the details of these two cases have not been published. Because of this high incidence of thoracic epidural associated nerve damage, several institutions no longer offer epidural analgesia as an option for this patient population. Experts from several institutions are proposing patient controlled analgesia, paravertebral nerve blocks and wound infusion catheters as safer alternatives. The advantages and disadvantages of opioids are well known. The use of PVNB for controlling postoperative pain in thoracotomy patients has been shown to have equal efficacy to epidural nerve blocks with a better side-effect profile and a lower incidence of pulmonary complications. In addition, no reports of paralysis have been attributed to the placement of PVNBs making this a viable alternative to neuraxial techniques. Epidemiologically, the trend in regional analgesia is away from neuraxial blocks and replacement with peripheral nerve block techniques such as paravertebral nerve blocks and wound infusion catheters which have a better safety profile.

In summary, this case is typical in that pain following the Nuss Procedure for repair of pectus excavatum is severe and often difficult to control. The use of a thoracic epidural catheter with local anesthetic infusion has traditionally been advocated as a superior method for controlling pain following this surgery. Thoracic epidurals, however, are not without risk and alternate modes of analgesia are being investigated.
References:


