Neuraxial Anesthesia

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Regional Anesthesia

- Peripheral Nerve Blockade
- Neuraxial Blocks

- Placed in the OR under general anesthesia by members of the regional anesthesia team

Sensory vs Motor Block

- Goal with any type of regional technique is strong sensory block but sparing of motor nerves. Often not possible.
- Continuous epidural catheters usually contain local anesthetic + opioid, for synergistic effect
  - Concentrated LA blocks motor nerves
  - No motor block with opioids

Sensory vs Motor Block (cont)

- Peripheral nerve blocks
  - Local anesthetic only, so usually have some motor weakness. Families educated pre-op, and patients contacted POD#1 by regional/pain team to assess return of function

Sensory vs Motor Block (cont)

- Single-shot neuraxial techniques
  - Caudal
    - Usually LA only, but may include long-acting morphine, which will last longer (12 hrs) than LA
    - May have motor block for 4-6 hrs
  - Spinal
    - For surgical anesthesia, gives dense sensory/motor block
    - Intrathecal morphine lasts 12 hrs without any motor block since no LA given

Neuraxial anesthesia

Spinal vs Epidural

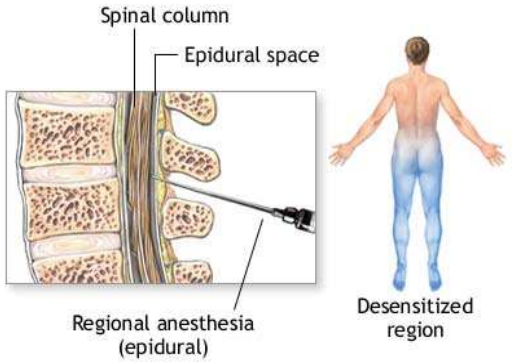
Spinal Anesthesia

- Used to provide short-lasting, dense anesthesia for surgical procedures
  - Traditionally has been utilized in infants for circumcision, hernia repair, muscle biopsy, etc
  - In adults, can be used for lower limb surgery, c-section, other lower abdominal procedures

Spinal Anesthesia

- Rarely used as sole anesthetic in infants and children
  - May be difficult to place in an awake child
  - Most young patients will have a difficult time remaining still for duration of operative procedure, even if no pain from surgery itself

Epidural Anesthesia



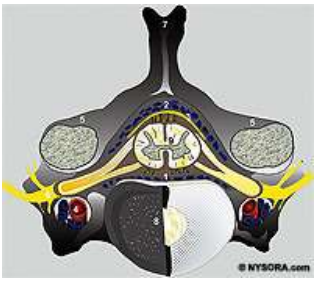
Anatomy

- 7 Cervical
- 12 Thoracic
- 5 lumbar

Anatomy of the Epidural Space

- Spans from base of the skull to the sacral hiatus
- Contains: fat areolar tissues, lymphatics, VEINS, nerve roots, NO FREE FLUID
- It is bound by
  - Anteriorly- the ligamentum flavum
  - Laterally- vertebral pedicles and the intervertebral foramina
  - Posteriorly- the vertebral body

Anatomy



Epidural Anesthesia

- For children, most commonly used for post-operative analgesia
- In adults, may be used to provide anesthesia for surgery, and then continued for post-operative analgesia

Epidural Anesthesia

- “Epidural” refers to the anatomic area outside the dural sac, and typically a catheter is threaded to provide continuous medication
- “Caudal” refers to level of approach, but still an epidural injection
  - Usually single-shot caudals performed for genito-urinary procedures
  - Caudal catheter may be placed and threaded up to desired level
    - Safer, easier than placing lumbar or thoracic epidural in infants

Caudal positioning

Caudal Block

Caudal Block

- Typically performed with up to 1cc Ropivacaine 0.2% per kg
- Benefit is greatly decreased opioid requirement intra- and post-op
- Block usually lasts 4-6 hrs
- May have some lower extremity weakness

Indications for Epidural Catheter

Patients who require specialized pain management including post surgical patient

- Open thoracic surgeries
- Abdominal procedures (open abdominal surgeries)
- Genitourinary (complex pyeloplasty, open bladder procedures)
- Orthopedic (lower limb and pelvis corrections)

Contraindications

- *Absolute*
  - Coagulopathies
  - Lack of consent
  - Raised intracranial pressure
  - Infection at insertion site
- *Relative*
  - Bacteremia
  - Severe spinal deformity
  - Cardiovascular impairment
  - Progressive neurologic deficit

Administration

- Continuous infusion-steady quantity of medication delivered over each hour.
- Intermittent injection-done usually by an anesthesiologist to evaluate function of the epidural.
- Patient Controlled Epidural Analgesia (PCEA)- continuous infusion plus a self-administered bolus.
- Single injection- usually done for short stay procedures. No extended monitoring if local anesthetic used.

Benefits

- Suppresses the body's stress response intra-op
- Minimizes amount of systemic opioids required
- Encourages earlier return of bowel function

Benefits (cont)

- Promotes recovery of postoperative pulmonary function – patients breathe more deeply with optimal pain relief, preventing atelectasis or pneumonia
- Provides up to 5-7 days of excellent pain relief
- Patients are more willing to participate in PT and ambulation if pain is better controlled -- at appropriate doses of ropivacaine there should be minimal motor blockade.

Risks

- Local anesthetic toxicity
  - Minimized with weight appropriate dosing.
  - Can result from accidental intravascular dosing
    - *Signs/Symptoms*
      - Paresthesia – sensation of tingling, burning, pricking
      - Tinnitus
      - Weakness or sensory changes
      - Seizure
      - Arrhythmia
      - Cardiovascular collapse

Risks (cont)

- Epidural hematoma
  - Occurs with trauma to epidural veins and subsequent accumulation of blood
  - Increase in childhood and adult ages 50-60's
  - Males to females 4:1
  - Can occur when epidural is initially placed or upon its removal
  - *Symptoms:*
    - Increase in localized back pain with radiation to the legs
    - Weakness, numbness, urinary and fecal incontinence
    - In an infant could be represented with increased irritability

Risks (cont)

- Local infection at site of epidural
- Potential introduction for systemic infections
- Depending on the fever curve, duration and day post-op, an epidural may be discontinued to decrease the risk of possible infection.
- Efficacy not guaranteed
  - Positioning of the patient, density of the solution, and contour of the spinal canal can affect distribution of the local anesthetic and therefore, how effectively the epidural functions.
  - Fluoroscopy can be used to check placement.

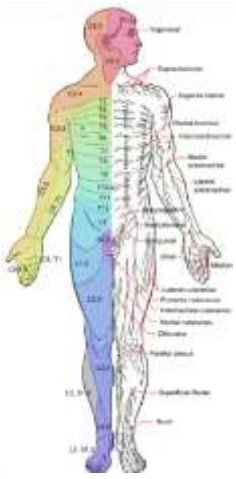
Side Effects

- Nausea/vomiting (more common with morphine)
  - Can use antiemetic or stop infusion
- Pruritis
  - Nalbuphine 0.05 – 0.1mg/kg q 4 prn
- Respiratory depression
  - Naloxone 10mcg/kg to a max of 400 mcg/dose repeated as necessary.
- Urinary retention
  - Foley catheter is needed with lumbar and caudal epidural. Thoracic epidurals do not require foley catheters.
- Hypotension
- Bradycardia
- Backache

Is it working?

- Epidural infusions and other regional techniques may provide excellent post-op analgesia
- BUT… Pediatric patients may be quite annoyed with PIVs, monitors, drains, tubes, etc, which is manifested in irritability
- May be difficult to assess a “functioning catheter” in a patient with multiple other causes for discomfort

Is it working?



•Site of epidural placement and infusion volume meant to “cover” post-op pain in certain area

•Can assess adequacy of sensory block in specific areas

- •Ice, pinprick, etc

Epidural Physiology

- What is correct order?
  - Pain
  - Motor
  - Temperature
  - Proprioception
- First, Temperature (sympathectomy)
- Second, Pain
- Third, Proprioception
- Last, Motor



Catheter Related Issues

- Leakage around site- About 6% incidence. Higher with infants. If leaking occurs, notify anesthesiologist on call to assess. Dressing changes increase risk of infection.
- Kinking or occlusion-10-11% incidence
- Dislodgement- 5% incidence. Tape is fairly secure but if the tubing does become disconnected and becomes unsterile it can not be restarted.

Anesthesiologist/Pain Service

- All orders for pain medicine need to be written by anesthesiologist/pain service
- Will assess the need for bolus of local anesthetic if patient experiencing pain
- Remove epidural catheters. Primary team may discontinue infusions if concerns for safety, but may not physically remove the catheter.

Nursing

- Safety equipment at bedside- resuscitation bag, fitted mask, oxygen, suction supplies and in a monitored bed.
- 2 RN's initiate epidural infusion and ensure correct orders
- Maintain IV access
- Assess for edema, erythema, pain at site and leakage every shift

Nursing (cont)

- Address skin integrity-provide protection to dependent areas including heels, elbows when non-mobile.
- Ensure frequent turning/changing of positions.
- Patient is ok to transfer to chair or be held by parents
  - Extra support staff might be needed to ensure the safety of the patient and the catheter
- If catheter disconnects wrap in sterile gauze, clamp tubing and turn off pump then page anesthesia at 1424 or call ascom 8345.

Education

- Patient Controlled Epidural Analgesia (PCEA)
  - Educate family about only the patient pressing the demand button
  - Anticipatory use with ambulation, PT or dressing changes

Monitoring

- Respiratory rate and depth with a stethoscope, pulse ox and sedation scores Q 1 H for the first 12 hours and then Q 2 H until epidural is stopped if opioids are used.
- Hourly sleep arousals can be omitted if:
  - Oxygen sats >94% and acceptable RR for 6 hours after initiation/change.
- Assess and document BP, HR and temp Q 4 H
- Pain scores Q 4 H with appropriate pain scale
  - Avoid FLACC scores for patients >7 years old because they are sleeping

Notify Anesthesiologist/pain service

1. Increased sedation
2. Respiratory depression/apnea
3. Arrhythmias
4. Seizures
5. Nausea/Vomiting
6. Urinary retention
7. Increasing motor block
8. Inadequate analgesia
9. Paresthesias- sensation of tingling, burning, pricking or numbness

Response to hypoventilation or seizure

1. Call CAT team or call CODE if indicated
2. Turn off epidural infusion
3. STAT page anesthesia on #1424 or 8345 ascom
4. Prepare naloxone as ordered on MAR

Discontinuation

- Typical discontinuation of the epidural accompanies good PO intake.
  - Oral medications are started and epidural infusion stopped.
  - Rescue medications are increased in frequency if needed.
- Anesthesiologist/Pain medicine team will discontinue epidural catheter. Please prompt for adhesive remover to promote skin integrity.
- Keep site clean and dry. No need to cover with dressing.
- Full sensation may not return for 2-3 hours post infusion discontinuation.
- Waste controlled substances per CNMC policy

Resources for Epidural Pumps

- Operations manual on the intranet
  - Biomed > education and training > operator manual
  - Online tutorial for CADD pump can be found on the intranet under computer based training (right side lower page) then going to Smith pump training for the CADD pump (lower left hand of page).

Resources and References

- www.asra.com
- www.nysora.com
- American Pain Society, The Assessment and Management of Acute Pain in Infants, Children, and Adolescents. *Pediatrics* 2001; 108(3): 793-797.
- Clinical Anesthesia, 4th edition, Paul G. Barash, Bruce F. Cullen, Robert K. Stoelting