Epidurals and Caudals

For Neonates
The Epidural Space

- The epidural space is the small space lying between the spinal meninges (layers surrounding the spinal cord) and the sides of the vertebral canal.
- It extends from the base of the skull to the sacral hiatus.
- It is filled with fat, blood vessels and nerve roots that traverse it.
What is epidural analgesia?

• Epidural analgesia is a form of regional anesthesia involving administration of drugs through a needle or catheter placed into the epidural space.
• The drugs administered can cause both a loss of sensation (anesthesia) and a loss of pain (analgesia) by blocking the transmission of signals through nerves near the spinal cord.
Continuous Epidural Analgesia

- This refers to placement of a catheter in the epidural space with subsequent administration of a continuous infusion of drugs for pain relief.
- The goal is to provide safe and effective analgesia that will minimize postoperative stress and facilitate recovery.
What is caudal analgesia?

• When the epidural space is entered through the sacrococcygeal membrane it is referred to as a caudal.
• If it is a single-injection technique with no catheter placement it is referred to as a ‘single-shot caudal’.
• If a catheter is placed it is commonly referred to as a caudal (epidural) catheter.
• The catheter may be threaded up the epidural space to the desired level / location (thoracic or high lumbar) and a continuous infusion of drugs can be administered for pain relief.
Benefits of Epidural and Caudal Analgesia in Neonates

• It provides good intraoperative and / or postoperative analgesia after thoracic, abdominal, lower extremity, or perineal / urologic surgery.

• It reduces the need for systemic narcotics (which may predispose the neonate to respiratory depression and need for continued intubation / mechanical ventilation) thereby facilitating earlier extubation in the postoperative period.

• It reduces general anesthesia requirements and in some instances can be the sole anesthetic.
Contraindications to Caudals / Epidurals

• Systemic sepsis
• Local skin pathology
• Patient (in this case parental) refusal
• Clinically significant coagulopathy
• Ongoing, progressive neuroaxial disease
• Abnormal anatomy (example myelomeningocele)
Drugs

• Typically a local anesthetic +/- an opioid are run as an infusion through an epidural or caudal catheter.
• Local anesthetics are drugs that cause reversible loss of nociception. Commonly used examples of local anesthetics include lidocaine, bupivacaine, chloroprocaine and ropivacaine.
• Commonly used opioids include fentanyl and morphine.
• All drugs administered caudally / epidurally should be preservative free.
### Maximum Dosages & Rates

<table>
<thead>
<tr>
<th>Local Anesthetic</th>
<th>Common Concentrations</th>
<th>Max rate for ≤ 2 months</th>
<th>Max rate for &gt; 2 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bupivacaine</strong></td>
<td>0.1% (1 mg/ml) (&gt; 2 months)</td>
<td>0.25 mg/kg/hr</td>
<td>0.5 mg/kg/hr</td>
</tr>
<tr>
<td></td>
<td>0.0625% (0.625 mg/ml) (&lt; 2 months)</td>
<td>0.25 mg/kg/hr</td>
<td>0.5 mg/kg/hr</td>
</tr>
<tr>
<td></td>
<td>0.05% (0.5 mg/ml) (&lt; 2 months)</td>
<td>0.25 mg/kg/hr</td>
<td>0.5 mg/kg/hr</td>
</tr>
<tr>
<td><strong>2-Chloroprocaine</strong></td>
<td>1.5% (15 mg/ml) (&lt; 2 months)</td>
<td>12 mg/kg/hr</td>
<td>12 mg/kg/hr</td>
</tr>
<tr>
<td><strong>Ropivacaine</strong></td>
<td>0.1% (1 mg/ml) &gt; 2 months</td>
<td>0.25 mg/kg/hr</td>
<td>0.5 mg/kg/hr</td>
</tr>
</tbody>
</table>
## Dosages & Rates of Common Epidural Infusion Adjuncts

<table>
<thead>
<tr>
<th>Drug</th>
<th>Common Concentrations</th>
<th>Usual rate for ≤ 2 months</th>
<th>Usual rate for &gt; 2 months</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fentanyl</strong></td>
<td>1 mcg / ml</td>
<td>0.5 - 1 mcg/kg/hr</td>
<td>0.5 - 1 mcg/kg/hr</td>
</tr>
<tr>
<td><strong>Morphine</strong></td>
<td>10 mcg/ml</td>
<td>3 - 5 mcg/kg/hr</td>
<td>3 - 8 mcg/kg/hr</td>
</tr>
<tr>
<td><strong>Clonidine</strong></td>
<td>0.2 mcg/ml</td>
<td>Usual rate for ≤ 6 months: 0.05 – 0.08 mcg/kg/hr</td>
<td>Usual rate for &gt; 6 months: 0.1 – 0.2 mcg/kg/hr</td>
</tr>
<tr>
<td>(caution in infants &lt; 1 yr – increased risk of apnea)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Risks of Epidural / Caudal Placement

- Infection
- Bleeding +/- hematoma
- Nerve damage
- Dural puncture (wet tap)
## Side Effects of Local Anesthetics

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>Possible Treatment / Intervention</th>
</tr>
</thead>
</table>
| Urinary retention (rare in neonates) (secondary to loss of sensory, autonomic & motor input to bladder) | • Monitor bladder distention (Q6H) if no foley  
• Intermittent catheterization or foley |
| Sympathetic blockade (hypotension is common in adults but rare in infants and small children) | • Adequate hydration  
• Careful local anesthetic dosing |
| Motor blockade (dose dependent)                                             | • Decrease concentration of local anesthetic  
• Change to a different local anesthetic (for example ropivacaine causes less motor blockade as compared to bupivacaine) |
| Pressure ulcers (secondary to sensory blockade)                             | • Protect potential pressure points  
• Reposition frequently (at least Q4H)  
• Avoid leaving hard / sharp objects in patient’s crib |
| Systemic toxicity                                                          | • Limit dosage (see dosage maximum table)  
• Aspiration and test dose when epidural placed to avoid intravascular injection  
• Avoid infusion of bupivacaine > 48hrs  
• If severe rxn, supportive tx + / - CPR and consider administering 20% Intralipid. |
# Side Effects of Opioids in Epidural Infusions

<table>
<thead>
<tr>
<th>Side Effect</th>
<th>Possible treatment / intervention</th>
</tr>
</thead>
</table>
| Itching                                                                     | • Naloxone infusion 0.5 – 2 mcg/kg/hr  
• Remove or decrease opioid in epidural infusion                                     |
| Nausea / vomiting                                                            | • Ondansetron 0.1 mg/kg IV  
• Naloxone infusion 0.5 – 2 mcg/kg/hr  
• Remove or decrease opioid in epidural infusion                                   |
| Urinary retention (secondary to effect on parasympathetic tone of the bladder detrusor muscles) – rare in neonates | • Monitor bladder distention (Q6H) if no foley  
• Intermittent catheterization or foley                                                                                 |
| Respiratory depression and Over-sedation                                     | • Stimulate patient  
• Provide ventilatory support +/- oxygen  
• Naloxone bolus 5 mcg/kg IV Q 1-3 minutes until spontaneous ventilation resumes  
• Remove or decrease opioid in epidural infusion                                                                 |
Continuous Epidural Analgesia Guidelines

• An anesthesiologist’s order is required for epidural analgesia.
• Only the acute pain service may change epidural orders.
• All previous opioid and sedative orders should be reviewed and discontinued as appropriate by the anesthesiologist writing epidural orders.
• There should NOT be any administration of opioids or sedatives unless ordered or approved by the acute pain service while the patient has the epidural.
• Naloxone (1 amp with syringes) should be at the bedside with a pre-planned dose clearly marked. It should accompany the patient off the unit.
• Oxygen, suction and cardio-respiratory resuscitation equipment should be immediately available.
Continuous Epidural Analgesia Guidelines

• The epidural / caudal catheter should be clearly marked and labeled.
• The infusion device and all tubing attached to the epidural / caudal catheter should be clearly labeled.
• Infusion tubing and filter should be changed every fourth day.
• All epidural catheters should be removed by the pediatric acute pain service.
Monitoring Neonates with Epidurals

- Pulse ox and cardiac monitors (ECG) are required for all neonates receiving epidural analgesia.
- Monitor pain (using PIPP scale), sedation, vital signs (RR, BP, HR & SpO2) & motor strength.
- Monitoring should continue for 8 hours after last morphine bolus, 4 hours after last fentanyl bolus, and 2 hours after any infusion is stopped.
- Patients should have a patent IV while they have an epidural in place and for 8 hours after epidural discontinuation unless otherwise ordered.
<table>
<thead>
<tr>
<th>및시</th>
<th>Basal</th>
<th>After bolus given from pump or rate increased</th>
<th>After local bolus given by Pain Service staff</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory rate and Sedation score</td>
<td>Q 1 hr x 12 hrs, then Q 2 hr x 12 hrs, then Q 4 hrs if no change in pain management and patient is stable</td>
<td>In 15 minutes, then q4 h</td>
<td>Q 4 h</td>
</tr>
<tr>
<td>Pulse ox</td>
<td>continuous</td>
<td>continuous</td>
<td>continuous</td>
</tr>
<tr>
<td>HR &amp; BP</td>
<td>Q 4 h</td>
<td>Q 4 h</td>
<td>In 20 minutes then Q 4 h</td>
</tr>
<tr>
<td>Pain Score</td>
<td>Q 4 h</td>
<td>Q 30 min x 2, then Q 4 h</td>
<td>Q 30 min x 2, then Q 4 h</td>
</tr>
<tr>
<td>Dressing and Catheter site</td>
<td>Q 4 h</td>
<td>Q 4 h</td>
<td>Q 4 h</td>
</tr>
<tr>
<td>Skin Integrity / pressure</td>
<td>Q 4 h</td>
<td>Q 4 h</td>
<td>Q 4 h</td>
</tr>
<tr>
<td>Bladder distention (if no foley)</td>
<td>Q 6 h</td>
<td>Q 6 h</td>
<td>Q 6 h</td>
</tr>
</tbody>
</table>
Documentation

• Document epidural solution, basal rate, pump bolus (if applicable), hourly max as well as any changes to the aforementioned epidural settings on the flowsheet.
• Document vital signs, pain scores, sedation scores, skin assessment, catheter site assessment.
• Frequency of documentation is equivalent to the monitoring frequency (see monitoring table).
• Document side effects, problems or adverse events.
• Document any additional medications relevant to the patient’s pain management on the flowsheet.
Notify Anesthesia Acute Pain Service if:

- Over sedation and / or inability to arouse patient
- Respiratory distress
- Decrease in SpO2 or increase in oxygen requirements or RR < 20
- Inadequate pain control
- Prior to RN epidural pump bolus
- Side effects (itching, N/V)
- New, unexplained neurologic deficit
- Decreasing movement of lower extremities
- Site leaks clear or bloody fluid
- Induration or redness at insertion site
- Fever
- Blood is in epidural catheter
- Catheter is disconnected or displaced
- Catheter is contaminated
- Occlusion in the line
- Dressing becomes loose
What to do if:

- **Epidural catheter becomes disconnected**: cover both ends with sterile gauze and notify the Pediatric Acute Pain Service.
- **Epidural leaking at skin insertion site (very common in neonates / infants)**: notify the pain service, reinforce dressing with clear occlusive tape (tegaderm) if necessary. May require a pressure bandage to decrease leak.
How to contact the Pediatric Acute Pain Service:

• The number to page is 123-4459 (24 hours a day, 7 days a week).

• If a prompt response is not obtained:
  ➡️ please check ‘Web X-change on call now’ for the Pediatric PSC Attending.
If you call the APS at night:

- You will get the PSC attending who is on service but is not ‘in house’
- They will assist by phone, may give verbal orders
- If pump needs troubleshooting or patient needs evaluation, the G1 resident (anesthesiology resident on call for the OR) will be asked to assist (triaged based on urgency)
- Therefore please call early with regards to pain interventions
Questions about the pump?

- Please refer to the NCCC Inservice powerpoint
- Please refer to the NCCC Epidural Pump Binder (will be kept in the Nurse Practitioner call room and at the patient bedside)
- Additional resources: 7CH and PICU nurses (soon the NCCC nurse practitioners as well)
- Key for epidural pump is only in the NCC1 pyxis machine, under ‘key control’