EPIDURAL PAIN MANAGEMENT

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Objectives
At the conclusion of this presentation, the participant will be able to:
– Describe the benefits of epidural analgesia
– Discuss the medications used in epidural pain management and the mechanism of action to include side effects and treatment of
– Identify possible complications of epidural pain management and required action by the RN
– Discuss nursing interventions of epidural pain management including patient safety and patient education.

Neuraxial Analgesia
• Subarachnoid space - between spinal cord and the dura
  – extends from the foramen magnum to the sacral hiatus
  – contains CSF
• Epidural Space
  – Potential space – clinical significance
  • Contains—vasculature, fat, network of nerve extensions
    – 31 pairs of spinal nerves
    – 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, 1 coccygeal (anterior and posterior)
  – Exit bilaterally – specific skin surface areas are innervated by a single spinal nerve or group of spinal nerves – dermatomes
Catheter Insertion

• Loss of Resistance Technique - LORT
  – 2-5 mL of air or saline in syringe while needle is advanced
  – Due to loss in resistance, syringe contents are injected
  – Based on personal preference
  – Norman and Winkelman (2006) found no difference in pain when comparing saline or air (≤ 3 mL) in LORT
  – Leo, et al (2008) found that CSE LOR with 2 ml air vs 2 ml saline resulted in more episodes of recurrent BTP
  – Injection of large amounts (10 mLs) of air has been shown to result in complications, such as, air embolism, patchy block, pneumocephalus and dural puncture; smaller amounts of air have been shown to result in breakthrough pain

Test Dosing

• After LORT
  – Aspirate and observe for
    • CSF
    • Blood
  – Inject Lidocaine with epinephrine
    • Observe vital signs
    • Change in sensation
Stress Response

• Initiated by nervous and endocrine systems
  – SNS ➔ medulla of adrenal gland to release catecholamines
    • Epinephrine, norepineprine, dopamine
    • Release of epinephrine and noradrenaline ➔
      ↑ myocardial contractility, ↑ HR, CO and BP

TEA in CABG

• Meta-analysis by Liu, et al 2004
  – Fewer dysrhythmias (atrial fibrillation and tachycardia) post CABG
  – ↓ risk of pulmonary complications (pneumonia and atelectasis)
  – Faster time to extubate
  – ↓ pain scores
  – No cases of spinal hematoma reported
    • Risk is 1 in 150,000 with EA and 1 in 220,000 with SA

Stress and the Endocrine System

• Cortisol and catecholamines released to increase energy availability
• Cortisol—hydrocortisone
  – gluconeogenesis and glycogenolysis
    • Results in ↑ BG
  – ↑ lipolysis, ↑ catabolism
### EA Effects in Diabetics

- Study by Lugli et al (2010)—12 diabetic (DM2) and 12 nondiabetic pts having colorectal surgery for nonmetastastic disease
  - 6 diabetic pts received GA with postop PCA morphine (1-2mg 7 min. lockout) and 6 received GA and periop EA plus cont. EA of 0.1% bupivacaine with 3 mcg/mL fentanyl postop; same for nondiabetic group (6 & 6); amino acid infusion given to both groups
  - Marked ↑ in positive protein balance in DEA group
  - ↓ muscle breakdown (catabolism)

### Benefits Combining Local Anesthetic with Epidural Opioids

- Synergistic analgesic action
- Reduced opioid dose
- Minimized opioid & LA side effects

### Opioid Mechanism of Action

- Recall—pathway of pain transmission from stimuli to dorsal horn of spinal cord
- Opiate receptors in brain, spinal cord and peripheral tissue, μ, κ, δ
  - pain transmission is blocked in spinal cord when opioids are bound to these receptors
Neuraxial Opioid Administration

- Lipophilic opioids (e.g. fentanyl):
  - Fast onset of action ~ 5-15 min.; duration 2-4 hours
  - Does not spread; doses similar to IV; PCEA rather than single bolus dosing
- Hydrophilic opioids (e.g. morphine):
  - Delayed onset of action ~ 30-60 min., peak effect ~ 90 min.
  - Spreads rostrally
  - Ideal for single-bolus dose—can last up to 24 hrs.
  - Epidural morphine is 10 x more potent than IV; spinal morphine is 10 x more potent than epidural

Hydromorphone (Dilaudid)

- 10 times more lipophilic than morphine
  - More potent than morphine
  - Onset 15-30 min. duration 6-7 hrs
  - Capable of spreading rostrally
  - Fewer side effects than morphine (pruritus, nausea and sedation)
  - Current dosing recommendation
    • 10-20 mcg/mL at 10-12 mL/h

Less frequently used opioids

- Meperidine—normeperidine
- Methadone –unpredictable half-life
- Sufentanil —very fast acting—twice lipid soluble than fentanyl and 1000 x more potent than morphine—peak ~ 5 min. with one hour duration
### LOCAL ANESTHETICS

- **Mechanism of Action**
  - Sodium Channel Blockers
  - Block action potential and nerve conduction
- **In sub-anesthetic doses, act as an analgesic**
  - High concentrations provide anesthesia
- **Only used in combination with opioids postoperatively**
- **Has been shown to suppress the stress response, improve GI function, and reduce CV, pulmonary and infectious complications in postop pts.**

### Local Anesthetics

- **Bupivacaine** - Marcaine - low concentration 0.05 – 0.125% -- fast - moderate onset (5-20 min. with long duration (up to 12 hrs)
- **Ropivacaine** - Naropin (0.05 – 0.2%) —fewer CNS and cardiac effects than bupivacaine; onset similar to bupivacaine but slightly shorter duration
  - Bupivacaine and ropivacaine are lipid soluble
- **Lidocaine**—fast onset with moderate duration

### Other drugs used in EA

- **Clonidine** – alpha²-adrenergic agonist
  - Decrease neurotransmitter release, i.e., Substance P
  - no opiate or local anesthetic side effects, i.e. motor block, urinary retention, respiratory depression or pruritus
  - Side effects – hypotension, bradycardia and sedation—dose related
- **Ketamine** – NMDA antagonist
- **Baclofen** – treatment of spasticity
EREM (Depodur) –
Provides up to 48 hrs of pain relief

- Reduction in PE after Total Joint Arthroplasty—Blackshear (2010)—study of 659 pt charts (Dec. 2002- Jan. 2006) 327 received EREM and 332 – control – ½ received EA of 0.125% bupivacaine and 2 mcg/ml fentanyl of 5 – 8 ml/hr and other ½ received PCA meperidine or morphine
- Anticoagulant dilemma – epidural/spinal hematoma
- Results—
  - PE significantly higher in total hip group of control 6 vs 0 in EREM
  - Rate of PE in total knee = 5 vs 0 in EREM
  - Higher rate of resp depression in EREM group—down from 16% in 2005 to 0.8% in 2007 due to implementation of order-sets and lower dose of EREM
  - Pain control significantly improved in EREM group with significantly lower use of breakthrough pain med
  - LOS reduced

Epidural Analgesia can Decrease the Surgical Stress Response

- Stress causes Rapid changes in the
  - Cardiovascular
  - Endocrine
  - Nervous
  - Immune
- All systems are effected during the stress response
  - GI
  - GU
  - Peripheral

PCEA vs CEI

- 104 rec’d PCEA and 101 rec’d CEI—goal was to compare pain scores
- PCEA was superior to CEI with
  - Lower pain scores esp. 24-72 hrs postop during rest and with movement
  - fewer requests by nurses for APS to “top up” the dose and higher satisfaction scores
  - Consumed less additional analgesics (opioids, NSAIDs)
  - Overall satisfaction at 72 hrs postop and at discharge
Combined Spinal and Epidural CSE

- Frequently done in OR and OB
- Needle through needle technique
- Rapid and reliable onset of anesthesia/analgesia
- Greater number of segments involved
- Lower risk of drug toxicity; fewer side effects
- Less intense motor blockade
- Better postop analgesia
- More rapid patient mobilization

CSE in OB

- {retrospective chart review of 788 pts (Aneiros et al 2009)}
  - Needle through needle technique
  - No difference in
    - rate of cesarean delivery
    - rate of instrumental vaginal delivery or
    - length of labor
  - Higher satisfaction with pain control with CSE

CSE in Abdominal Surgery (Stamenkovic, et al 2007)

- CSE has also been successful in major abdominal surgery – Study of 160 pts. – comparing CSE with EA
  - Epidural cath at T6-7 or T7-8 and spinal injection at L2-3 in OR preop of either
    1. MBF
    2. MB
    3. M
    4. NS (EA group)
  - Postop epidural injections of morphine 2 mg and bupivacaine 0.125% 13 ml bolus
  - All who received CSE had better outcomes than EA but those who received CSE MBF had: earlier extubation; required fewer bupivacaine injections intraop; fewer episodes of hypotension; less pancuronium intraop; and better pain control postop
Adverse Effects of Neuraxial Analgesia

• Note that AEs usually occur with concomitant use of opioids and/or sedatives or sedating meds with epidural opioids

Minor Problems Related to Opioids

• Pruritis
  – Very common
  – Avoid Benadryl – due to sedation and can mask LOC changes
  – Naloxone – mu antagonist 5 mcg/kg/hr
  – Nalbuphine—agonist-antagonist (adult 2.5mg)

• Nausea
• Urinary Retention

Urinary retention

• Ladak, et al study (2009-PMN Journal) – found that ~ 10% of patients with thoracic epidural infusions of either hydromorphone with bupivacaine (n=44) or ropivacaine (=5)
• Mechanism of urinary retention not fully understood
SEDATION AND RESPIRATORY DEPRESSION

- Level of sedation and respiratory rate assessment
- Determine if cause is the opioid
- If untreated can lead to respiratory depression
- Respiratory Depression is preceded by sedation—
- More likely if T4-T5 is effected

Siriussawakul et al Study (2010)

- Upper abdominal procedures with subcostal and/or midline incision
- Compared EA bupivacaine 0.0625% and morphine 0.02 mg/mL or fentanyl 1-2 mcg/mL to IV cont infusion or PCA
- Cont. O2 sat was measured until 48 hr postop in pts who did not require O2 when discharged from PACU
- Pts. cared for on general surgical unit
- Desat occurred in 65 pts (38%) and given O2
- Factors independently related to desaturation
  - BMI > 25; subcostal incision, use of neuraxial opioid for pain control
- Recommendation—Cont. O2 sat and supplemental O2 for 48 hrs. postop in these groups

LATE ONSET RESPIRATORY DEPRESSION

- Can occur with bolus injection (5 mg morphine)
  - 6-12 hrs after injection
- Earlier resp depression at 5 – 10 min and before 2 hrs can occur
  - Due to vascular uptake
- Usually preceded by sedation and decreased LOC
- Monitor Q1H – sedation level and respiratory status for the first 12 hours
NALOXONE

- Mix 0.4 mg (1 amp) of naloxone and 9 ml NS
  - Give slowly – 2.5 ml over 2 min and observe pt
  - If no response repeat up to total of 0.8 mg. or 20 ml of dilute naloxone
  - May need repeated dosing due to half-life
- Adverse effects
  - Anxiety, irritability → potentially life-threatening tachycardia and hypertension

ADVERSE EFFECTS OF EPIDURAL LOCAL ANESTHETICS

Local Anesthetic Neuro-Toxicity

- High blood levels cause
- Neurotoxicity—due to depression of inhibitory cells → that leads to neuro excitation
  - Lightheadedness, dizziness—early signs
  - Circumoral tingling and numbness
  - Ringing in ears
  - Metallic taste, slow speech,
  - Irritability, twitching
  - Seizures ↔ CNS depression ↔ cessation of seizures ↔ coma ↔ cardiopulmonary arrest
Local Anesthetic Cardio-Toxicity

- Cardiotoxicity
  - Bupivacaine prolonged dwell time of 1.5 s
  - Lidocaine dwell time 0.15 s
  - Ropivacine – larger margin of cardiac safety
  - PR interval prolongation
  - Widening of QRS complex
    - can lead to bradycardia
    - atrioventricular conduction blockade
    - sinus arrest
    - myocardial depression
  - Incidence – 7 cardiac arrests for every 10,000 – most are resuscitated – 1.5 deaths per 10,000
    - Cardiac arrest from spinal anesthesia is 3 x > than regional techniques

Treatment for Toxicity

- Supplemental O₂—may need to intubate
- Propofol or midazolam for seizures
- Amiodarone 300 mg for arrhythmias

Hypotension in L & D

- Hypotension from relaxation of vascular smooth muscles
  - Higher concentrations cause hypotension
- Preprocedure hydration—500-1000mls crystalloid helps minimize sympathectomy
- Place woman in lateral position and elevate legs
- Ephedrine IV—5-10mg up to 30mg
- Maternal signs
  - pallor
  - sweating
  - nausea
  - vomiting
  - changes in sensorium
Increased risk of intravascular injection in OB patients
• Due to anatomical and physiological changes
  – Relatively low venous pressure
  – Engorgement of epidural venous plexus
• Adverse hemodynamic effects
• Treat with IV fluid bolus

CNS toxicity usually proceeds Cardiotoxicity
CNS toxicity rapidly progress to Cardiotoxicity
Pregnancy is risk for toxicity

PDPH
• Meta-analysis by Choi, et al.
  – 39 studies from three databases-Medline, CINAHL and HealthSTAR
  – 1966-2002
  – Accidental dural puncture (ADP) with epidural
    • One in 67 risk of DP during epidural insertion
    • ~50% will result in PDPH
    • Risk diminishes with smaller needles but not much less
    • Onset of PDPH is early as one day and as late as 7 days following DP
    • 1/3 begins after two days postpartum—as many as 6 of 18 pts will not begin in the hospital
PDPH Management
Baysinger (2010) article
• Survey of North American members of the Society for Obstetric Anesthesia and Perinatology—18% responded
  – Post ADP 6%
    • use ITC and 76% found it effective
    • 53% reduce EBP dosing
    • 7% give saline via EC
    • 4% give saline via ITC
    • 8% do prophylactic EBP
    • 75% use hydration
    • 32% prescribe BR
    • 58% use caffeine therapy
    • 8.7% give ITC opioid—4.8% via EC
  – PDPH – 89% use hydration
    • 85% use caffeine
    • 48% prescribe BR
    • 81% perform EBP (60% give 11-20 mL) → 90% success rate
    • If failed → 74% would repeat EBP

Rate of Hematoma and Infection in OB patients—meta analysis
• Overall rate of epidural hematoma was 1 in 183,000 women or 5 per million
  – larger studies = 1 in 168,000 women or 6 per million
• Epidural infection – study of 1.2 million women
  – Overall rate was 1 in 110,000 women or 9 per million
  – Larger post-1990 studies were 1 in 145,000 or 7 per million

Neurologic Injury (Ruppen article)
• Overall rate of persistent neurologic injury was 1 in 257,000 women or 4 per million
  – Larger studies – post 1990 – 1 in 237,000 women or 4 per million
• Transient neuro injury – injury lasting less than one year – overall rate was 1 in 3,900 or 257 per million
  – Larger post-1990 studies were 1 in 5,537 or 180 per million
• Neurologic injury of unknown duration – overall rate was 1 in 4,300 women or 230 per million
  – Larger post-1990 studies were 1 in 6,700 women or 150 per million
Cauda Equina Syndrome

- Serious complication
- Acute loss of neurologic function below termination of the spinal cord
- Result of damage to the spinal nerve roots
- Caused by maldistribution and excessive local anesthetic dose concentrations in the CSF

Epidural Infection

- Pasero, McCaffery pp. 434-435
  - Epidural abscess, arachnoiditis, bacterial meningitis
  - Very rare but serious complication
  - 6-year review in 8,100 hospital pts. – 6 cases of epidural abscess and 3 of meningitis
  - Tunneled epidural systems have higher rate of infection—15% of pts. with catheter for 70 days with only 1% infection is deep
  - Implanted spinal cord stimulators – overall infection 5%
- Cameron, et al study—16-year period (1990-2004) 8,210 pts – 6 with epidural abscess; one required surgical intervention

Pump Programming Error


- 26 y.o. OB pt at 41 weeks gestation in L&D
  - BP 114/57, HR 100
  - Epidural placed at L4-5
  - 2 boluses of 4 mL of 0.2% ropivacaine and 50 mcg fentanyl – 3 min. interval
  - Cont EA of 0.2% ropivacaine at 10 mL/h with 70 mls remaining in bag
- 1 ½ hrs later pt. exp more pain and received bolus of 5 ml of 0.2% ropivacaine and cont infusion to 11 mL/h
- 50 min. later pt. became hypotensive and unresponsive to ephedrine – anesthesiologist contacted
  - Noted that infusion bag was empty—“111 mL/h” instead of 11mL/hr was programmed
  - BP 90/50, HR 70—given phenylephrine infusion given
- pt and baby did fine
- Authors felt the reason a bad pt outcome was avoided in this situation was because of their routine use of ropivacaine vs bupivacaine
CATHETER RELATED PROBLEMS

- Catheter occlusion from blood clot
- Catheter shearing – from improper insertion or removal
- CSE needle shearing
- Retained catheter tip – noted on discontinued cath
  - May require surgical removal
- Inadequate pain control due to migration

Catheter migration to Intrathecal space

- Signs and symptoms
  - Nausea
  - decreased BP
  - loss of motor function without a definable cause
  - increased analgesia
  - Seizures
  - respiratory depression
  - cardiovascular collapse
  - death

Case Review {Fivez (2010)}

- 32 y.o. OB pt. with 28 weeks’ gestation dead fetus in active labor
- CSE initiated (18G Tuohy needle with 27G spinal needle through the epidural needle – ropivacaine 0.175% with sufentanil 0.75mcg/ml then needle removed -> catheter advanced; aspiration test with no blood aspirated
- 4 ml PCEA with 15 min lock-out and 2 ml/h cont
- 13 hrs later pain epidural bolus of 10 ml given
- Within 1-2 min pt had visual disturbances, metal taste in mouth, perioral tingling and difficulty pronouncing words -> catheter aspirated and blood returned -> cath redrawn wo blood and signs of toxicity disappeared within 10 min—pt. wo complications
NURSING INTERVENTIONS

1. MONITORING V/S, LOC, SEDATION, PAIN
2. RR Q1H POSTOP AND WITH DOSING CHANGE, EITHER RATE OR CONCENTRATION
3. ASSESS SITE
4. ASSESS FOR SIDE EFFECTS for UP TO 24 HRS. AFTER EPIDURAL DC’D
5. ASSESS FOR COMPLICATIONS
6. ASSESS SENSATION AND MOTOR FUNCTION
7. ASSESS CATHETER, MEDICATION DOSING AND PUMP SETTINGS
8. PATIENT EDUCATION


