Acute Pain Management for Spinal Fusion

Patrick Ross, MD
Children’s Hospital Los Angeles
Assumptions for Idiopathic

- TIVA for neuromonitoring
- Blood sparing technique
- Otherwise healthy neurologically intact
- 4 to 5 day hospitalization
- Want rapid emergence
Assumptions for Non-Idiopathic

- **TIVA for neuromonitoring**
- **Blood sparing technique**
- **Underlying disorders**
  - Seizures, respiratory compromise
- **6 to 10 day hospitalization**
- **May remain intubated**
Goals for Acute Pain

- Effective
- Quick and easy to perform
- Low failure rate
- Good risk / benefit balance
- Does not require PICU
- Does not delay emergence
Possible therapies to start in the OR

- **Intrathecal opioids**
- **Epidural catheter**
- **IV Methadone**
- **IV Ketamine**
- **IV acetaminophen**
- **Subcutaneous local anesthetics**
- **Decadron**
Possible therapies to start after

- Epidural PCEA
- Continuous opioids / PCA
- NSAIDs
- Diazepam
- Acetaminophen
- Others: Ketamine, Magnesium and Gabapentin
Intrathecal Opioids

- Prolonged post-operative analgesia
- Decreased anesthetic agents
- Limited effect on neuromonitoring
- Decreased blood loss
- Intrathecal morphine 20 mcg / kg with sufentanil 50 mcg total

M. Goodarzi. Pediatric Anesthesia 1998
Higher IT morphine dose does not improve efficacy

- Prospective pediatric study comparing Intrathecal morphine 0, 5 mcg/kg, 15 mcg/kg
- IT morphine decreased EBL, post-op opioids, pain score
  - Eschertzhuber et al. BJA 2008

- Retrospective pediatric study comparing Intrathecal morphine 0, mean 14mcg/kg, mean 24 mcg/kg
- IT morphine lower pain scores, longer time to rescue
- Higher dose associated with increased respiratory depression
  - Tripi et al. Spine 2008
What is the correct IT morphine dose?

- **IT morphine ceiling effect**
  - Higher doses do not improve analgesia

- **Larger doses delay post-op IV morphine**
  - 20 mcg/kg may last 18 to 24 hours
  - May not matter with multi-modal therapy

- **Decreased blood loss starting at 5 mcg/kg**
  - Gall et al. Anesthesiology. 2001

- **Several studies show low pain scores with IT morphine dosing 3 to 7 mcg/kg**
What comes next?
Epidural or IV morphine

- **Epidurals provide better analgesia**
  - Taenzer et al. Paediatr Anaesth 2010
- **Epidurals can fail (8.5 to 37%)**

- **ITM + PCA > Epidural alone > PCA alone**
  - Milbrandt et al. Spine 2009
- **PCEA alone > PCA alone**
- **ITM + Epidural > PCA alone**
- **All report low pain scores**
Continuous Bupivacaine?

- Decreased post-operative opioid use
  - Ross et al. Spine 2011
- It seemed appealing at the time
- Benefit outweighed by risk of infection
- No other reports in the spine literature
Remifentanil Hyperalgesia

- Increases post-operative morphine use
  - Crawford et al. Anesth Analg 2006

- Is / Is not prevented by low dose ketamine
  - Is, Moustafa et al. Middle East J Anesth 2008

- Not prevented by morphine

- IT morphine? No studies
IV Acetaminophen

- Pediatrics- improved analgesia, did not reduce opioid use
  - No intrathecal morphine
  - Hiller et al. Spine 2012

- Adult- decreased morphine 46%, did not change pain scores
  - No intrathecal morphine
Ketamine

- **Pediatric Spine Surgery**
  - No change in pain score or opioid
  - Neither study used intrathecal morphine
  - Engelhardt et al. Pediatric Anesthesia 2008
  - Tsui et al. Pediatric Anesthesia 2007

- **Pediatric Meta-analysis all surgeries**
  - Decreased PACU pain scores
  - Did not decrease post-op opioids
  - Dahmani et al. Pediatric Anesthesia 2011
Ketorolac Therapy

- Low dose Ketorolac decreased pain scores and morphine usage
  - No intrathecal morphine
- Survey study; 59% of pediatric anesthesiologists prescribe NSAIDs
  - Hayes et al. Pediatric Anesthesia 2009
Ketorolac complications

- Does not increase risk of transfusion or reoperation
  - Vitale et al. The Spine Journal 2003

- Does not increase risk of pseudoarthrosis
  - Incidence pseudoarthrosis 2.5% each group
    - Sucato et al. Spine 2008
  - Similar adult findings with no increase risk of pseudoarthrosis
    - Pradhan et al. Spine 2008
Methadone

- Decreased post-op opioids shown in adult spine fusion
  - 0.2 mg / kg Pain scores same in first 24h
  - Control group sufentanil infusion

- Methadone has efficacy in pediatric Non-spinal surgery
Methadone Pediatric Spine Surgery

- Pharmacokinetics similar to adults
- Only 2 studies so far
- No decrease in opioids or pain scores
- Bolus doses of up to 0.3mg / kg used
- Recommend bolus followed by infusion
  - Sharma et al. Anesthesiology 2011
  - Stemland et al. Paediatr Anaesth 2012
Diazepam

- Reduces muscle spasm
- Not studied separately in spine surgery, pediatric or adult
IV Magnesium

- Adult studies (none spine) show decrease pain and opioid consumption
- Meta-analysis reduces opioids and pain scores
  - Albrecht et al. Anaesthesia 2013
- Hypomagnesemia occurs after pediatric spine surgery
  - Chrun et al J Pediatr (Rio J) 2012
Gabapentin

- Pediatric scoliosis
- Gabapentin versus placebo
  - 15 mg / kg pre-op, 5 mg / kg post TID
- Lower pain scores
- Decreased morphine usage
- Did not decrease opioid side effects
  - Rusy et al. Anesth Analg 2010
Jens Voigt’s Bike
15 lbs; >$14,000
Multimodal therapy

- Each addition likely lowers pain scores and opioid use
- Unable to separate effect of the individual from the group
- Not a new concept
Multimodal published report

Adult study

- Pre-op: Acetaminophen, celecoxib, gabapentin, and usual opioid
- Intra-op: Remifentanil, propofol, dexamethasone, ketamine bolus and gtt, morphine, Epidural bupivacaine, ondansetron
- Post-op: Acetaminophen, ibuprofen, gabapentin, Epidural bupivacaine and morphine (or) morphine PCA, ondansetron, droperidol, and dexamethasone

- Opioid consumption was reduced
  - Mathiesen et al. Eur Spine J. 2013
Multimodal at CHLA

- As an example for discussion
- Limited number of anesthesia, surgery, and pain service attendings
- Multiple iterations
- Pain service available 24/7
CHLA multimodal

- **Pre-op:** 2 mg midazolam

- **Induction:** An addition to standard
  - Ketamine 1 mg/kg to max 50 mg
  - Fentanyl 50 to 150 mcg as needed
  - Dexamethasone 0.2 mg/kg to max 10 mg

- **Neuromonitoring performed**
  - Remifentanil and propofol infusions
CHLA multimodal

Intra-op:
- Duramorph intrathecal by surgeon early
- Duramorph 5 mcg/kg to max 250 mcg
- Duramorph drawn up by attending
- IV acetaminophen at the end of the case
- After extubation titrate morphine to need

Transfer to PACU then floor
CHLA multimodal

Post-op day 0:
- Start morphine PCA immediately
- No basal rate, bolus based on size
- Valium scheduled RTC
- Acetaminophen scheduled RTC
- Ketorolac scheduled RTC
  - 1 surgeon, others start POD 1
- Start clears and advance as tolerated
CHLA multimodal

Post-op day 1:
- Start ketorolac if not already going
- Stop morphine PCA
- Start oxycodone schedule Q4h RTC
- D/C foley
- PT/OT consult
- Out of bed at least 2 times

Current LOS for AIS under 4 days
Multimodal congenital scoliosis

- Intrathecal morphine removed at attending discretion
- For older children PCA written as authorized agent controlled analgesia
- For younger children IV morphine infusion is used
- Non-verbal pain scale (FLACC) used
- All other therapy remains the same
Customize to your hospital

- Intra-op: either IT morphine or IV methadone
- Post-op: either Epidural or IV PCA
- Adjuvants; choose any or all
  - Low risk: Acetaminophen, Diazepam, Dexamethasone
  - Slight risk: Ketorolac, Ketamine, Gabapentin
  - Limited info: Magnesium
Thank you
Bibliography


