Analgesic Options for Posterior Spinal Fusion for Adolescent Idiopathic Scoliosis

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Objectives

- Methods of analgesia for PSF for AIS
- Intrathecal Morphine- our experience at U of M
- Less common adjuvants for analgesia following PSF

Analgesic Options for PSF

- PCA
- Epidural
- Intrathecal morphine (ITM)
- Adjuvants

Epidural

With Bupivacaine

- **Best quality analgesia**
- Concern for **delayed diagnosis** of surgical complication

Without Bupivacaine

- Frustrating equipment
- **No "level"**
- **Delivery of central-acting narcotic**
- Patient comfort comparable to PCA

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PCA

- Usually morphine
- Basal rate
- Analgesic method to which all others are compared

Intrathecal Morphine (ITM)

- Dose?
- Transition to PCA
- Analgesia appears to be better while the ITM is working
- Floor vs PICU?

ITM for PSF is Not New

SPINE Volume 34, Number 14, pp 1499–1503

A Comparison of Three Methods of Pain Control for Posterior Spinal Fusions in Adolescent Idiopathic Scoliosis

Todd A. Milbrandt, MD, MS,*† Manuj Singhal, MD,† Christin Minter, MS,‡
Anna McClung, RN,§ Vishwas R. Talwalkar, MD,*† Henry J. Iwinski, MD,*†
Janet Walker, MD,*† Claire Beimesch, MD,† Christopher Montgomery, MD,*†
and Daniel J. Sucato, MD, MS§¶

SPINE Volume 33, Number 20, p 2248–2251

Intrathecal Morphine for Postoperative Analgesia in Patients With Idiopathic Scoliosis Undergoing Posterior Spinal Fusion

Paul A. Tripi, MD, Connie Poe-Kochert, RN, CNP, Jennifer Potzman, MD,
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A Review of Intrathecal and Epidural Analgesia After Spinal Surgery in Children

Tobias, Joseph D. MD

Anesthesia & Analgesia: April 2004 - Volume 98 - Issue 4 - pp 956-965

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- 4 studies, 1988-2001; ITM dose 2-25 mcg/kg
- Respiratory depression only a problem in 1 study
  - 5/33 pts with late (~ 6hrs post op) respiratory depression
  - All responded to naloxone
- Less EBL in the ITM groups
- Similar side effects

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Group	No ITM	Moderate dose (9-19 mcg/kg)	High dose (>=20mcg/kg)
N	68	293	46
Mean ITM dose	0	14 mcg/kg	24 mcg/kg
Mean Pain score (PACU)	5.2	0.5	0.2
Time to IV rescue	6.6 hours	16.7 hours	22.9 hours
Resp. depression	1 (1.5%)	8 (2.7%)	7 (15.2%)
PICU admission	0	6 (2%)	8 (17.4%)

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- **PCA (morphine), ITM/PCA (7mcg/kg), EPI (hydromorphone/bupivacaine) groups**
- **ITM/PCA had lowest pain scores for 1st 8 hours, then EPI**
- **Respiratory adverse events most frequent in EPI group at 11/55; ITM/PCA was 1/42 and PCA 0/41**
- **Pruritus worst in EPI group**

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Why Are We Using ITM at Mott Now?

- Surgeon request, March 2014
- Clinical protocol to transition from ITM directly to oral analgesics- May 2014
- Favorable initial chart review, expanded use in 2015

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ITM for PSF: 2015 Clinical Protocol

- ITM dose = 8-10 mcg/kg, max 800mcg
- Advise against sufentanil infusions
- Acetaminophen
- Ketorolac
- Valium IV PRN
- 16 hours post-ITM: schedule oxycodone

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ITM vs EPI for PSF for Idiopathic Scoliosis: Results

- No IV narcotics after PACU
- No patients admitted to PICU or had RRT/Code called for cardiopulmonary concerns
- Discharge home ½ day sooner, earlier ambulation, and earlier Foley catheter removal for ITM group

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ITM vs EPI for PSF for Idiopathic Scoliosis: Results

Group	ITM (n = 20)	EPI (n = 20)
PONV	18	16
Pruritus	8	13
Nasal Cannula O_2	7	7
Over-Sedation	0	3
Agitation	0	1
Urinary Retention	0	1
Other Adverse Event	1 = desat with sleeping	1 = hypotension + desat

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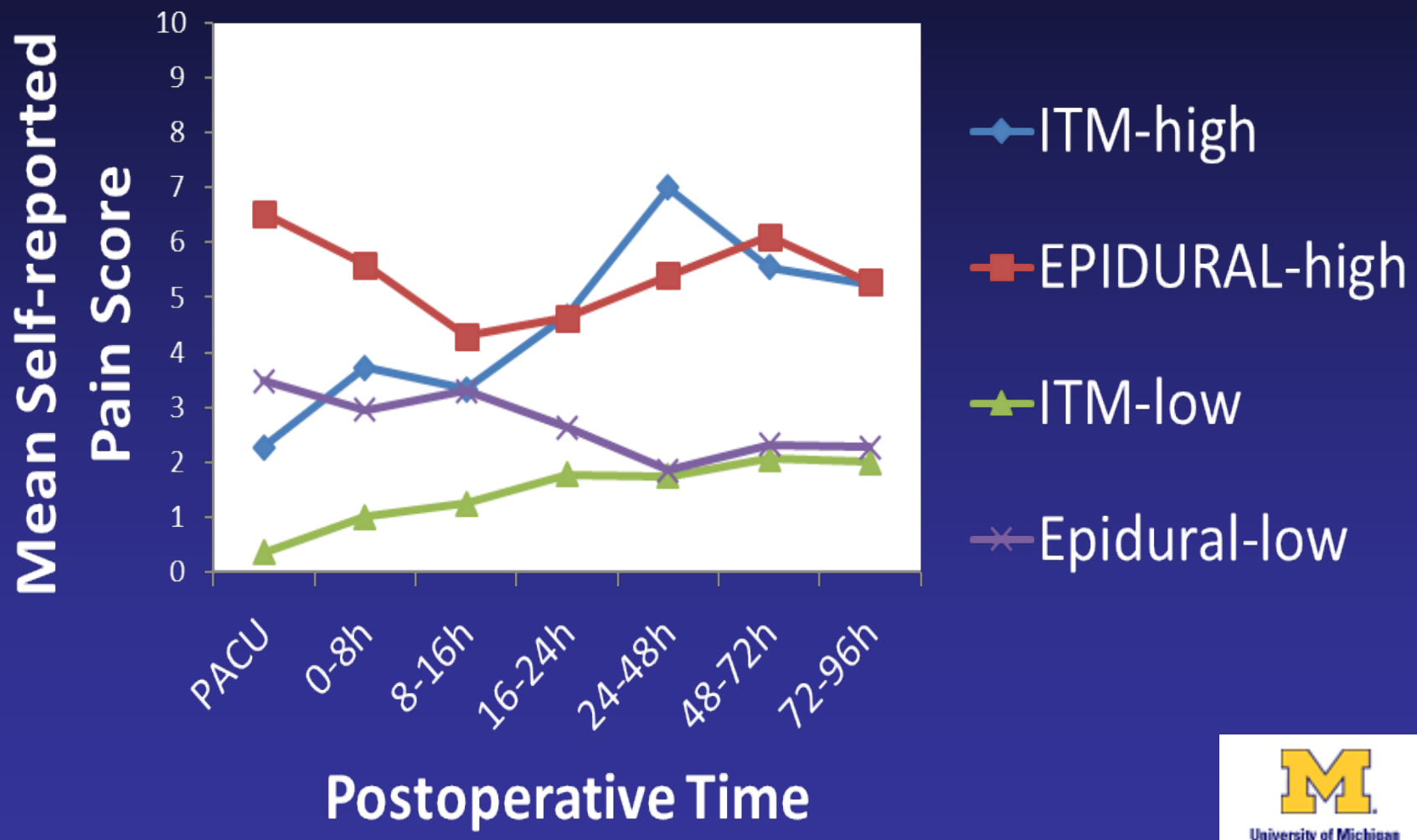
ITM vs. EPI Pain Scores



Data from: Paediatr Anaesth. 2017 Jan;27(1):91-97.

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Follow-up Study (2015-2016)

- Purposes
  - Continue to evaluate safety of ITM
  - Improve pain control after ITM wears off
  - Improve rates of adverse events/side effects

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Key Differences

- Mean 9 mcg/kg ITM, max 800mcg
- Oxycodone given 2 hours earlier
- Nalbuphine and ondansetron both ordered ATC instead of PRN for 24 hours

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Outcomes: Follow-up Study

- 28 patients/group
- Similar to superior analgesia
- Earlier discharge, Foley removal, ambulation in ITM group
- No difference in adverse events
- <10% of patients to PICU

Spine (Phila Pa 1976). 2018 Jan 15;43(2):E98-E104.

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Michigan Difference for Adolescent PSF

- ITM protocol used for almost all patients
- Multidisciplinary care plan addresses analgesia, wound, antibiotics, diet, ambulation, PT, discharge

- Most patients going home on POD #2 or #3!

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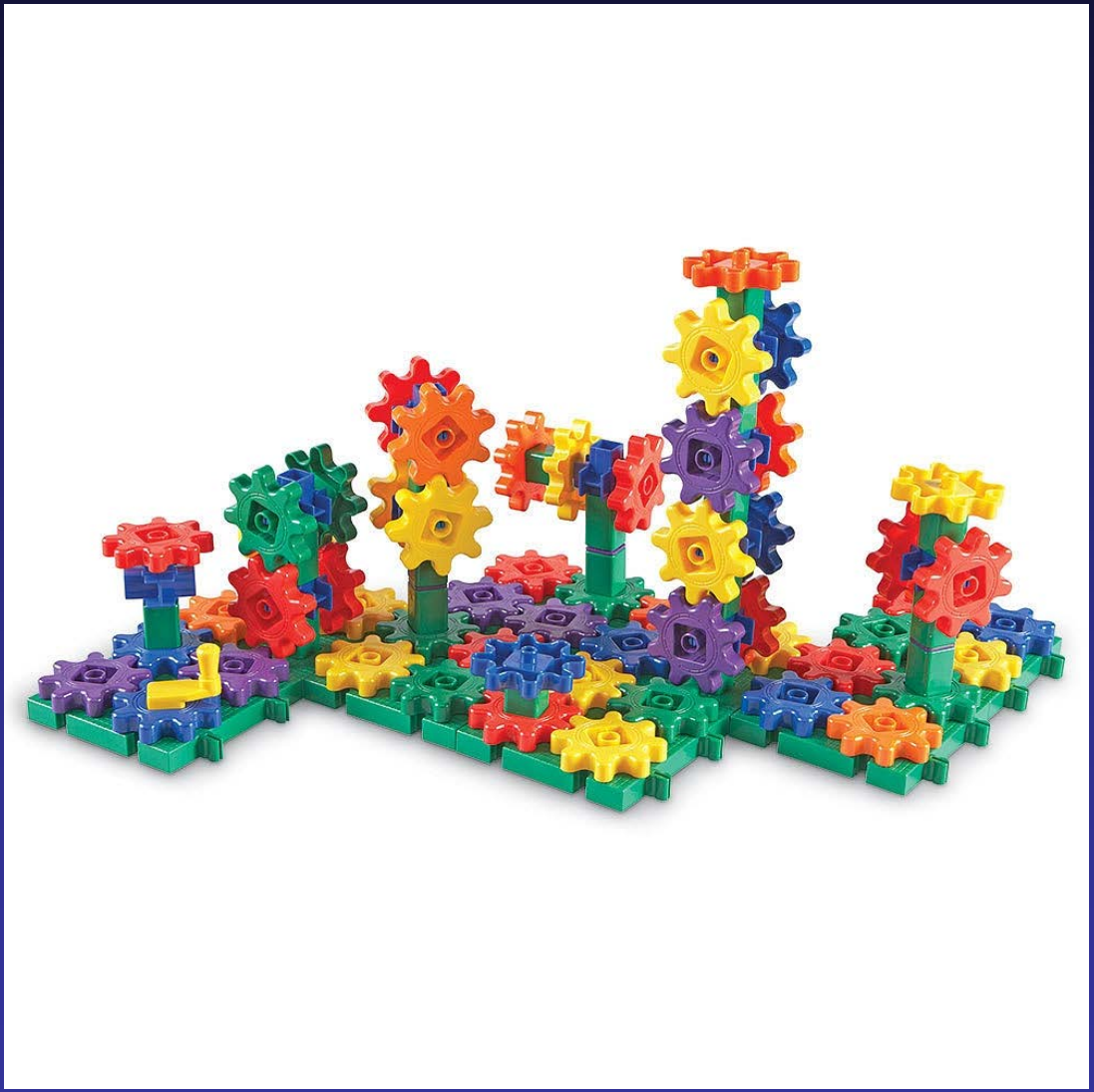
Changing Gears…



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Other Analgesic Approaches to Analgesia for PSF

- Dexmedetomidine
- Ketamine
- Gabapentin/Pregabalin
- Clonidine
- Methadone

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Other Approaches to Analgesia for PSF

Hwang *et al. BMC Anesthesiology* (2015) 15:21
DOI 10.1186/s12871-015-0004-1

BMC Anesthesiology

RESEARCH ARTICLE Open Access

Dexmedetomidine versus remifentanil in postoperative pain control after spinal surgery: a randomized controlled study

Wonjung Hwang, Jaemin Lee, Jihyun Park and Jin Joo*

BMC Anesthesiol. 2015;15:21

- **Propofol/remi vs. Propofol/dexmedetomidine**
- **Hydromorphone PCA post-op for all**
- **Dexmedetomidine better?**

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Evaluation of Dexmedetomidine and Postoperative Pain Management in Patients With Adolescent Idiopathic Scoliosis: Conclusions Based on a Retrospective Study at a Tertiary Pediatric Hospital

Jones, John S. MD[1]; Cotugno, Richard E. MHSM[2]; Singhal, Neil Raj MD[1]; Soares, Neha MD[2]; Semenova, Janet MSN[2]; Nebar, Sean BS[2]; Parke, Emily J. DO[1]; Shrader, M. Wade MD[2]; Hotz, Jeffrey MD[1]

Pediatric Critical Care Medicine: July 2014 - Volume 15 - Issue 6 - p e247–e252

- PCA only (usually morphine) vs. PCA + Dexmedetomidine (started in OR)
- Morphine equivalents as a proxy for pain
- No difference!

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Other Approaches to Analgesia for PSF: Ketamine

Acta Anaesthesiol Scand. 2015 Nov;59(10):1260-8. doi: 10.1111/aas.12571. Epub 2015 Jun 16.

Intra- and postoperative low-dose ketamine for adolescent idiopathic scoliosis surgery: a randomized controlled trial.

Minoshima R[1], Kosugi S[1], Nishimura D[1], Ihara N[1], Seki H[1], Yamada T[1], Watanabe K[2], Katori N[1], Hashiguchi S[1], Morisaki H[1].

- **Morphine consumption less in ketamine group**
- **No difference in pain scores or side effects**

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Ketamine

Spine

SPINE Volume 42, Number 5, pp E304–E312

OUTCOMES

Prolonged Perioperative Low-Dose Ketamine Does Not Improve Short and Long-term Outcomes After Pediatric Idiopathic Scoliosis Surgery

Marina Perelló, MD,* David Artés, MD,* Cristina Pascuets, MD,* Elisabeth Esteban, PhD,† and Ana M. Ey Batlle, MD‡

Spine. 2017;42(5):E304-E312

- **No difference in any outcome**

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Other Approaches to Analgesia for PSF: Methadone

- μ-agonist & NMDA antagonist
- Rapid onset, slow elimination
- No active metabolites
- High interpatient variability

http://www.opiateaddictionresource.com/media/images/methadone_tablets

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Other Approaches to Analgesia for PSF: Methadone

Perioperative Pharmacokinetics of Methadone in Adolescents

Anshuman Sharma, M.D.,* Danielle Tallchief, R.N.,† Jane Blood, R.N.,† Thomas Kim, Ph.D.,‡ Amy London, B.S.,§ Evan D. Kharasch, M.D., Ph.D.‖

Anesthesiol. 2011;115(6):1153-61.

- **May be better as an adjuvant**
- **No difference in pain scores or opioid use**

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Clonidine

- Selective α_2-agonist
- Lipid soluble
- Anti-hypertensive
- Frequently used off-label

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Other Approaches to Analgesia for PSF

Evaluation of Gabapentin and Clonidine Use in Children Following Spinal Fusion Surgery for Idiopathic Scoliosis: A Retrospective Review

Dinesh K. Choudhry, MD, FRCA, B. Randall Brenn, MD,* Karen Sacks, APRN,* and Suken Shah, MD†*

J Pediatr Orthop. Epub Apr 2017

- **Retrospective; 3 groups (P, G, C)**
- **Possibly better pain control with gabapentin and clonidine**
- **No difference in observed side effects**

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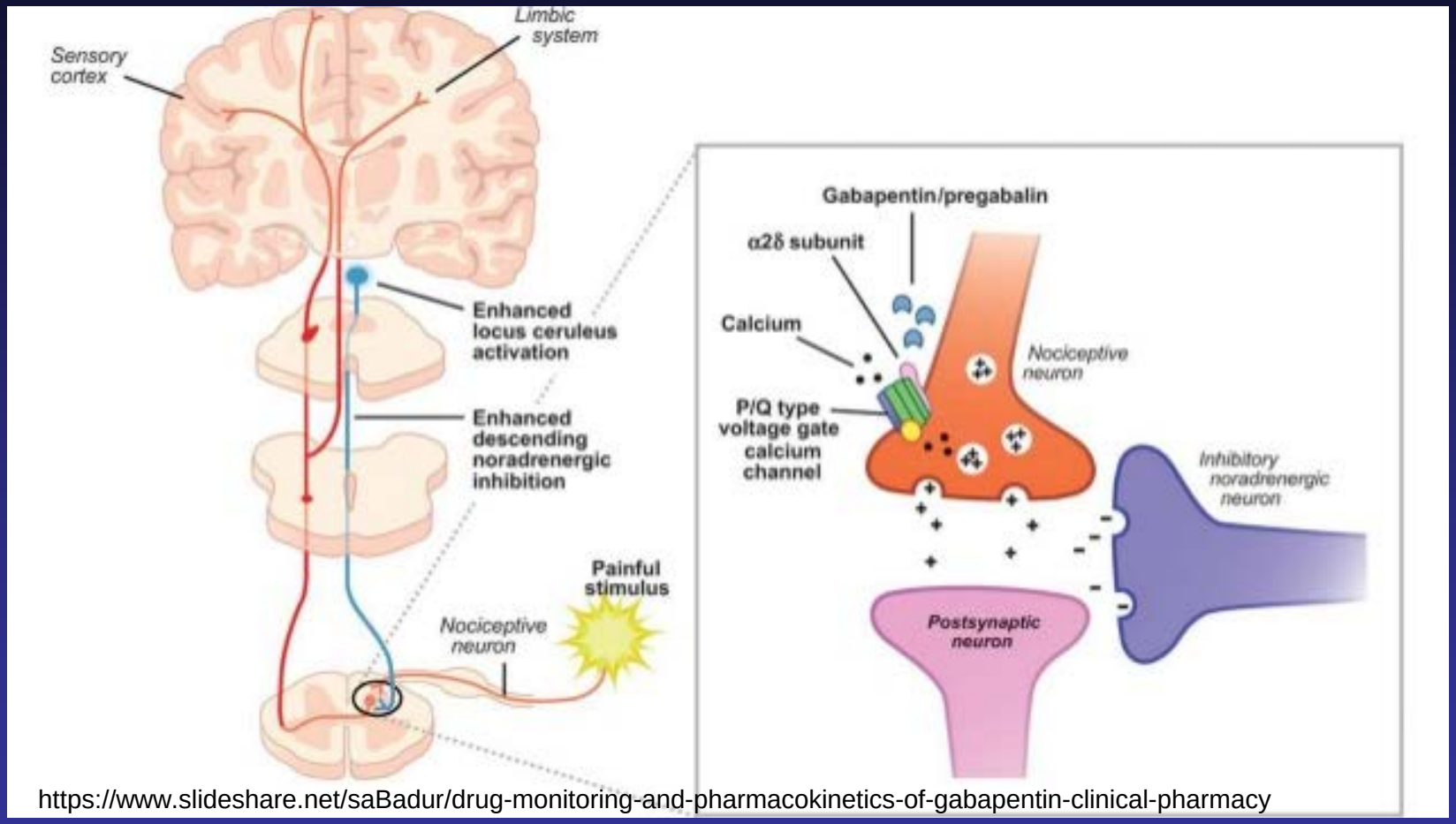
Gabapentin



https://www.slideshare.net/saBadur/drug-monitoring-and-pharmacokinetics-of-gabapentin-clinical-pharmacy

- **Pediatric dosing: 10-15mg/kg/day initial dose, titrate up to 40mg/kg/day**

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Gabapentin

Gabapentin Use in Pediatric Spinal Fusion Patients: A Randomized, Double-Blind, Controlled Trial

Lynn M. Rusy, MD,*§ Keri R. Hainsworth, PhD,* Tom J. Nelson, PharmD, RPh,§
Michelle L. Czarnecki, MSN, RN, BC, CPNP,§ J. Channing Tassone, MD,†§
John G. Thometz, MD,†§ Roger M. Lyon, MD,†§ Richard J. Berens, MD,*‡§
and Steven J. Weisman, MD*‡§

Anesth-Analg. 2010;110(5):1393-1398

- **Gabapentin 15mg/kg preop, then 5mg/kg TID x 5 days postop**
- **Reduction in morphine requirements, pain scores x 48 h**
- **No change in opioid-related adverse effects**

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But…Figures From This Study:

Pain Scores

Figure 3. Postoperative pain scores. Data are shown as mean (SD), $P < 0.05$.

Morphine Consumption

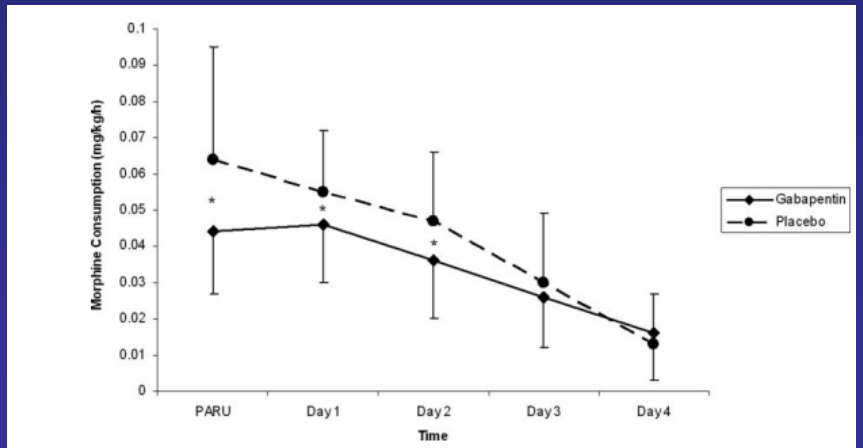

Figure 2. Total morphine consumption. Data are shown as mean (mg/kg/h ± SD), $^{*}P < 0.05$.

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Gabapentin and PSF

- Several other studies exist in adult literature for gabapentin & pregabalin
- Most show reduction in total morphine consumption
- Many show small reduction in pain scores

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Gabapentin and PSF

- What dose to use?
- Median effective dose of gabapentin = 21.7 mg/kg (1200mg adult dose)
- Side effects?
- Further studies needed

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Is Adult PSF Comparable to Adolescent PSF?

Adolescent

- Correct curvature
- ~10 thoracolumbar segments
- SSEP's & MEP's
- ♀ >> ♂

Adult

- Pain/Neuropathy
- Few segments, typically lumbar
- Often literature includes discectomy procedures
- Occasional neuro monitoring
- ♀ ≈ ♂

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http://www.collegerank.net/letter-of-recommendation/

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