



# We have come a long way.... Is there anything left to do?

## An Update on Acute Pediatric Pain Management

**Sabine Kost-Byerly, MD, FAAP**  
Director, Pediatric Pain Management  
Johns Hopkins University, School of Medicine  
Baltimore, Maryland



**JOHNS HOPKINS**  
CHILDREN'S CENTER

- Are you practicing at an institution with a Pediatric Pain Service?
- 1) Yes
- 2) No



- The average daily census of patients followed by the Pediatric Pain Service at my institution is:
  - 1) <10
  - 2) 10-20
  - 3) 20-30
  - 4) >30
  - 5) don't know/no pain service



- Does your Pain Service staff cover acute pediatric pain patients 24/7- 365 days or do you use OR cross-coverage?
  - 1) 24/7 - 365 days pain service coverage
  - 2) OR cross-cover at night
  - 3) OR cross-cover on weekends
  - 4) OR cross-cover nights & weekends
  - 5) 24/7 - 365 OR coverage of pain patients



- How comfortable/prepared are you managing acute postoperative pain in pediatric inpatients?
- 1) very comfortable/well prepared
- 2) comfortable/prepared
- 3) so-so
- 4) not comfortable/not prepared
- 5) very uncomfortable/very poorly prepared



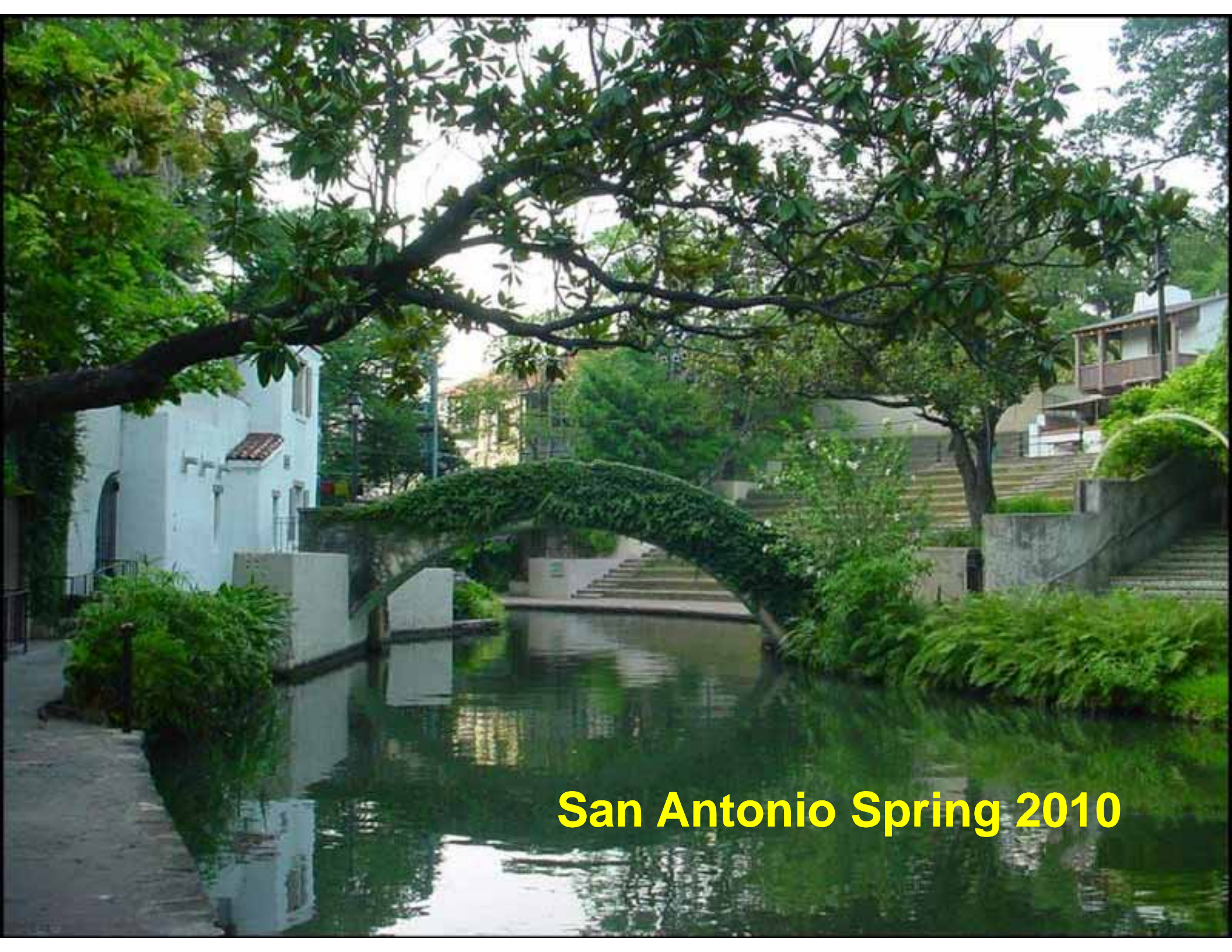
- Would you be interested in attending a (biannual?) Pediatric Pain Meeting offering CME before SPA?
- 1) Yes, whole-day meeting on Thursday
- 2) Yes, half-day meeting on Thursday PM
- 3) No



Baltimore winter  
Blizzard of 2010







**San Antonio Spring 2010**



# Disclosures

- Past:
  - **Cadence IV acetaminophen trials**
- Present:
  - **none**



# Objectives

- Methods for assessment of pain in children and potential problems
- Concept of multimodal analgesia for the pediatric patient
- Strategies for the more complex patient
- Current QA/QI processes in pediatric pain management



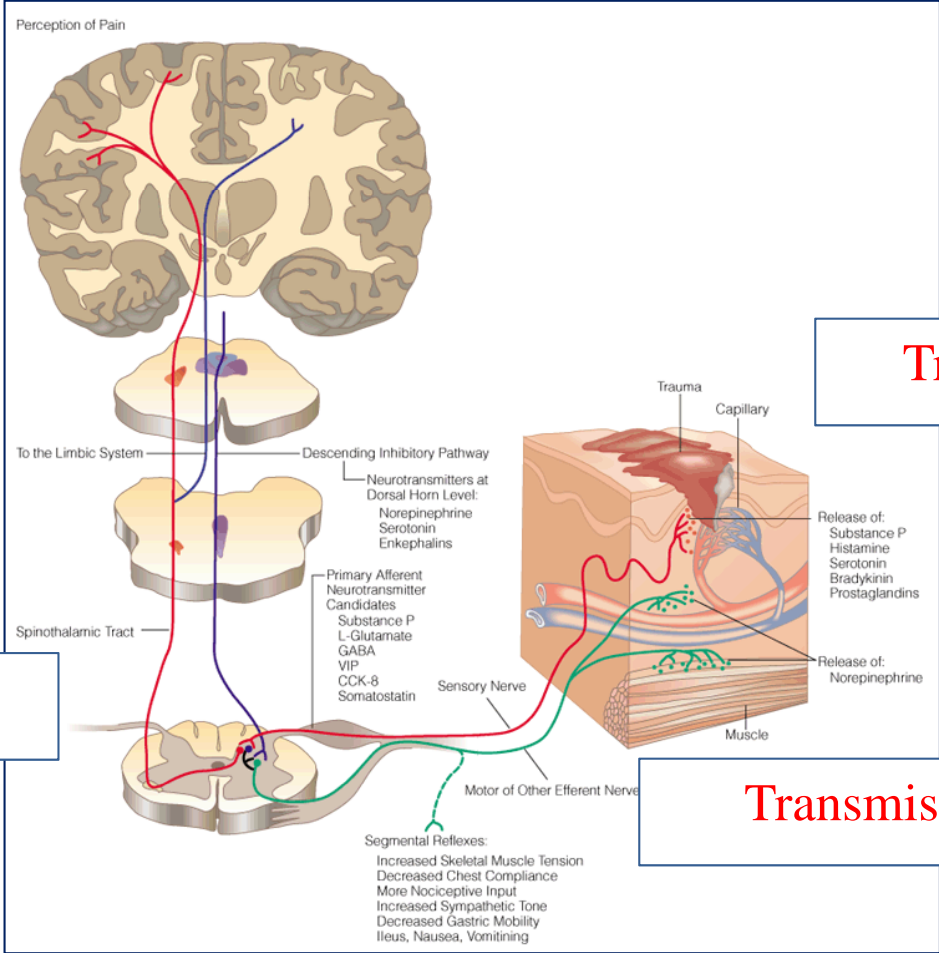
# Nociception

Perception

Transcription

Modulation

Transmission



# Pain Assessment

## Quantitative - Intensity

“How much does it hurt?”

- Infants and non-communicative children:  
Behavioral Observational Scales
- Other children:  
Self-Report Scales

## Qualitative -

“What kind of pain is it?”

When, where, why, how does it hurt?

“An unpleasant and emotional experience”





# Perception of Pain by Children affected by:

- Age
- Gender
- Previous pain experiences
- Relevance of disease causing pain
- Parental Expectations
- Secondary gain
- Cultural background



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# Pain Assessment

## Behavioral Observational Scales

### CRIS

Crying, oxygen requirement, vital signs, facial expression, sleep

Score: 0-2 for each item  
Age: <1 year

### NIPS

Facial expression, cry, breathing pattern, arms, legs, arousal state pre and post intervention

Score: >3 indicated pain  
Age: <1 year

### FLACC

Face, legs, activity crying, consolability

Score: 0-2 for each item  
Age: 2 months – 7 years

### CHEOPS

Cry, facial expression, verbalization, movement

Score:  $\geq 4$  indicated pain  
Age: 1 - 7 years



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# FLACC Behavioral Pain Assessment:

recommended for postoperative and procedural pain  
(age 2 months to 7 years)

Categories	Scoring		
	0	1	2
Face	No particular expression or smile	Occasional grimace or frown, withdrawn, disinterested	Frequent to constant quivering chin, clenched jaw
Legs	Normal position or relaxed	Uneasy, restless, tense	Kicking, or legs drawn up
Activity	Lying quietly, normal position, moves easily	Squirming, shifting back and forth, tense	Arched, rigid or jerking
Cry	No cry, (awake or asleep)	Moans or whimpers, occasional complaint	Crying steadily, screams and sobs, frequent complaint
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Difficult to console or comfort



# Assessment of Pain - Problematic Patient Populations

Any patient in whom assessment of face, legs, activity, crying, consolability is limited.

- **Non-verbal, cognitively impaired child**
- **Child with spasticity**
- **Child with tracheostomy/ ETT**
- **Child with spina bifida.**





# The Revised FLACC

## Behavioral Pain Assessment for Children with Cognitive Impairment

Malviya S et al. *Pediatr Anaeth* 2006;16;258-65

Categories	0	Scoring 1	2
Face	No particular expression or smile	Appears sad or worried	Distressed-looking face; expression of fright or panic
Legs	Usual tone & motion to limbs	Occasional tremors	Marked increase in spasticity, constant tremors or jerking
Activity	Regular, rhythmic respirations	Tense or guarded movements; mildly agitated (e.g. head back and forth, aggression); shallow, splinting respirations, intermittent sighs.	Severe agitation; head banging; shivering (not rigors); breath holding, gasping or sharp intake of breaths, severe splinting
Cry	No cry, (awake or asleep)	Occasional verbal outburst or grunt	Repeated outbursts, constant grunting
Consolability	Content, relaxed	Reassured by occasional touching, hugging or being talked to, distractible	Pushing away caregiver, resisting care or comfort measures



# Pain Assessment in the ICU

	DATE/TIME								
<b>ALERTNESS</b>	1 - Deeply asleep 2 - Lightly asleep 3 - Drowsy 4 - Fully awake and alert 5 - Hyper alert								
<b>CALMNESS</b>	1 - Calm 2 - Slightly anxious 3 - Anxious 4 - Very anxious 5 - Panicky								
<b>RESPIRATORY DISTRESS</b>	1 - No coughing and no spontaneous respiration 2 - Spontaneous respiration with little or no response to ventilation 3 - Occasional cough or resistance to ventilation 4 - Actively breathes against ventilator or coughs regularly 5 - Fights ventilator, coughing or choking								
<b>CRYING</b>	1 - Quiet breathing, no crying 2 - Sobbing or gasping 3 - Moaning 4 - Crying 5 - Screaming								
<b>PHYSICAL MOVEMENT</b>	1 - No movement 2 - Occasional, slight movement 3 - Frequent, slight movements 4 - Vigorous movement 5 - Vigorous movements including torso and head								
<b>MUSCLE TONE</b>	1 - Muscles totally relaxed; no muscle tone 2 - Reduced muscle tone 3 - Normal muscle tone 4 - Increased muscle tone and flexion of fingers and toes 5 - Extreme muscle rigidity and flexion of fingers and toes								
<b>FACIAL TENSION</b>	1 - Facial muscles totally relaxed 2 - Facial muscle tone normal; no facial muscle tension evident 3 - Tension evident in some facial muscles 4 - Tension evident throughout facial muscles 5 - Facial muscles contorted and grimacing								
<b>BLOOD PRESSURE (MAP) BASELINE</b>	1 - Blood pressure below baseline 2 - Blood pressure consistently at baseline 3 - Infrequent elevations of 15% or more above baseline (1-3 during 2 minutes observation) 4 - Frequent elevations of 15% or more above baseline (> 3 during 2 minutes observation) 5 - Sustained elevations of 15% or more								
<b>HEART RATE BASELINE</b>	1 - Heart rate below baseline 2 - Heart rate consistently at baseline 3 - Infrequent elevations of 15% or more above baseline (1-3 during 2 minutes observation) 4 - Frequent elevations of 15% or more above baseline (> 3 during 2 minutes observation) 5 - Sustained elevations of 15% or more								
	<b>TOTAL SCORE</b>								

## Comfort Scale

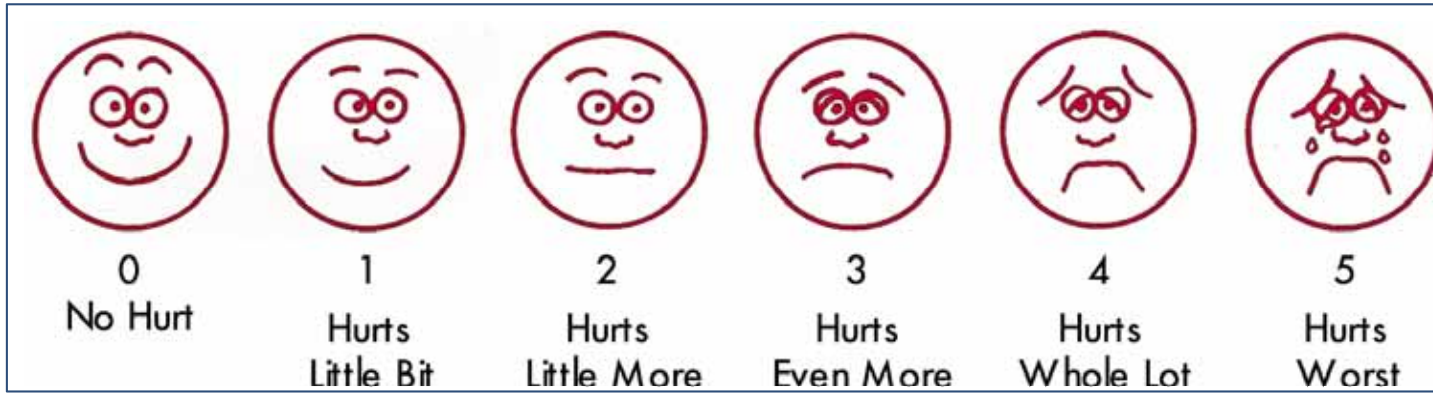
- Score ranges from 8 to 40
- Age group 0-3 years

Sedation – but not pain scales:

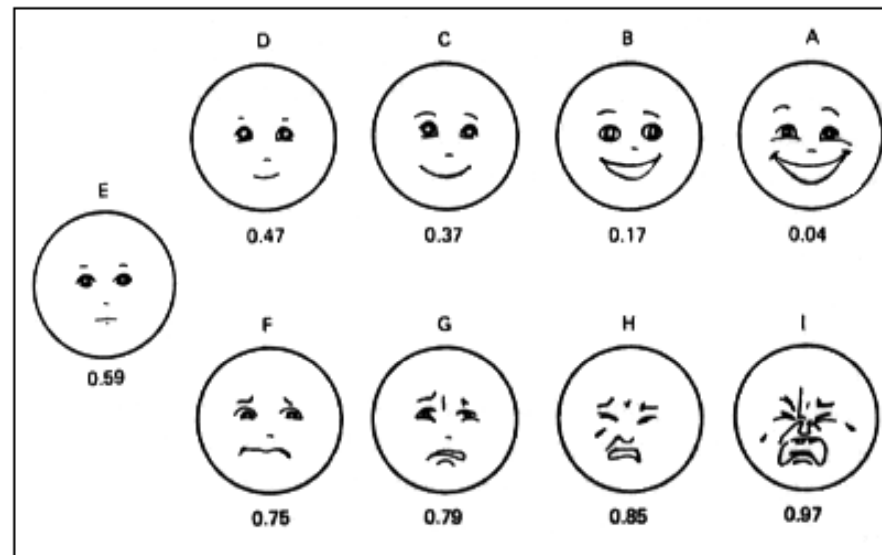
- Univ. of Michigan Sedation Score (MISS)
- Univ. of Richmond Agitation and Sedation Score (RASS) – not validated for children



# Pain Assessment - Self Report Measures



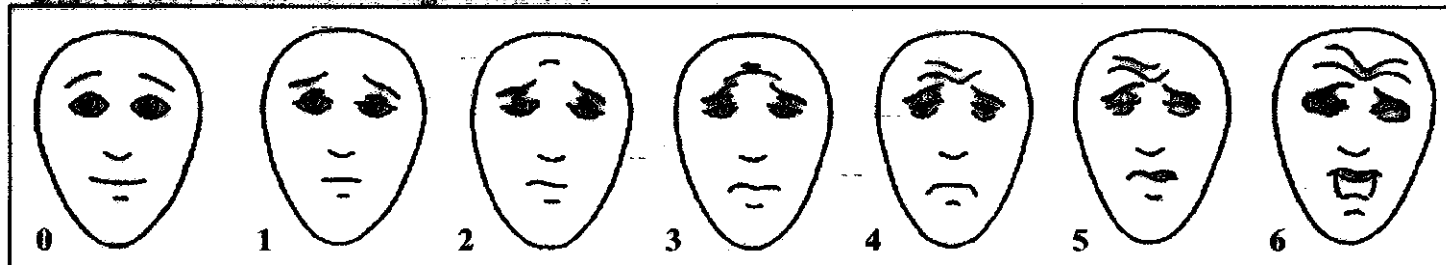
Wong-Baker FACES  
Pain Rating Scale



Happy-sad face scale



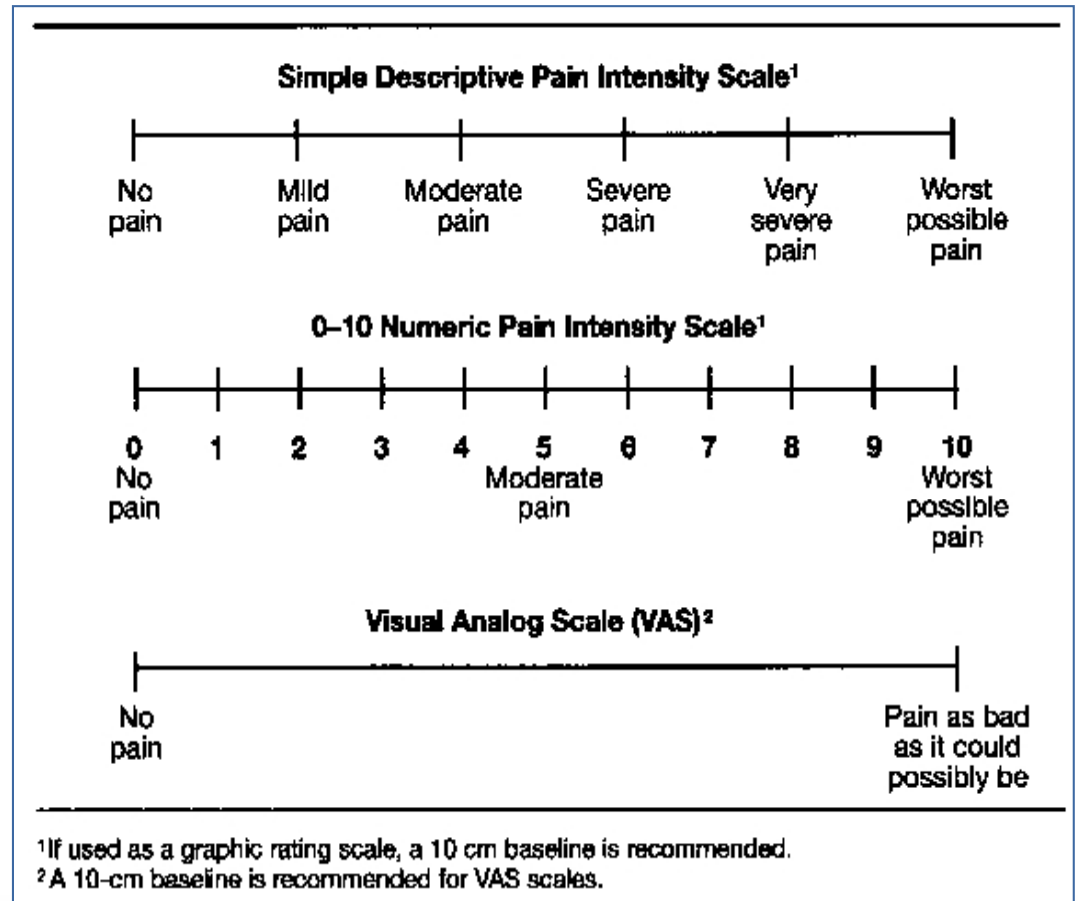
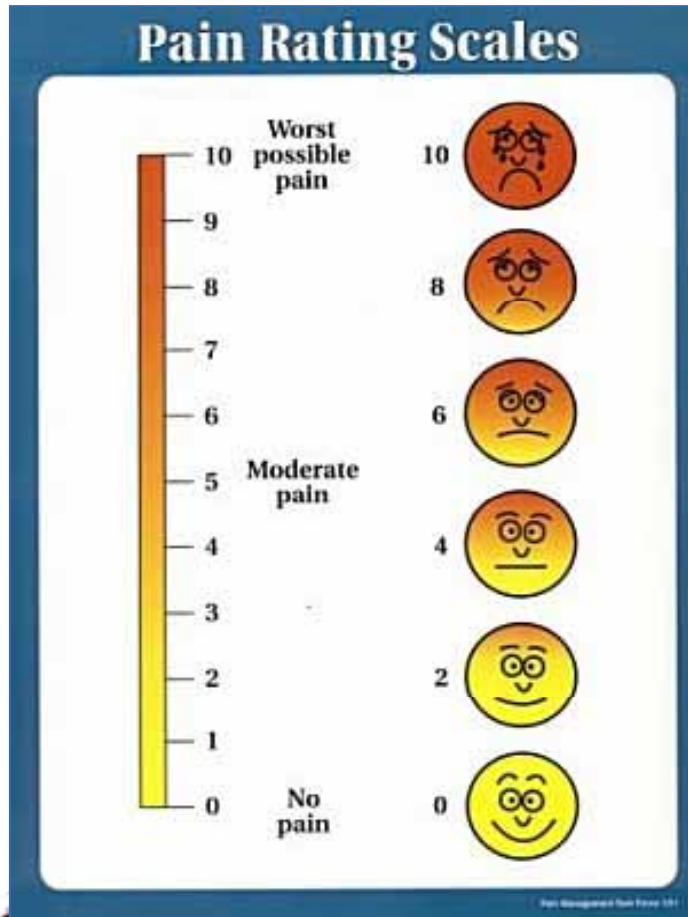
**Bieri Face Scale** school age children 3-7



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# Pain Assessment - Self Report Measures



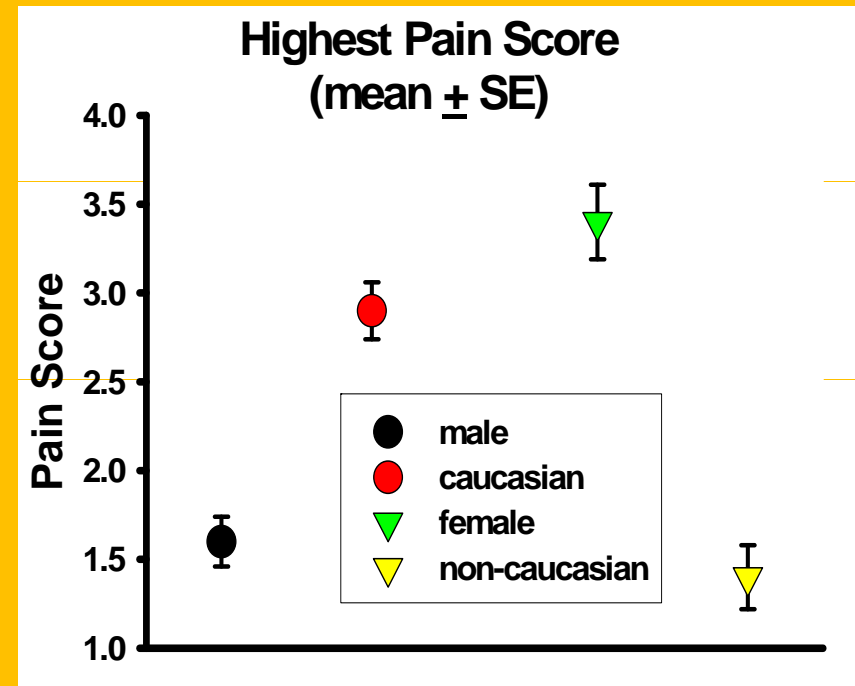
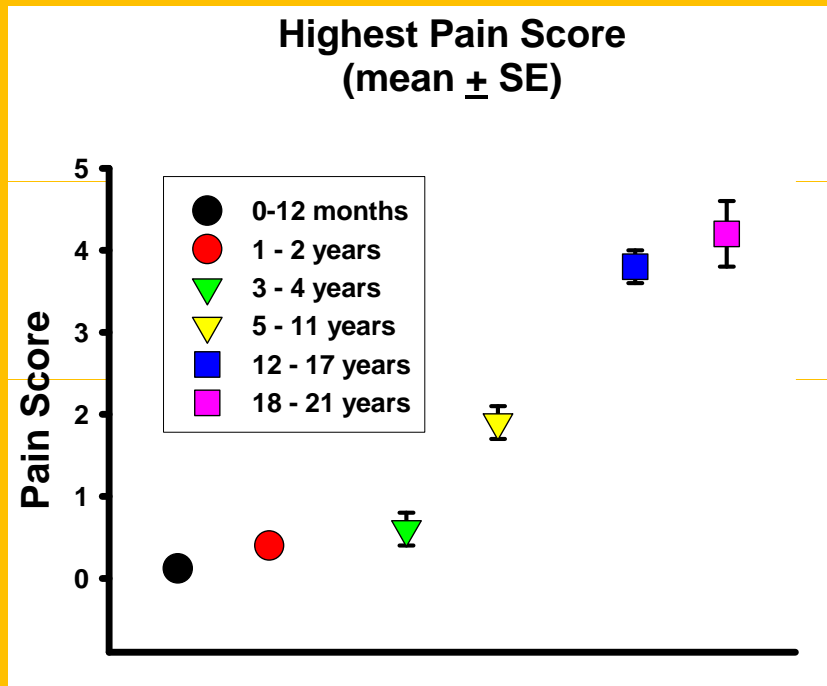
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# “An Analysis of Analgesic Use and Pain Assessment Methods in a Hospitalized Pediatric Population”

*Kozlowski L et al. ASA abstract 2009*



# When should Pain be treated?

*Is there a “magic” number?*

- **Goal: Treat all pain  $>2/10$ ?**
- Consider:
  - **A score of 3 or 4 is relative only to the patient's experience and not to a standardized criterion**
- Recommended:
  - **Treat at a score above the patient's stated goal**
    - an individualized number at which the patient wants to be medicated.



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# Pain Management

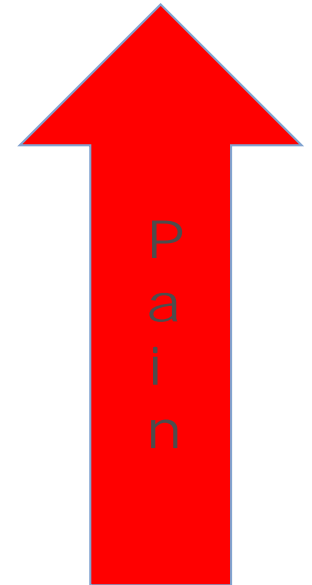
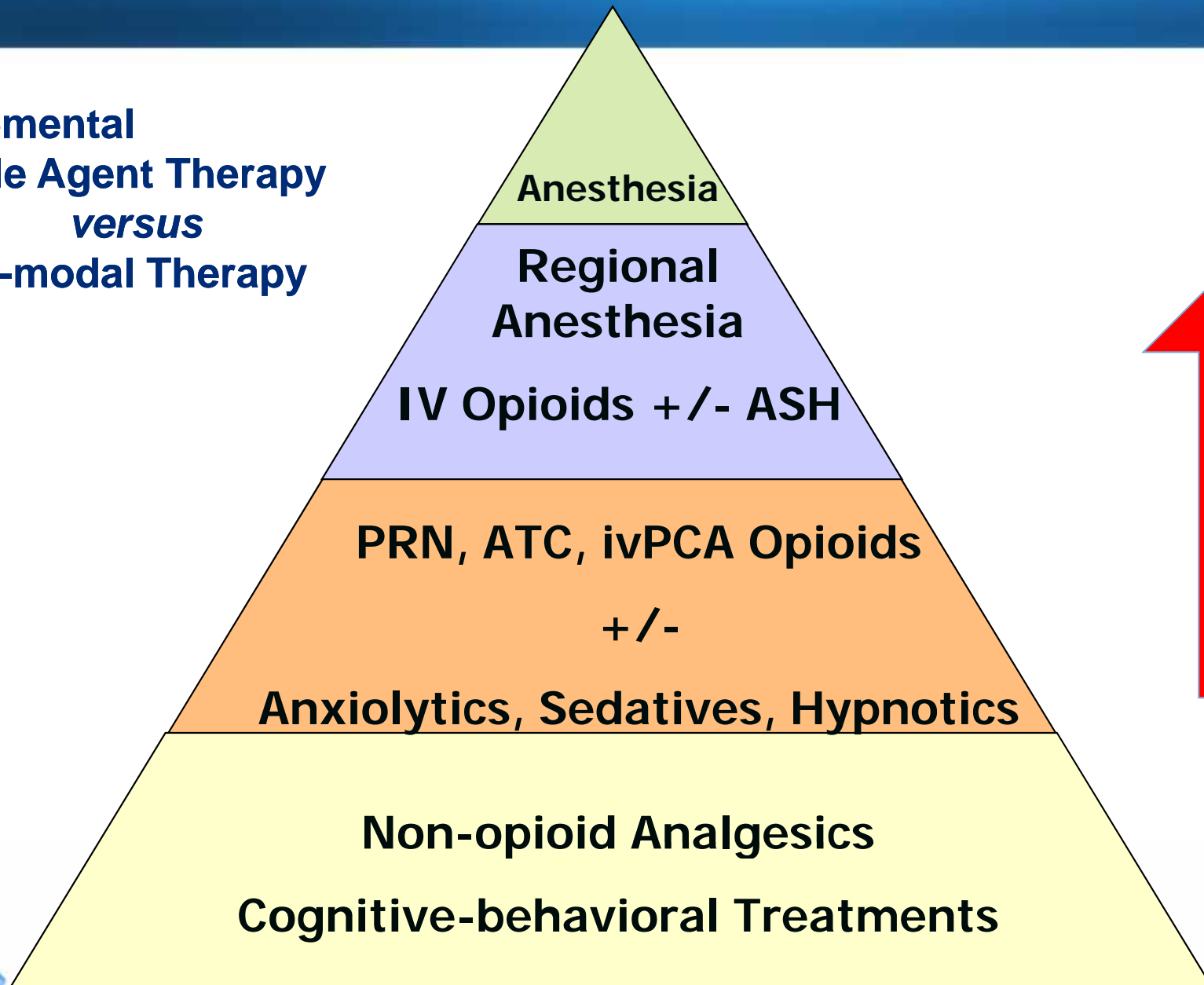
The patient care team will collaborate with the family/patient to develop a pain management plan that balances pain relief, safety, side effects and optimizes global therapeutic goals.

“Shared planning and decision making between patient and/or family and the patient care team will occur in the development of the plan/approach to pain management including pharmacological and non-pharmacological methods”

*Cincinnati Children's Hospital  
Ken Goldschneider*



**Incremental  
Single Agent Therapy  
*versus*  
Multi-modal Therapy**





# Management of Pain

- Mild to moderate pain
  - Acetaminophen
  - Nonsteroidals
  - Ketorolac – Is it safe for infants and when?
  - Opioids - Recent shortage of opioids



# Mild to Moderate Pain

## Acetaminophen

- Inhibition of cyclooxygenase in the central nervous system
  - No anti-inflammatory or platelet effect
  - Potential hepatotoxicity
- **Dose - *Plasma level for analgesia not defined***
  - **PO: 10-15 mg/kg daily max: up to 100 mg/kg/d or 4 grams**
    - Infant: 75 mg/kg/day; > or < 32 PCA: 60 mg/kg/day, 40 mg/kg/day
  - **Rectal: 30-40 mg/kg (single), 20 mg/kg (repeat)**
- **Interval**
  - **PO: q 4 hours**
  - **Rectal: q 6 hours, q 12 hours (prematurity)**
  - **IV: q 4-6 hours – not yet on the US market**



# NSAIDS

## Inhibition of cyclooxygenase (COX)

	<b>Dose</b>	<b>Interval</b>	<b>Max. Daily Dose</b>
Ibuprofen	6-10 mg/kg	Q 4-6 hrs.	40 mg/kg/day or < 2.4 gram
Naproxen	5-10 mg/kg	Q 12 hrs.	20 mg/kg/day
Ketorolac	0.5 mg/kg	Q 6 hrs.	< 2 mg/kg/day or 120 mg. Max. 20 doses or 5 days



Berde et al. "Analgesics for the Treatment of Pain in Children."  
NEJM. 2002, 347: 1094-1103



# Intravenous Patient Controlled Analgesia (ivPCA)

- Patients self administer dose
  - **Warning against PCA by proxy**
- Authorized vs *un*authorized PCA



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# 2006 SPA Membership Survey:

**228/400 (57%) institutions (70% academic):**

- 49% PNCA**
- 33% routine use of continuous infusions with ivPCA**
- 77% permitted concomitant anxiolysis**

*Nelson KL et al. Anesth Analg. 2010;110:754-60.*



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# Intravenous PCA



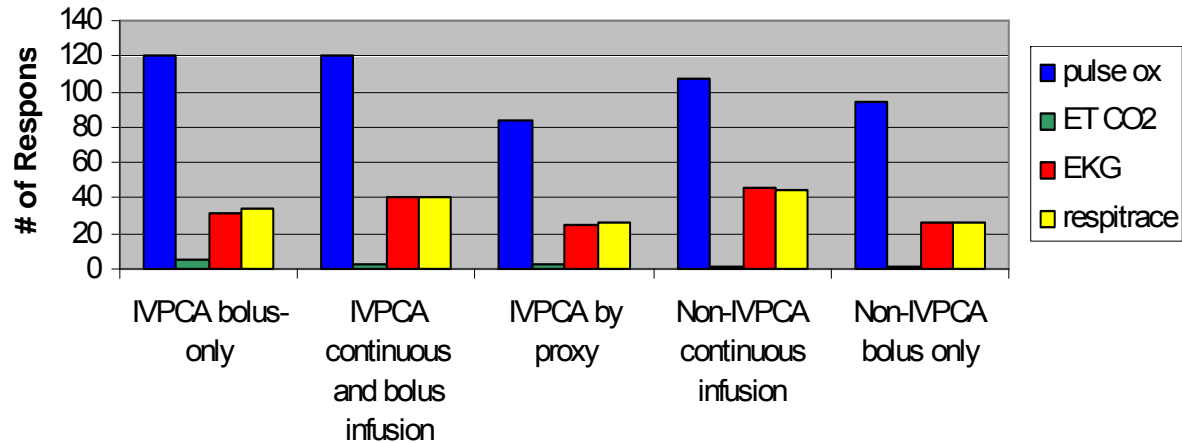
Drug	Continuous rate	Bolus dose	Lockout interval	Max. dose/h
	mcg/kg/h	mcg/kg	minutes	
Morphine	10-30	10-30	6-10	4-6
Hydro-morphone	3-5	3-5	6-10	4-6
Fentanyl	0.5-1	0.5-1	6-10	2-4





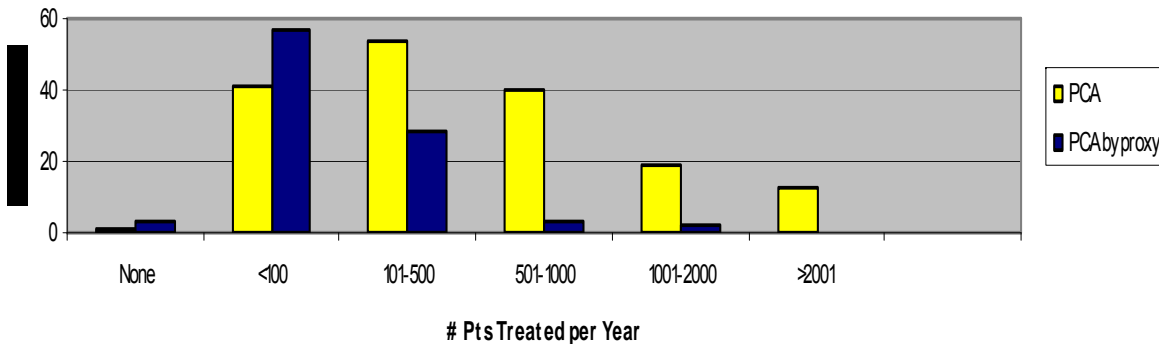
# Monitoring for IV PCA

Monitoring Utilized During Opioid Use



Only 41% of institutions provided formalized parental education

Annual Use of PCA and PCA by proxy



Nelson KL et al. *Anesth Analg.* 2010;110:754-60.



*APA national audit of pediatric opioid infusions*

NEIL S. MORTON MD, FRCA, FRCPC, FFPMRCA\* AND AGATA  
ERRERA MBBChB, FANZCA†

\*Pediatric Anesthesia & Pain Management and †Fellow in Pediatric Anesthesia, Royal Hospital  
for Sick Children, Glasgow, Scotland

- 10 726 opioid infusion techniques
  - **Grade 1 incident – cardiac arrest: 1/10 726**
    - underlying neurological condition
  - **Grade 2 incidents: 1/383**
    - 50% were respiratory depression
  - **Grade 3 incidents: 1/631**
    - Drug programming or prescribing errors (by one center)
- **Incidence of serious harm is comparable to the risks with pediatric epidural infusions and central blocks**



# IVPCA - Complications

## “The Prevalence of and Risk Factors for Adverse Events in Children Receiving Patient-Controlled Analgesia by Proxy or Patient-Controlled Analgesia After Surgery”

*Voepel-Lewis T et al. Anesth&Analg 2008;107:70-5*

- 145 PCA-P and 157 PCA
  - no differences in the initial opioid orders between groups
  - 70 % continuous basal infusions
- Clinically significant adverse events in:
  - 22% of patients in PCA-P group vs 24% in PCA group



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# Complications

Table 1. Description of the Sample

	PCA-P (n = 145)	PCA (n = 157)
Male gender	78 (54)	75 (48)
Age (yr)	7.08 ± 5.3	13.1 ± 3.2*
Weight	23.1 ± 14.4	54.1 ± 24.4*
Comorbid conditions	106 (73)	73 (47)*
Respiratory	36 (25)	24 (15)*
Obstructive sleep apnea	7 (5)	6 (4)
Neurologic	69 (48)	25 (16)*
Cognitive impairment	67 (46)	6 (4)*
Cardiovascular	14 (10)	11 (7)
Obesity	7 (5)	14 (9)
ASA physical status		
1-2	92 (63)	132 (84)*
3	53 (37)	25 (16)
Baseline oxygen saturation	98.3 ± 1.6	98.4 ± 1.4
Surgical type		
Orthopedic	111 (77)	123 (78)
General surgery	15 (10)	7 (5)
Urology	19 (13)	27 (17)

Table 4. Adverse Events in the Groups

	PCA-P (n = 145)	PCA (n = 157)
Respiratory events		
Bradypnea <sup>a</sup>	4 (2.8)	6 (3.8)
Minor oxygen desaturation <sup>a</sup>	80 (55)	94 (60)
Major oxygen desaturation <sup>a</sup>	21 (14)	30 (19)
Clinically significant events <sup>c</sup>	32 (22)	37 (24)
Threshold event	21 (15)	37 (24)*
Rescue event	11 (7.6)	0*
Interventions		
Supplemental oxygen	28 (19)	29 (18)
Discontinue or decrease dose	10 (7)	13 (8)
Patient stimulation	3 (2)	3 (2)
Airway management <sup>d</sup>	7 (5)	0*
Naloxone administration	4 (3)	0
Admission to ICU/MCU	9 (6)	0*
Hours to respiratory event	16.7 ± 16	27.4 ± 18.1*
Range of hrs to event	1-56.5	1-69

Adjust PNCA doses!



# Adverse Effects

## An Analysis of Analgesic Use and Pain Assessment Methods in a Hospitalized Pediatric Population”

*Kozlowski L et al. ASA abstract 2009*

<u>Side effect</u>	<u>% of patients receiving opioids</u>
• Pruritis	28
• Nausea and vomiting	44
• Urinary retention	2
• Sedation score <4	3
• Respiratory depression treated with naloxone	<1
• Respiratory depression requiring intubation	<1



28  
44



# Improving Analgesia – decreasing adverse effects

## Options:

- **Multi-modal - analgesic therapy**
  - Increased efficacy via synergy
- **Single (almost single) analgesic therapy**
  - Increased efficacy by limiting adverse effects
- **Combination of the two**





# Multi-modal Analgesia

- Nonopioid analgesics
- Anticonvulsants:
  - **gabapentin, pregabalin**
- NMDA receptor antagonists
  - **Ketamine, methadone**
- Regional analgesia



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# Addition of Nonopioid Analgesic

Early postop period with limited po intake:

## **Ketorolac:**

- **0.5 mg/kg, up to 30 mg, every 6 hours, for up to 5 days.**
- **demonstrated decrease in postoperative opioid need (– watch out for S. Reuben’s studies!)**
- **Cost effective as it may be associated with earlier discharge.**
- **Hemorrhagic complications**
- **Pseudoarthrosis?**



## Postoperative Ketorolac Does Not Predispose to Pseudoarthrosis Following Posterior Spinal Fusion and Instrumentation for Adolescent Idiopathic Scoliosis

Daniel J. Sucato, MD, MS,\* John F. Lovejoy, MD,† Sundeep Agrawal, BA,\*  
Emily Elerson, RN,\* Trudi Nelson, RN,\* and Anna McClung, RN\*

Retrospective study of 319 patients at  
Texas Scottish Rite Hospital for Children,  
Dallas, TX

Surgeries 1990-2000  
minimum f/u 2 years

Ketorolac averages:  
6.7 doses, 26.7 mg, 46 hours



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# Pseudoarthrosis

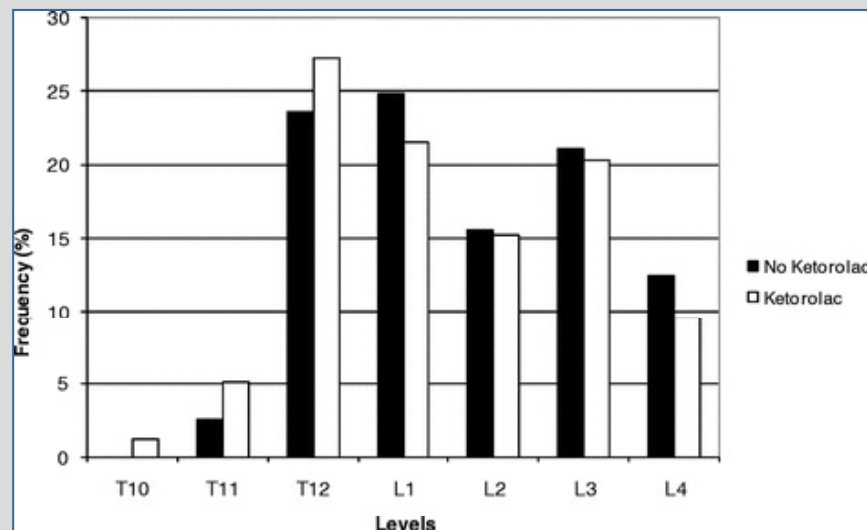
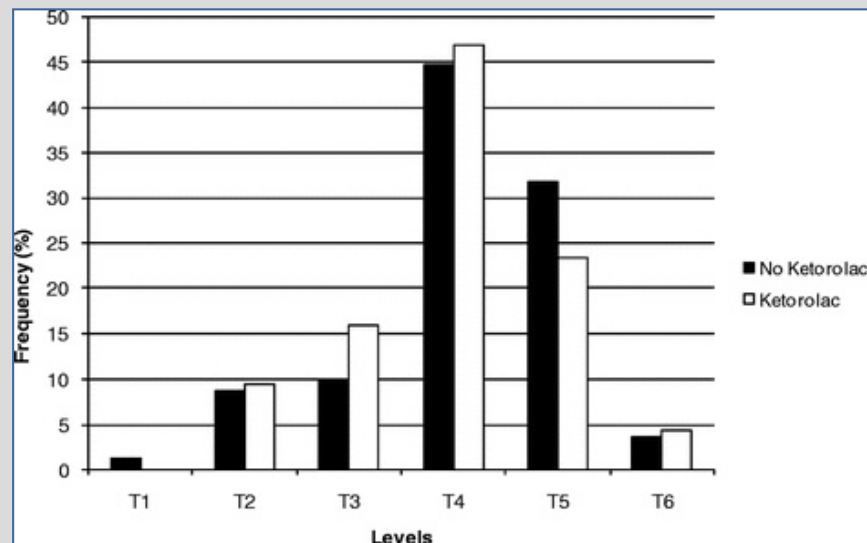
Risk overall:  
2.5% (8/139) patients

Ketorolac group: 1.9%  
No – K. group: 3.1%  
(p=0.72)

Orthopedic complication  
rate overall: 12% vs 10.6%



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# Pain and Hyperalgesia

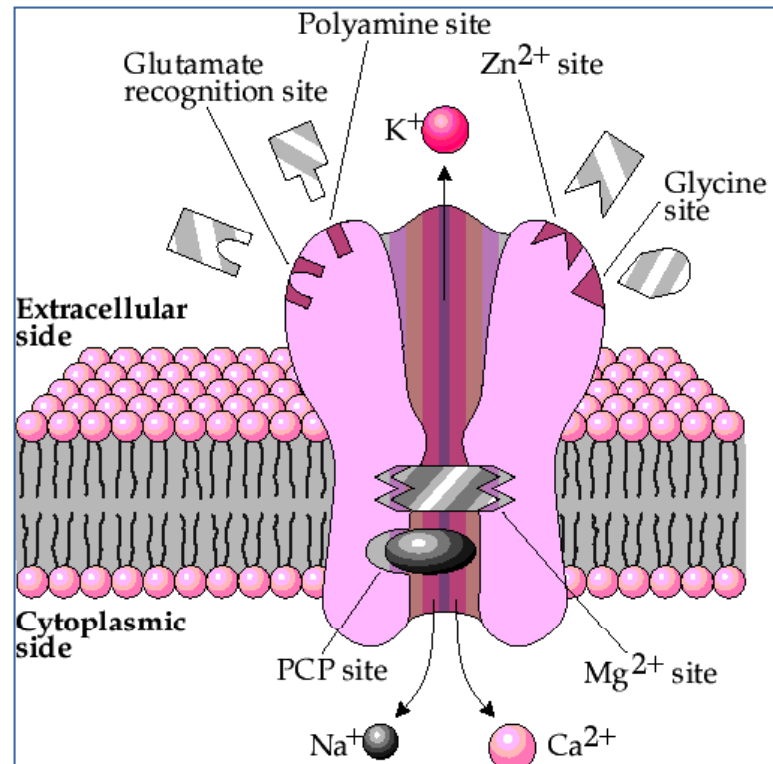
## PAIN

↑ Neural Sensitivity

↑ Excitation

↑ Receptive Field  
Size

Central  
Sensitization



## OPIOIDS

Analgesia

Tolerance

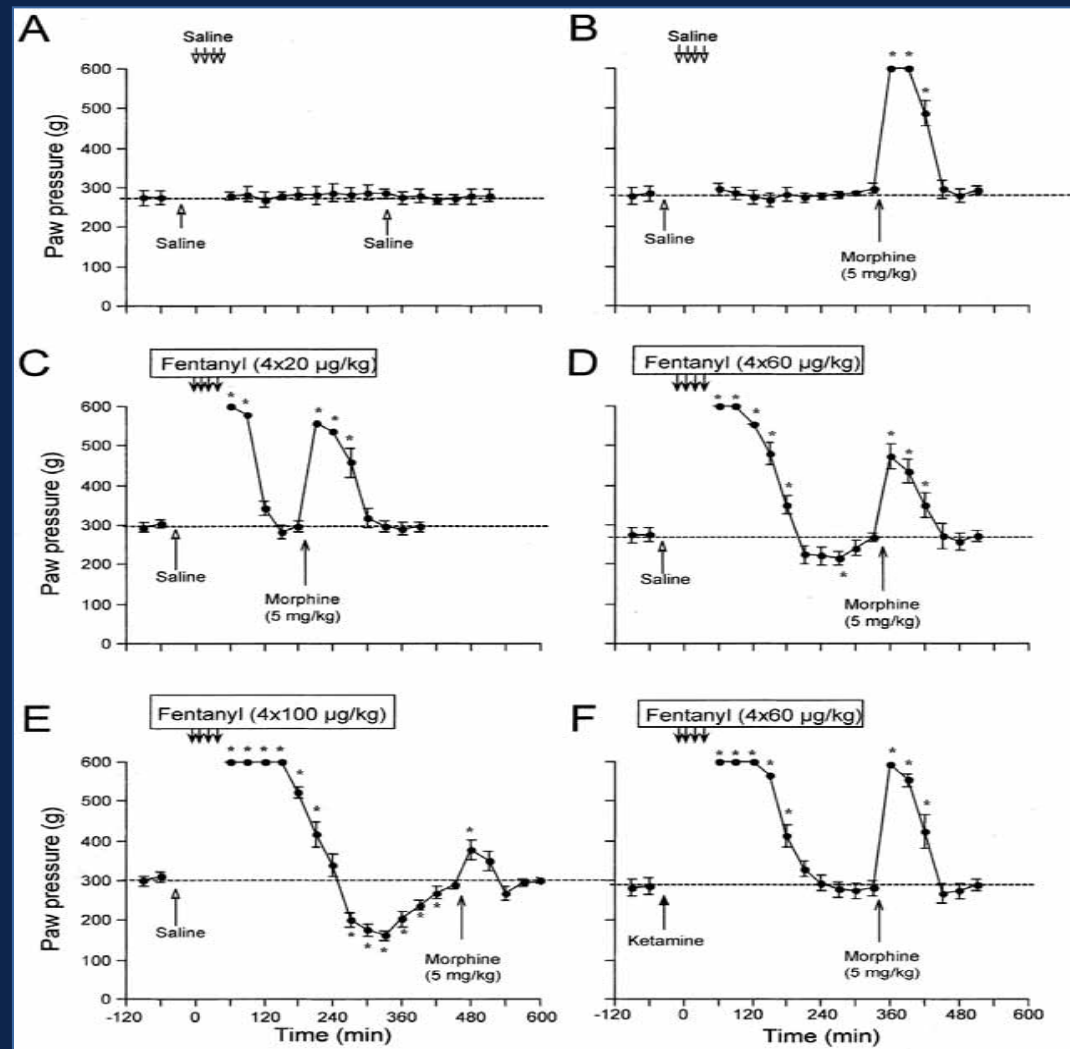
Hyperalgesia

NMDA receptor  
potentiation



# “The role of ketamine in preventing fentanyl-induced hyperalgesia and subsequent acute morphine tolerance”

*Laulin et al. Anesth Analg 2002;94:1263-9*

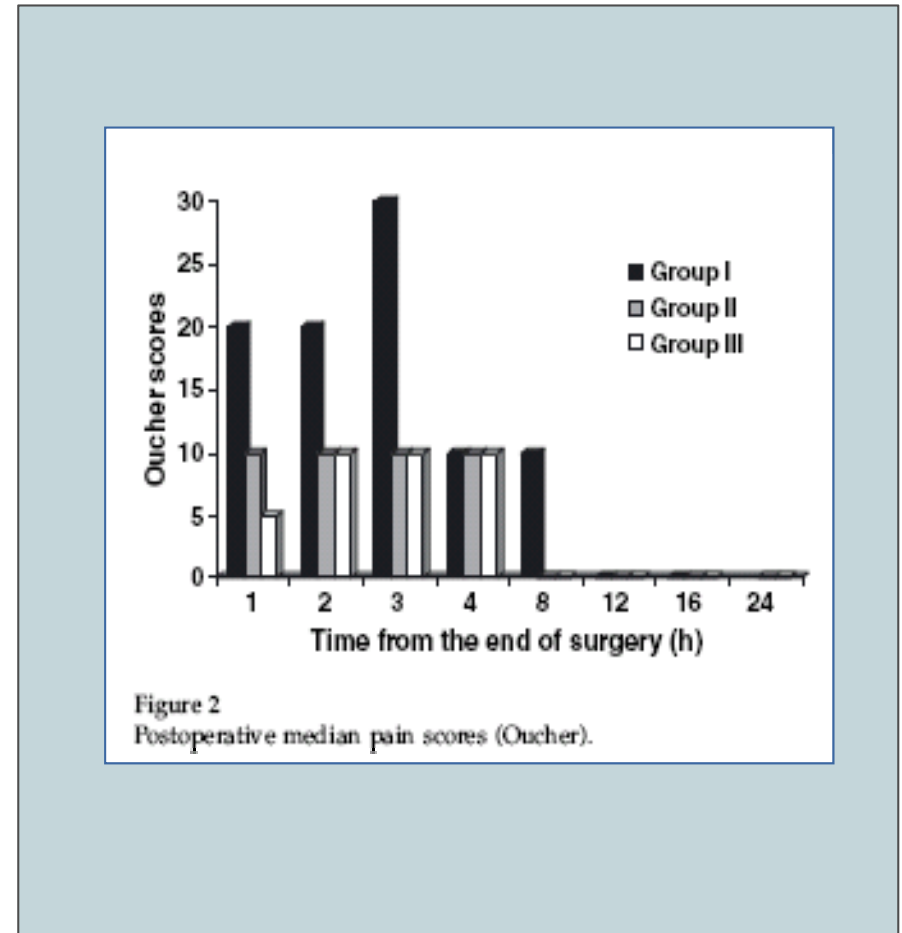




# Preventive Analgesia

## Tonsillectomy

- 90 children, age 5-7 years
  - Diclofenac 1 mg/kg p.r. pre-op
  - Acetaminophen 20 mg/kg p.o. post-op
- Control
  - **K 0.5 mg/kg** pre-incision
  - **K 0.5 mg/kg** post-procedure
- 
- Preventive...but not Pre-emptive

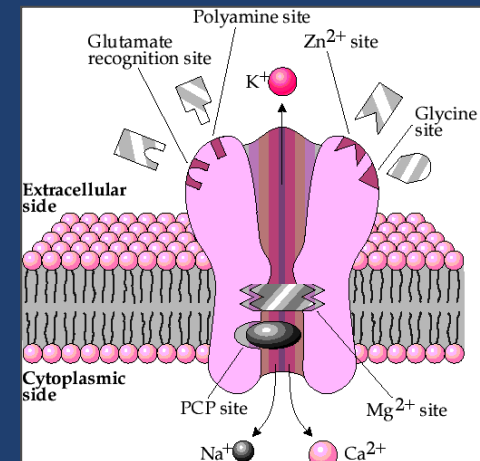


# Pre-surgical Ketamine

## Tonsillectomy

- 80 children
  - Group I: control
  - Group II: **K 0.15 mg/kg** pre-incision
  - Group III: MgSO<sub>4</sub> 30 mg/kg pre-incision
  - Group IV: K 0.15 mg/kg & MgSO<sub>4</sub> 30 mg/kg pre-incision
- No difference in pain ratings
- No difference in opioid requirement

*O'Flaherty & Lin Paediatr Anaesth 2003;13:413-21*



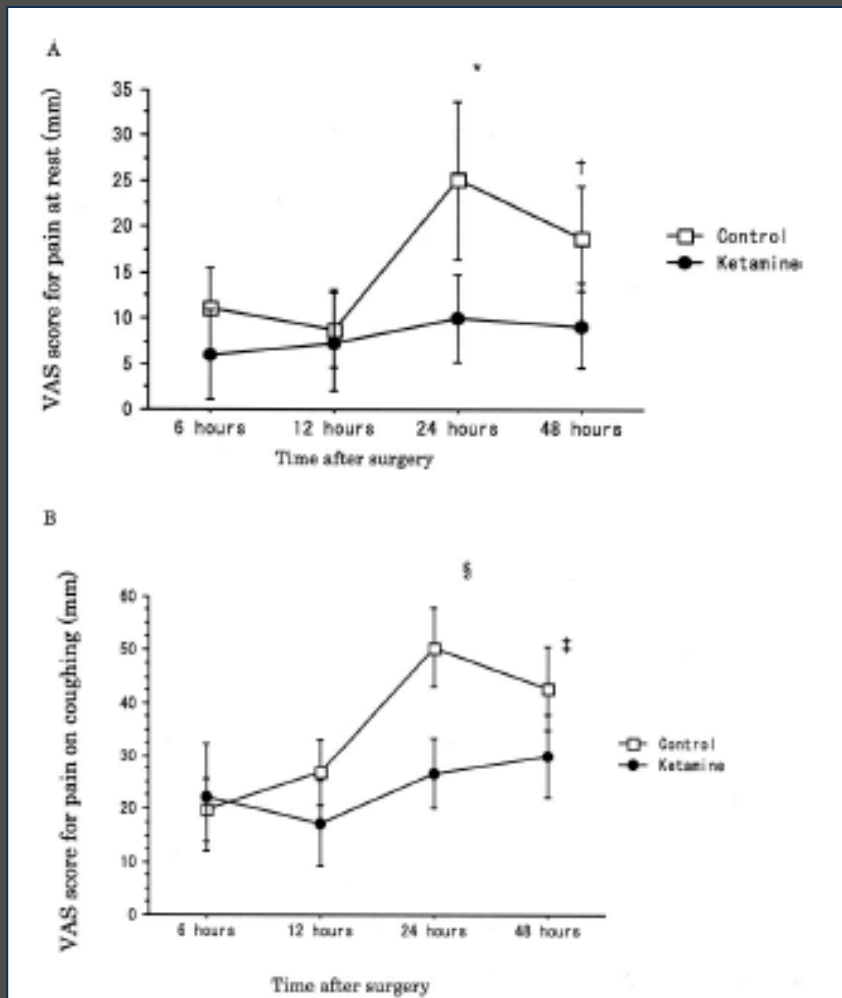
## ■ PAIN AND REGIONAL ANESTHESIA

Anesthesiology 2006; 105:111-9

© 2006 American Society of Anesthesiologists, Inc. Lippincott Williams & Wilkins, Inc.

### *Low-dose Intravenous Ketamine Potentiates Epidural Analgesia after Thoracotomy*

Manzo Suzuki, M.D.,\* Syuji Haraguti, M.D.,† Kikuzo Sugimoto, M.D., Ph.D.,‡ Takehiko Kikutani, M.D.,\* Yoichi Shimada, M.D., Ph.D.,§ Atsuhiro Sakamoto, M.D., Ph.D.||



Epidural infusion of ropivacaine and morphine for 2 days after thoracotomy

In addition: Ketamine 0.05 mg/kg/h iv for 3 days (up to 3 mg/h)

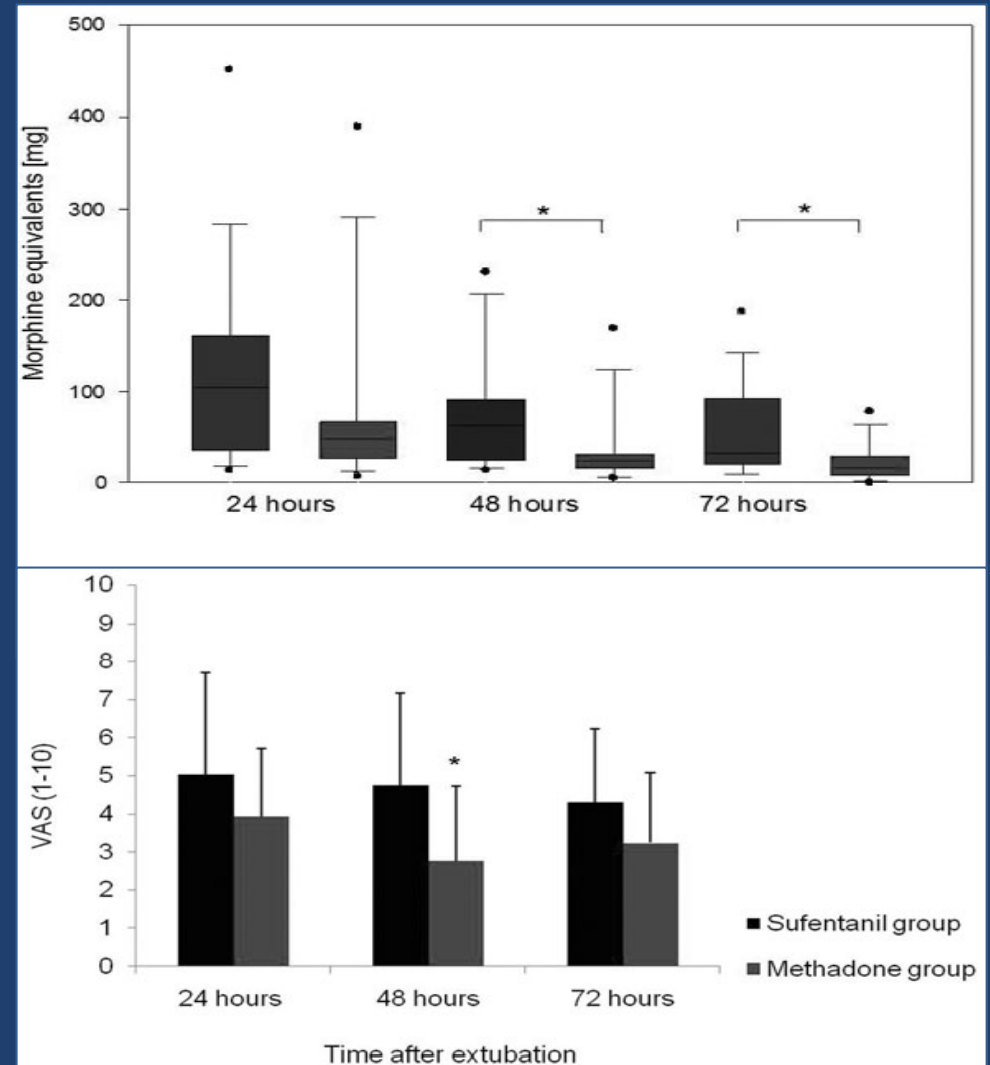
- Double-blind, placebo-controlled, randomized, two-group parallel study
- 48 adult patients
- ↓ pain at 24h, 48h, 1 mo, and 3 mo

*Suzuki et al. Anesthesiology 2006;105;111-9*

# “Intraoperative Methadone Improves Postoperative Pain Control in Patients Undergoing Spine Surgery”

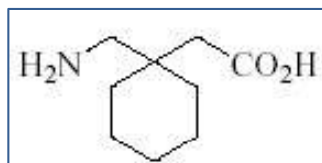
*Gottschalk A et al. ASA Abstract A807, 2009*

- Randomized controlled
- 29 adult patients
- Pre-incision:
  - Methadone 0.2 mg/kg  
or
  - Sufentanil 0.75 mcg/kg, then infusion of 0.25 mcg/kg/h
- Postoperative: iv PCA

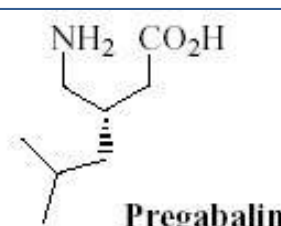


# Adjunctive Analgesic: Anticonvulsants

## Gabapentin



Gabapentin



Pregabalin

## Pregabalin

- Mechanism of action:
  - **Unknown**
  - **structurally related to the neurotransmitter GABA**
  - **Does not seem to interfere with GABA itself**
  - **May be related to binding to auxiliary subunits of voltage-dependent calcium channels**

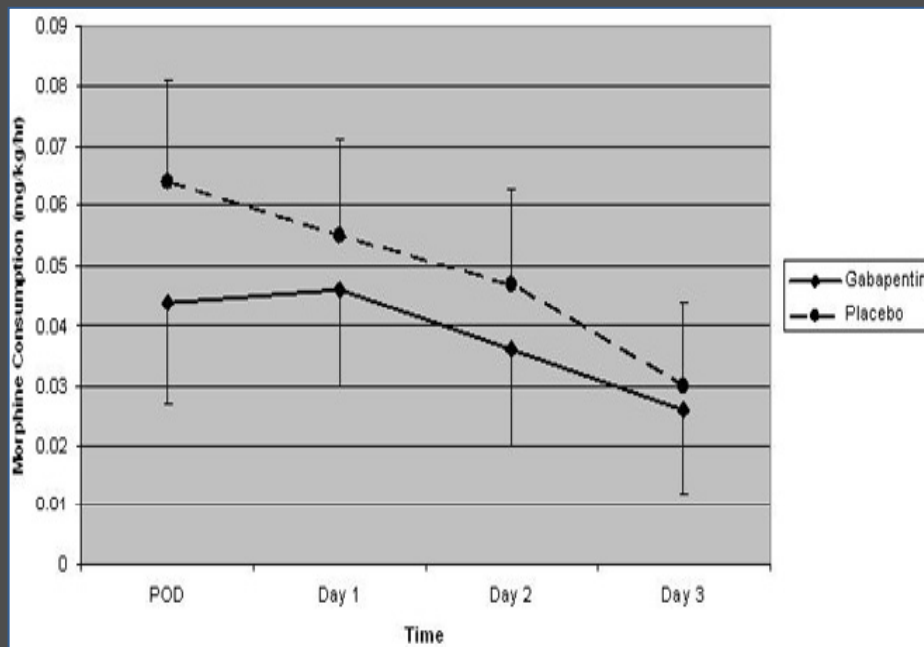


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# “Perioperative Use of Gabapentin To Decrease Opioid Requirements in Pediatric Spinal Fusion Patients”

*Rusy LM et al. ASA Abstract 1559, 2009*



**Total morphine consumption was significantly lower in gabapentin group on Postop day 0, day 1, and day 2.**

- Randomized controlled
- 59 pediatric patients
- Preoperative oral midazolam with gabapentin (15 mg/kg) or placebo

**Gabapentin reduced pain scores: recovery room (2.5 vs. 6.0,  $p < 0.001$ ) evening of surgery (3.4 vs. 5.1,  $p < 0.05$ )**





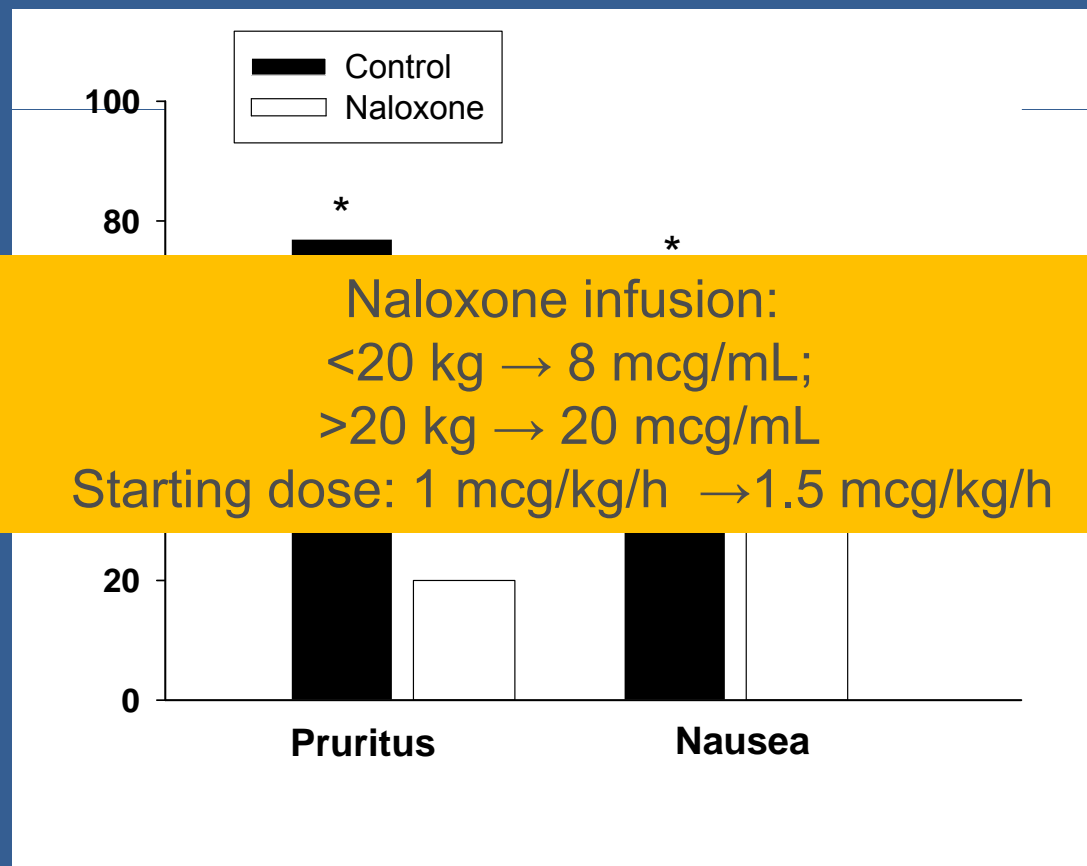
# Improving Analgesia – decreasing adverse effects

Options:

- Multi drug - analgesic therapy
  - increasing efficacy via synergy
- Single (almost single) analgesic therapy
  - increasing efficacy by dissociating desirable analgesic properties from undesirable adverse effects
- Combination of the two



“The effects of a small-dose naloxone infusion on opioid-induced side effects and analgesia in children and adolescents treated with intravenous patient-controlled analgesia: a double-blind, prospective, randomized, controlled study”.



Maxwell LG et al *Anesth. Analg* 2005; 100: 953-8

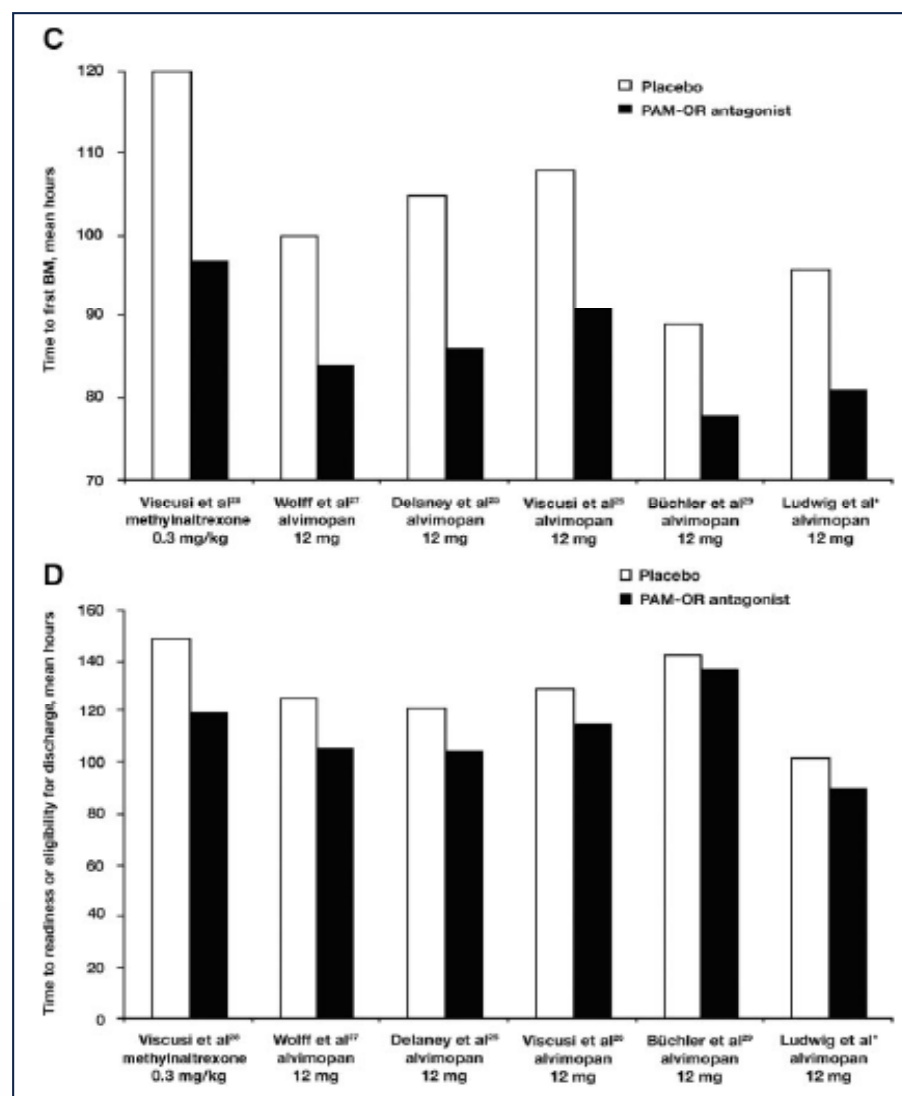


- Peripherally acting mu-opioid receptor (PAM-OR) antagonists

- Methylnaltrexone (Relistor®)

- Alvimopan (Entereq®)

- Pediatric studies pending

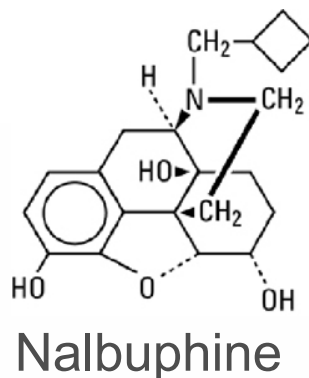


Viscusi ER et al.  
Anesth Analg 2009;108:1811-22

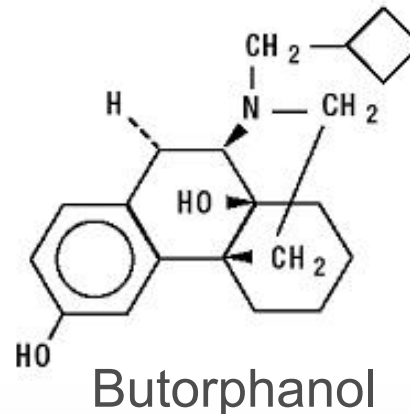
# Mixed agonist-antagonists

- Nalbuphine (Nubain<sup>®</sup>): ↑ dose ↓ pruritis
- Butorphanol (Stadol<sup>®</sup>): ↑ analgesia, ↓ side effects - except for ↑ sedation

Only a few very small pilot studies in children – no apparent change in profile of adverse effects



• HCl



# Challenging Everyday Cases

- **The Nuss patient**
- **The spinal fusion patient**
- **The bladder exstrophy patient**



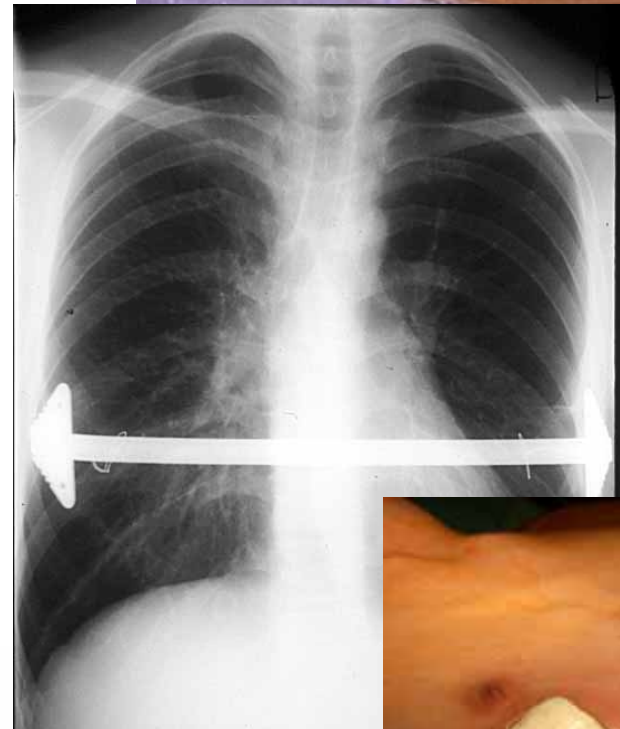
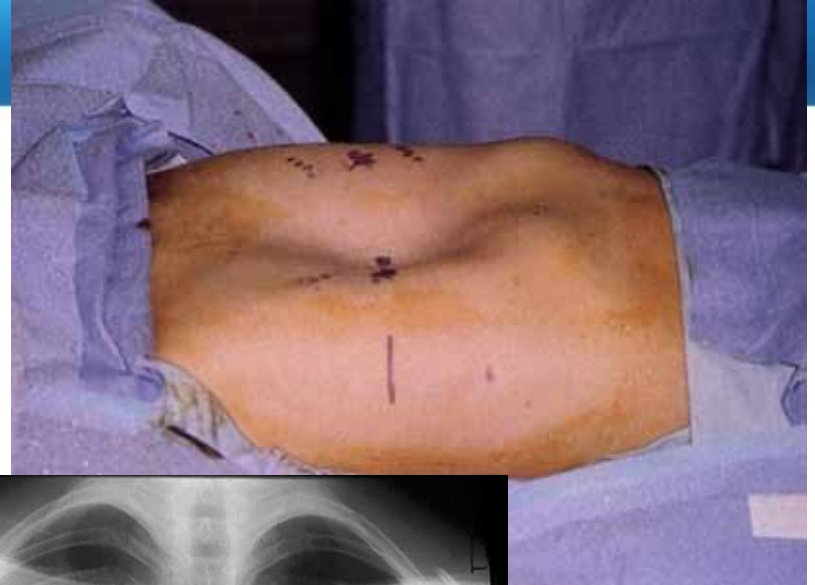
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# Pectus Excavatum

## Nuss Procedure

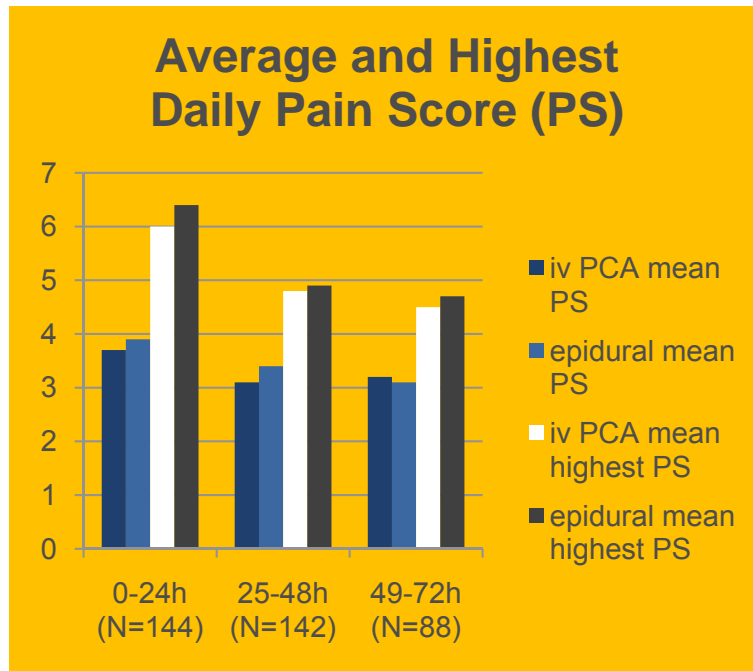
- Congenital deformity of the anterior chest wall
- Incidence 1 : 400-1000 births
- Placement of one or two bars via two small submamillary incisions
- A minimally invasive procedure



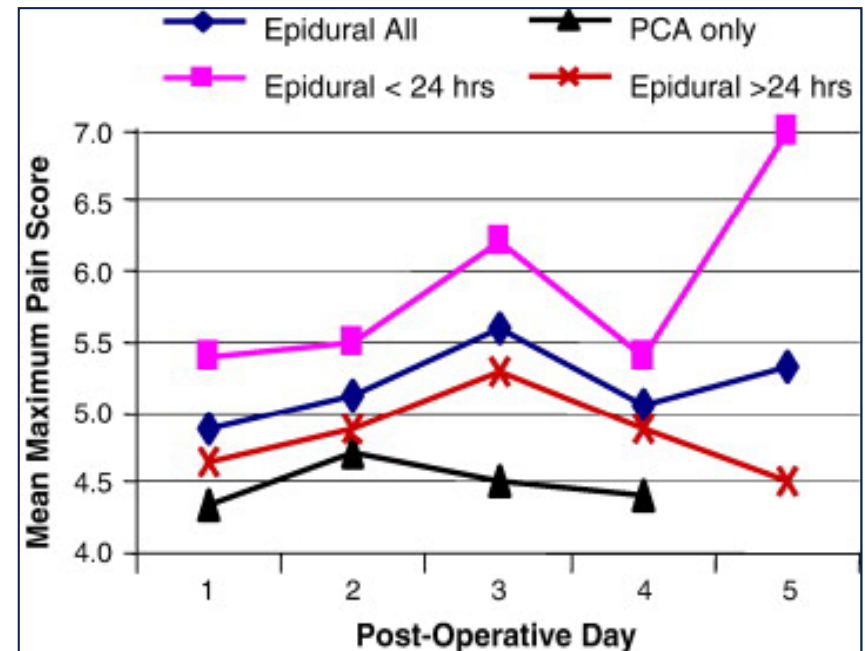


# Pain Management

## Epidural – iv PCA – or both – plus more?



May C et al. ASA abstract 2009



St Peter SD et al. J Pediatr Surg. 2008;43:79-82

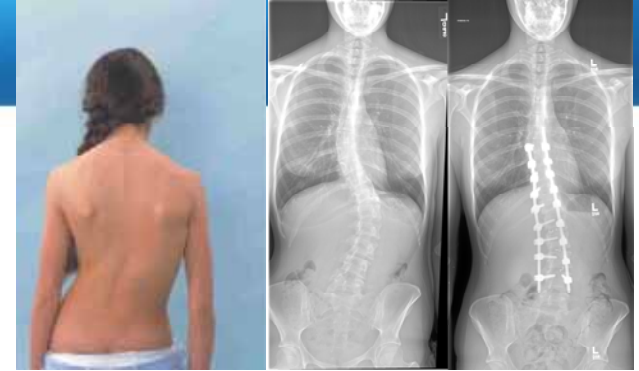


**Combined epidural/iv?  
Gabapentin? Diazepam?  
Naloxone infusion?  
GI agents?**



# Scoliosis

## *Posterior Spinal Fusion*



**Ideal for Analgesic Clinical Pathway:**

**ivPCA – primary therapy**

**Opioid sparing technique – NSAIDS -  
gabapentin**

**Naloxone infusion**

**Muscle relaxation**

**Prophylactic GI agents**

**Is this necessary? Is it cost effective?**

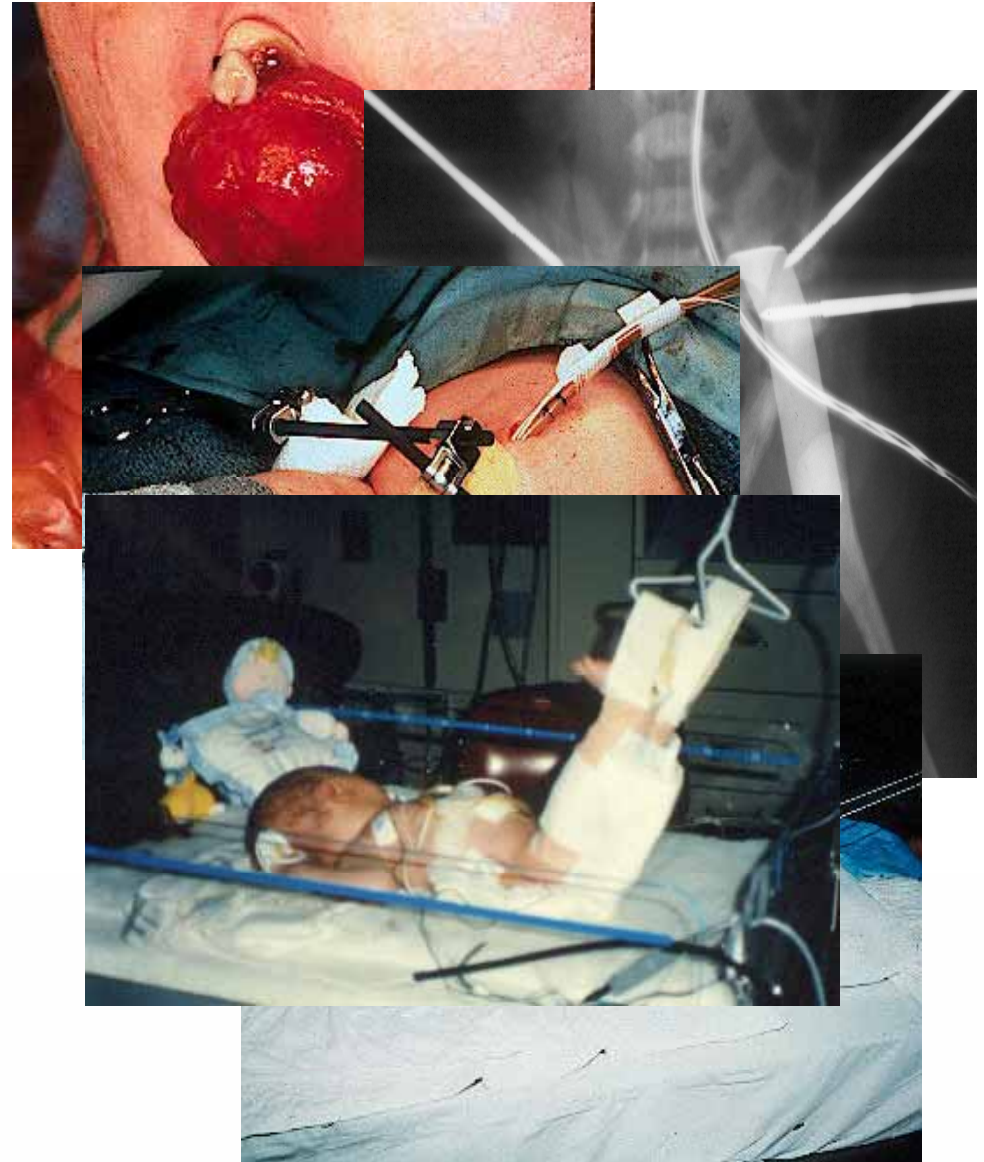
**Could there be unanticipated adverse effects?**



# Bladder Exstrophy – Analgesia and Sedation

- Rare congenital condition
- Bladder closure and pelvic osteotomies
- Postoperative immobilization with 4-6 weeks of traction

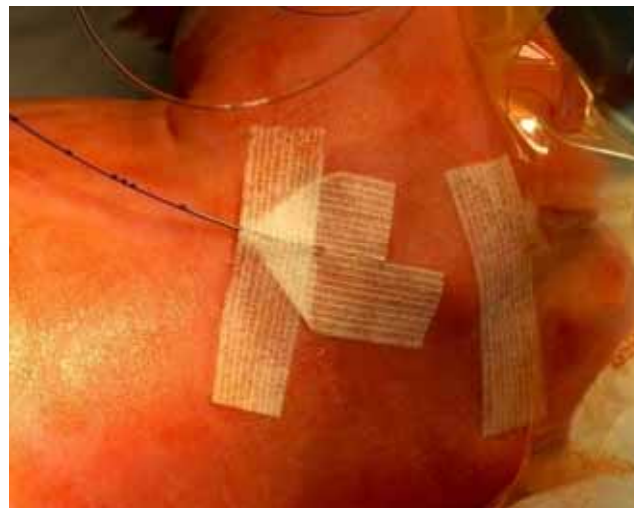
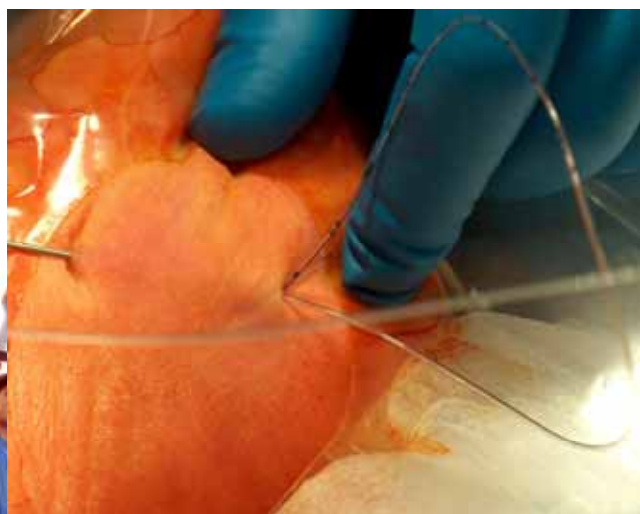
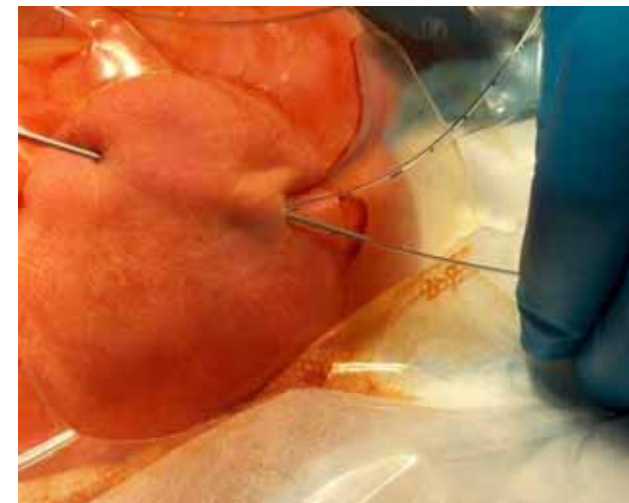
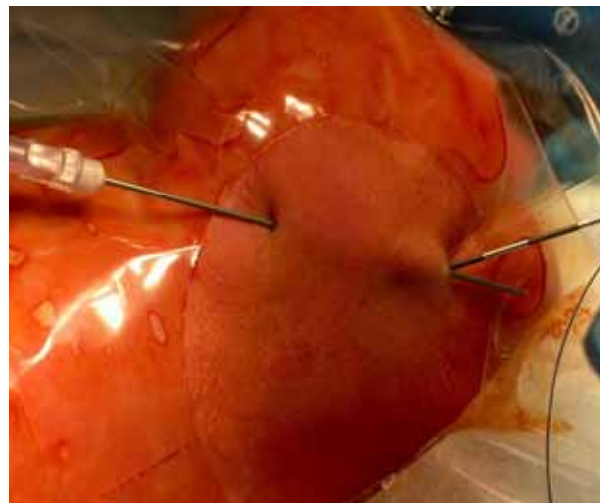
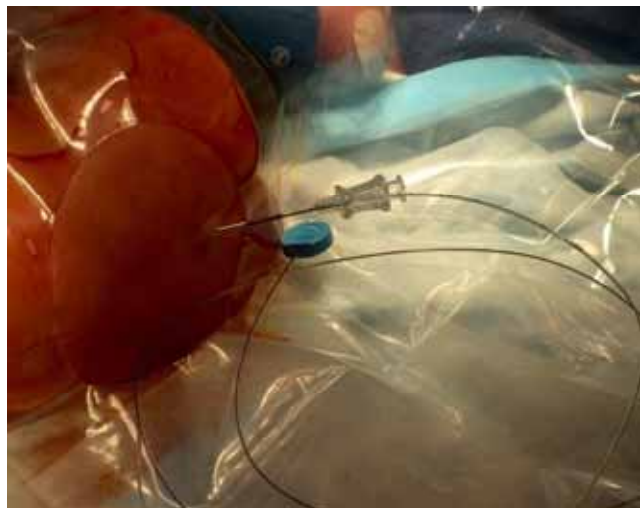
**Prolonged use of  
regional analgesia**



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## Tunneling of epidural catheter



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## Neonate

- Continuous epidural infusion:
  - **0.1% lidocaine at 0.8 mg/kg/h**
- Iv/po diazepam



## Toddler

- Continuous epidural infusion:
  - **0.1% bupivacaine at 0.3 mg/kg/h**
  - **2 mcg/mL fentanyl (10 mcg/mL hydromorphone)**
  - **1 mcg/mL Clonidine**
- Iv/po diazepam
- Iv butorphanol



# JCAHO

## Standards for Pain Management 1999

- Recognize patients' rights to assessment and management of pain
- Assess the nature and intensity of pain in all patients
- **Establish safe medication prescription and ordering procedures**
- Ensure staff competency and orient new staff in pain assessment and management
- Collect data to monitor performance

*Joint Commission Perspectives, Sept./Oct. 1999*



# Challenging Areas

## Standardization and Practice Guidelines

Free-standing Children's Centers  
Mixed care facilities

- Pain/sedation assessment scales
- CPOE and pharmacy formulary
  - Example: **weight-based dosing – bigger patients**  
**Nebulized opioids**

• Smart PCA pumps





# Challenging Areas

## Equipment:

- **New “smart” PCA pumps**
  - Institute of Medicine endorsed
  - “50%” reduction in programming errors – which may only be a few % of total error rate
- **Limitations (guardrails) for a “limitless” drug**
  - Designing guidelines/guardrails – particularly difficult in “mixed” facilities
- **Potential software problems**
  - Air-in-line sensor
- **Need for WIFI technology**



# JCAHO

## Standards for Pain Management 1999

- Recognize patients' rights to assessment and management of pain
- Assess the nature and intensity of pain in all patients
- Establish safe medication prescription and ordering procedures
- Ensure staff competency and orient new staff in pain assessment and management
- **Collect data to monitor performance**

*Joint Commission Perspectives, Sept./Oct. 1999*



# Quality Assessment/Quality Improvement

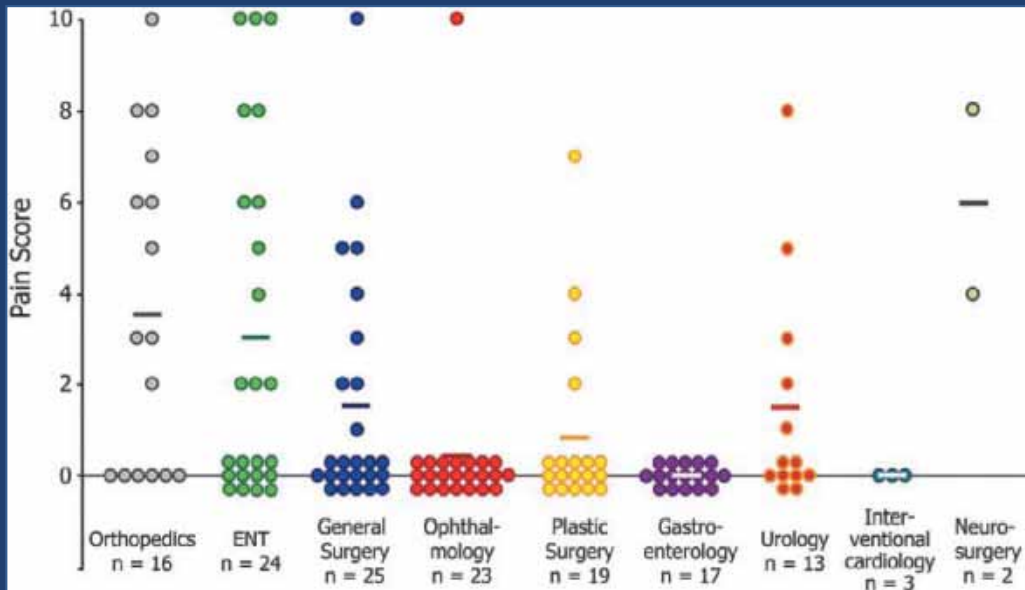
## Morbidity and mortality

- The missing N
- Incidence of “minor” side effects

## Industry standard

- Side effect acceptance rates
- Single institution databases
- PRAN – may not be granular enough for the individual institution
- Other national databases
  - Expense, personnel needs
- Requirement by insurance companies





Trudeau JD et al. AORN 2009;90:531-42

**Table 4**  
**Epidural Analgesia Monitor**  
 Confidential — For Nursing Quality Assurance Purposes Only

UNIT: 8000  
 MONTH: July 1990  
 # OF AUDITS: 5

RESPONSE CODE: Y = Yes  
 N = No  
 NA = Not Applicable

TOPIC: EPIDURAL ANALGESIA  
 (Complete Audit Prior to Discharge From Acute Pain Service) (Fictitious Data)

PATIENT ROOM NUMBER	8010	8012	8042	8061	8020	Total #	
						Yes	Total Possible Yes
<b>PATIENT INTERVIEW</b>							
1. Did patient receive epidural analgesia teaching handout?	Y	Y	Y	Y	Y		5 / 5
2. Does patient feel the information was adequate?	Y	Y	Y	Y	Y		5 / 5
<b>PATIENT ASSESSMENT</b>							
1. Epidural catheter labeled with orange epidural sticker?	Y	Y	Y	Y	Y		5 / 5
<b>CHART REVIEW</b>							
1. Documentation of epidural teaching? (on P.E.R., nurses notes)	Y	Y	Y	Y	Y		5 / 5
2. Documentation of patients response to teaching? (on P.E.R., nurses notes)	Y	Y	N	Y	N		3 / 5
3. Documentation of epidural catheter dressing condition? (S.N.F.S.)	Y	Y	Y	Y	Y		5 / 5
4. Documentation Q 1 hr respiratory rates over past 24 hr or since return to unit? (S.N.F.S.)	Y	Y	Y	Y	Y		5 / 5
5. Documentation Q 1 hr sedation level over past 24 hr or since return to unit? (S.N.F.S.)	Y	Y	Y	Y	Y		5 / 5
6. Documentation of current epidural syringe on continuous infusion? (S.N.F.S.)	Y	Y	Y	Y	Y		5 / 5
7. Has current epidural syringe been subtracted from the Substance Control Record?	Y	N	Y	Y	Y		4 / 5
<b>TOTAL # YES</b>	10	9	9	10	9		47 / 50
<b>TOTAL # POSSIBLE YES</b>	10	10	10	10	10		50
<b>% Yes</b>	100	90	90	100	90		94
N = (For CMHS/Division Use Only)							

Reprinted with permission from Catherine McAuley Health System.

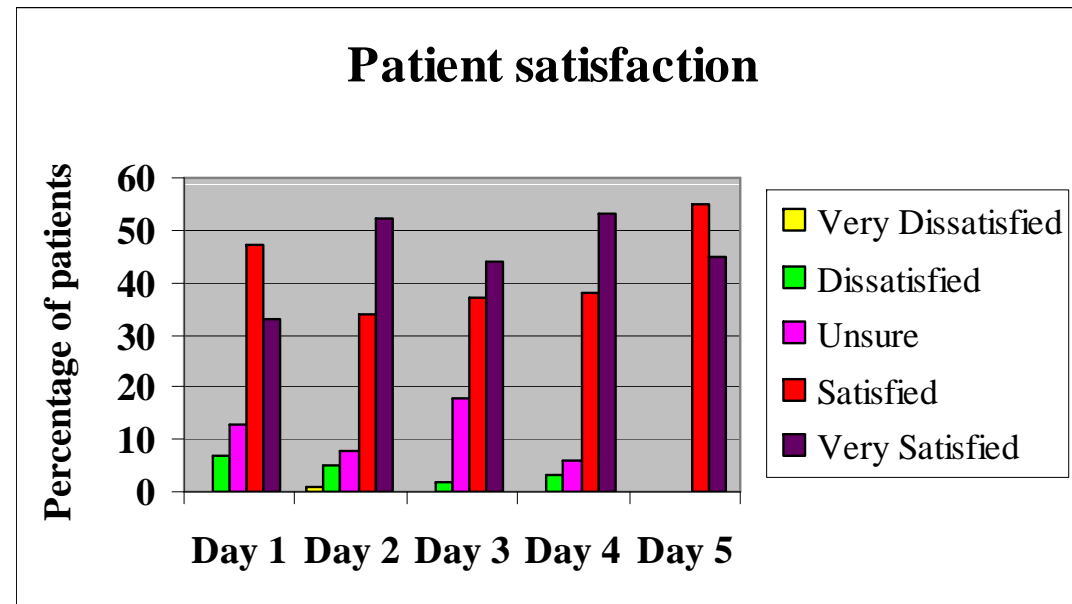
Williams NH et al.  
 Orthop Nurs 1991;10:45-54



# Quality Assessment/Quality Improvement

## Patient satisfaction assessments

Pre-and post  
intervention



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# Aspects of Customer Service

- Availability
- Responsiveness
- Timeliness
- Completeness
- Professionalism
- Overall satisfaction and quality

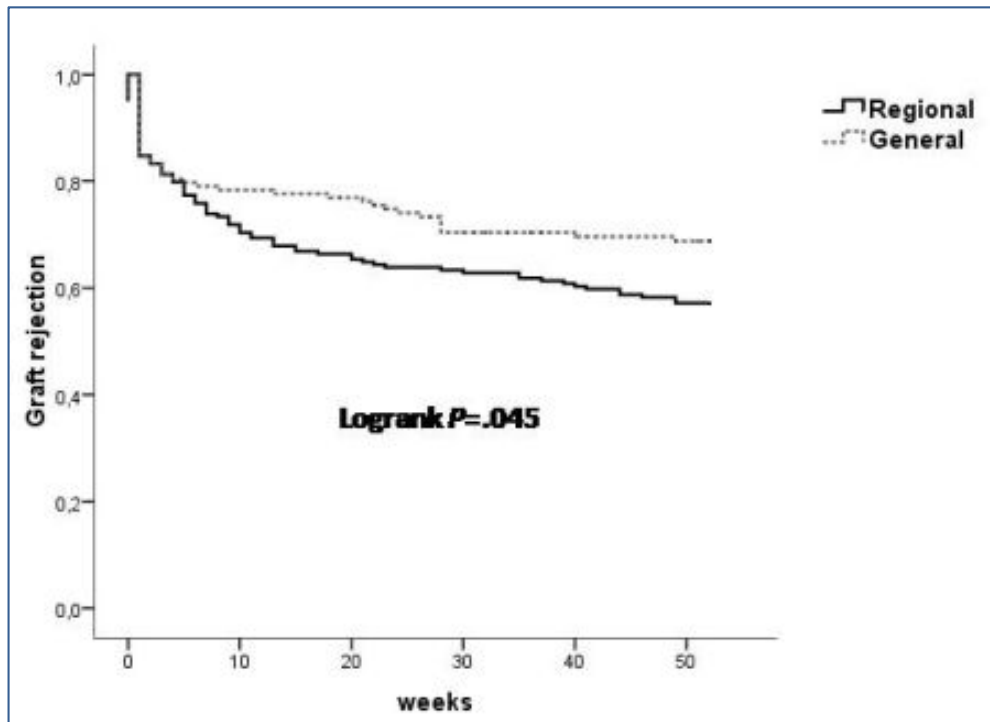


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# Long-term Outcome Assessment

## *Immunomodulation*



“Regional Anesthesia and Renal Allograft Rejection after Renal Transplantation”

*Pirat A et al. ASA abstract 2009*

Regional anesthesia was associated with an increase in 1-year graft rejection rate after renal transplantation



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# Conclusion

- Assessment and management of pain in children should be considered a standard of care. This includes children of all ages and all physical and cognitive abilities.
- Systematic “balanced” analgesia amplifying desirable effects and diminishing adverse effects of primary analgesic agents should be considered for all pediatric patients.
- Quality assessment and quality improvement in pediatric pain management will be our next big challenge to tackle.



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# Thank You

