

Multi-Modal Perioperative Pain Regimen for Posterior Fusion in Adolescent Idiopathic Scoliosis

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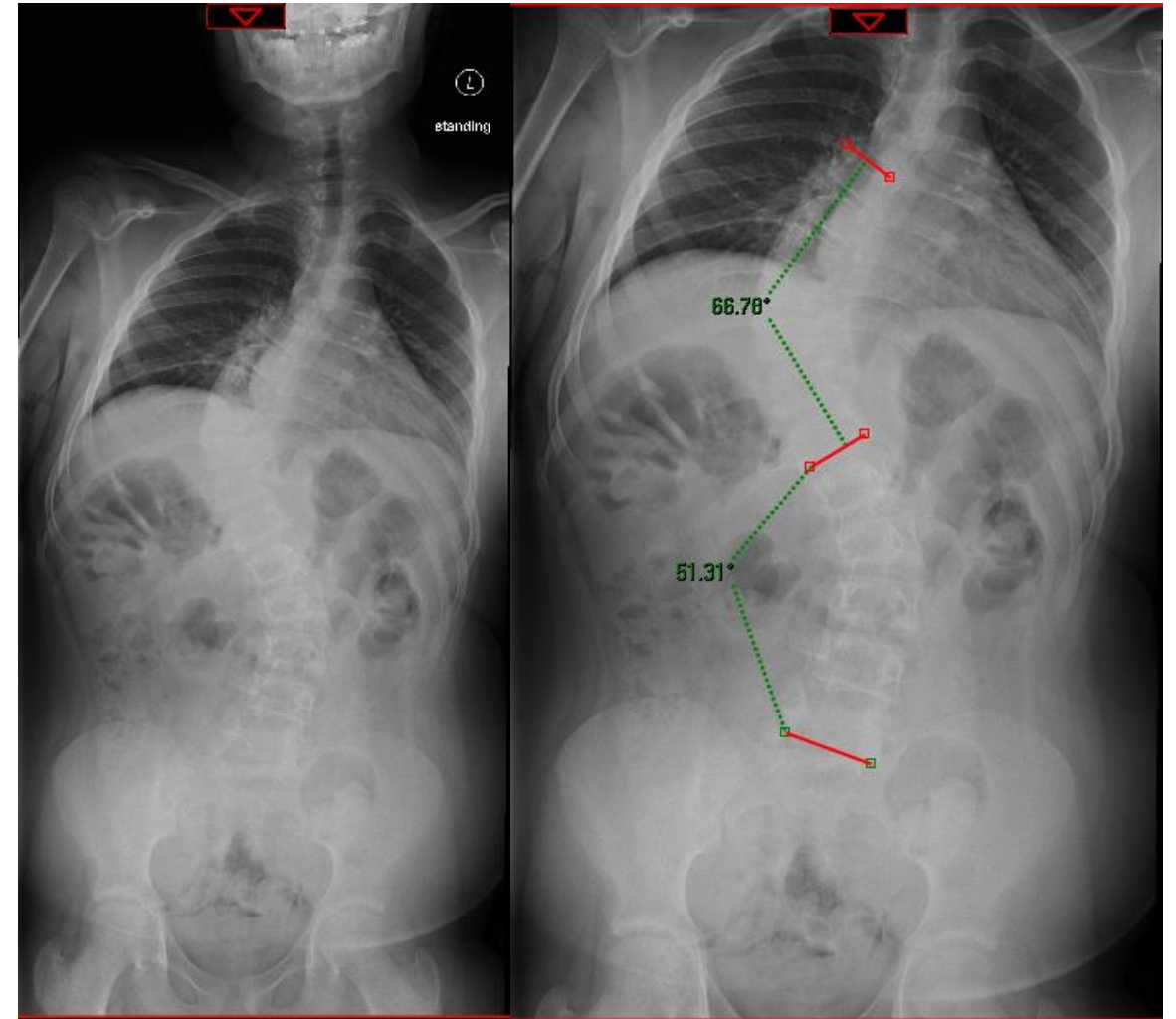
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Problem/ Background

- Adolescent idiopathic scoliosis (AIS)
 - ~Coronal plane deformity
 - 10-18 years old
 - Most common type
 - 10:1 female to male curves > 30 degrees
 - Operative if cobb angle > 45 degrees



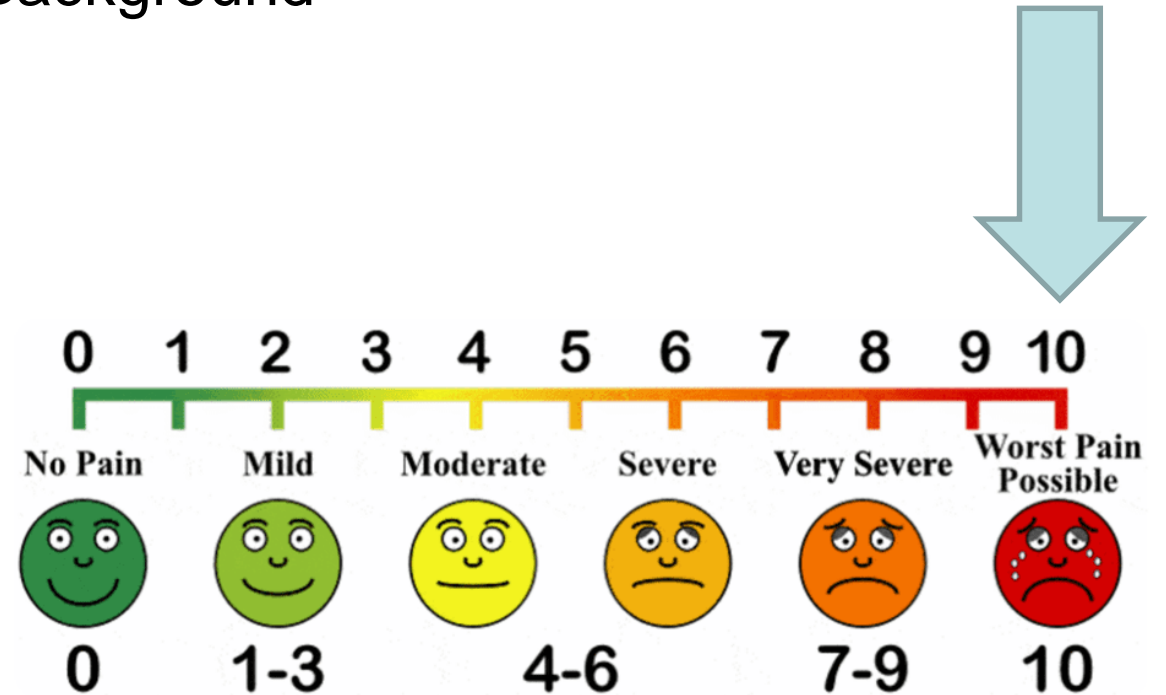
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 - Pedicle screw fixation
 - Curve correction with rods



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Problem/ Background

- 1989, Amaranath
 - efficacy of epidural morphine
- 2000, Cassady
 - RCT similar efficacy of epidural morphine to PCA pump
- 2008, Sucato
 - no increased pseudoarthrosis with post-op toradol
- 2011, Ross
 - Bupivacaine infusion reduces opioid requirements
- 2015, Ibach
 - Tylenol reduces morphine requirements
- 2016, Muhly
 - Rapid recovery pathway (RRP) and multimodal analgesia

Situation

- Erlanger incidence
 - ~One PSIF per week
- Pediatric team (RN, staff) difficulty in maintaining scheduled medication regimen while on the floor
 - Inconsistency of medication administration
 - Variability in pain control
 - Average LOS: 4 days

Pre-RRP	RRP
<ul style="list-style-type: none"> • First night in PICU • Once daily PT starting on POD1 • ECA • IV PCA (if no ECA or pain poorly controlled with ECA) • Foley removed once ECA removed, otherwise on POD1 • Diazepam 0.1mg/kg IV (max dose 5mg), Q6 hours PRN for muscle spasms • Hydrocodone/Acetaminophen 5/325mg PO, Q4 hours • Morphine IV 0.05-0.1mg/kg, Q2 hours PRN for breakthrough pain 	<ul style="list-style-type: none"> • First night in PICU • BID PT starting POD1 • Foley removed on POD1 • Dexamethasone 0.2mg/kg IV (max dose 10mg), TID for 3 doses • Ketorolac 0.5mg/kg IV (max dose 30mg), Q6 hours scheduled for max 6 doses • Diazepam 0.1mg/kg IV (max dose 5mg), Q6 hours PRN for muscle spasms • Gabapentin 5mg/kg PO (max dose 300mg) TID. Continued until discharged from hospital. • Hydrocodone/Acetaminophen 5/325mg PO (max dose acetaminophen 3250mg/day), Q4 hours PRN for pain • Morphine IV 0.05-0.1mg/kg, Q2 hours PRN for breakthrough pain • IV PCA (if pain not relieved with breakthrough Morphine IV)

AIM

- Improve consistency of RRP implementation
- Decrease inpatient narcotic medication use (MME)
- Decreased length of stay
- Increase patient/family satisfaction
- Increase RN/staff satisfaction

Causes Leading to the problem

Patient

Adolescent

Surgeon

Large exposure
Large correction
Time constraints

Uncontrolled Pain
High MME req.
Prolonged LOS

RRP

Extensive
Strict schedule

Environment

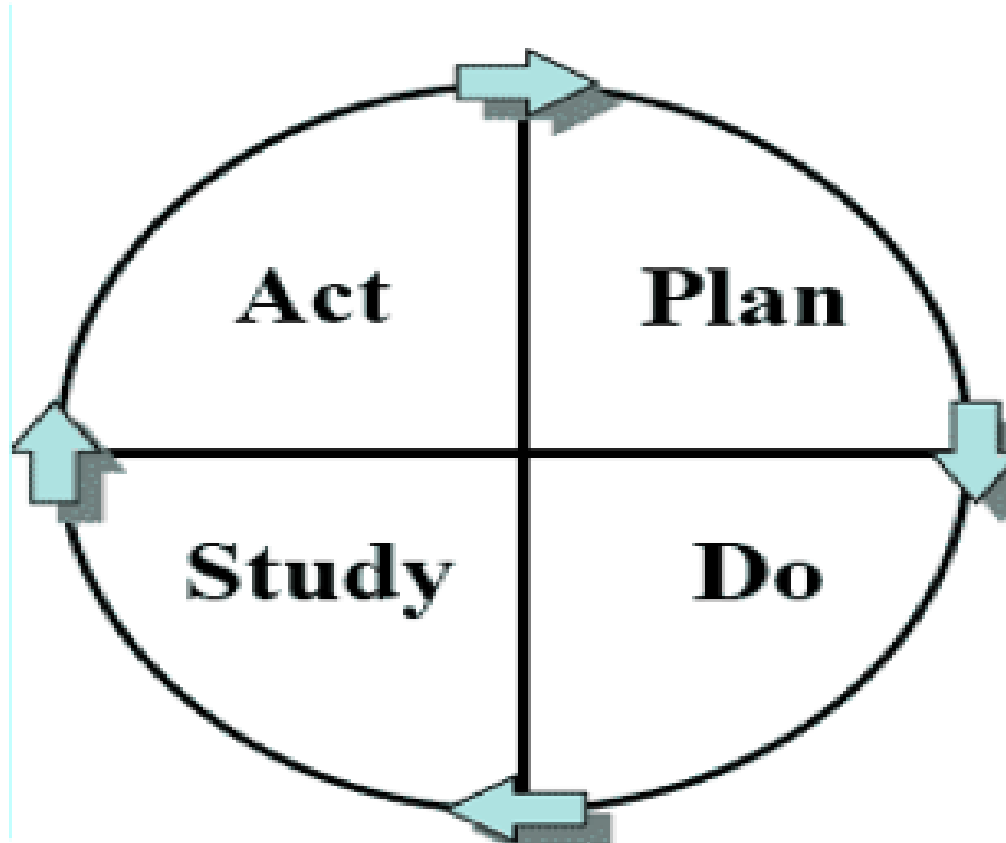
Nursing to patient ratio
Comfortability with medications
Lack of advanced monitoring techniques

Measures

- Outcome measure
 1. Average length of stay following posterior spinal fusion
 2. Inpatient narcotic use (measured in MME's) following posterior spinal fusion
 3. Post operative time to mobilization
- Process measures
 1. Initial percent of patients leaving by post-operative day #3
 2. Percent of patients successfully mobilizing with physical therapy by post-operative day #2
 3. Initial nurse feedback on overall changes in patient comfort with introduction of a more standardized multi-modal pain management protocol.
- Balance Measure(s)
 1. Percent and description of unexpected problems leading to increased narcotic requirement
 2. Decreased mobilization
 3. Decreased adherence to the new protocol.

PDSA- 1: August 2020-September 2020

- Admit to the ICU post operatively
- Pediatric team (nursing and staff) indicated difficulty maintaining the pain medication schedule on the floor
- Significant inconsistency floor versus ICU postop

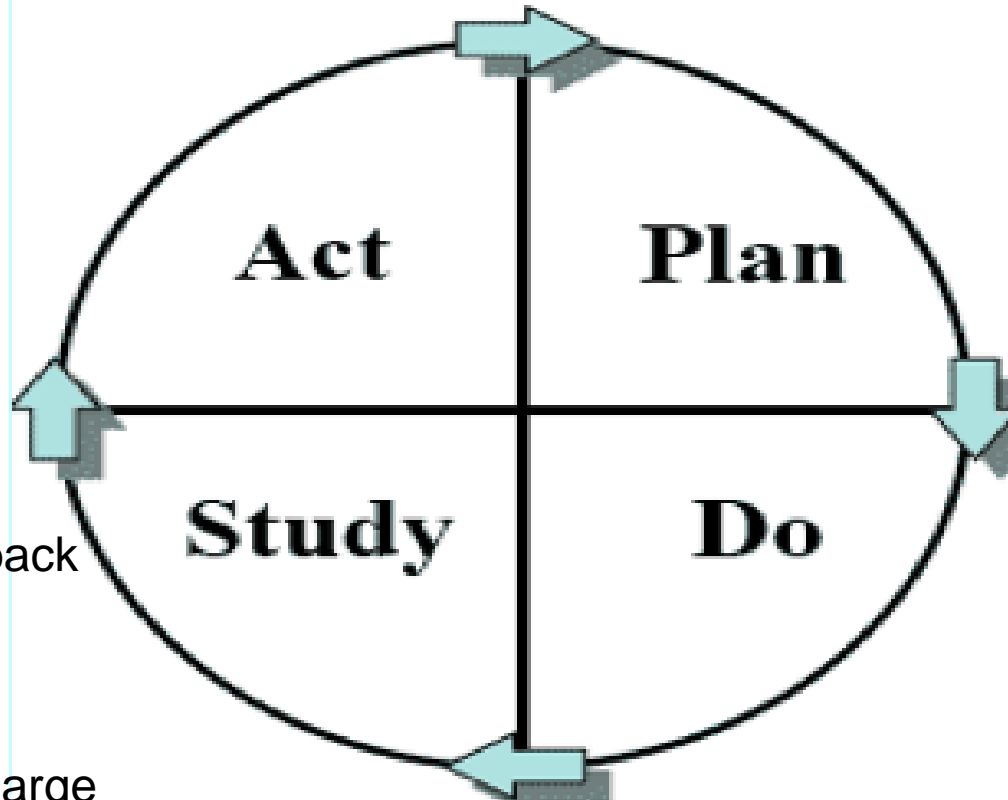


- Implement new multimodal pain management program
- We will know when we have
- MME requirements decrease
- time to mobility decreases
- time to discharge significantly decreases
- Initiated August 2020
- All patients following PSIF for AIS

PDSA- 2: September 2020-December 2020

- Continue the protocol for the next year
- Retrospective study
- Confirm a significant difference of our study measures

- Positive subjective feedback
- Pain medication requirements
- Earlier mobilization
- Decreasing time to discharge
- Small sample size



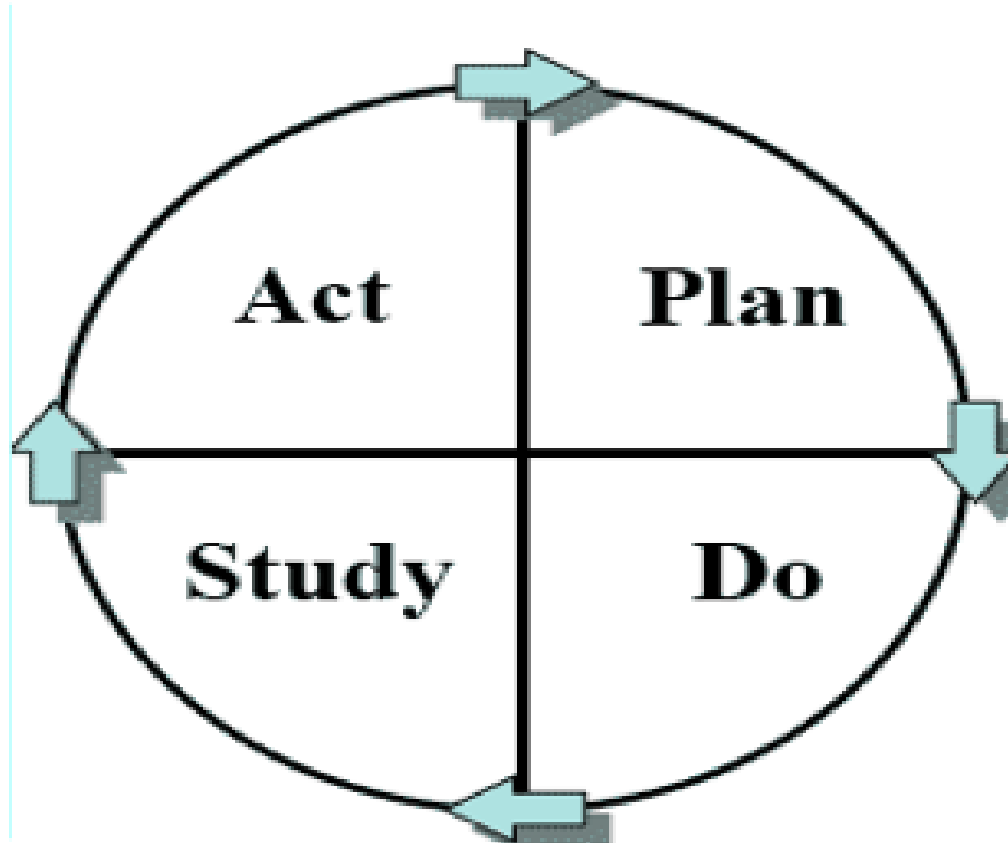
- Multimodal pain management program
- PSIF for AIS
- Admitted to ICU

- Carried out September 2020

PDSA- 3: December 2020-December 2021

- Continued to monitor and update protocol
- Assess adherence

- Statistically significant decrease
 - LOS
 - MMEs

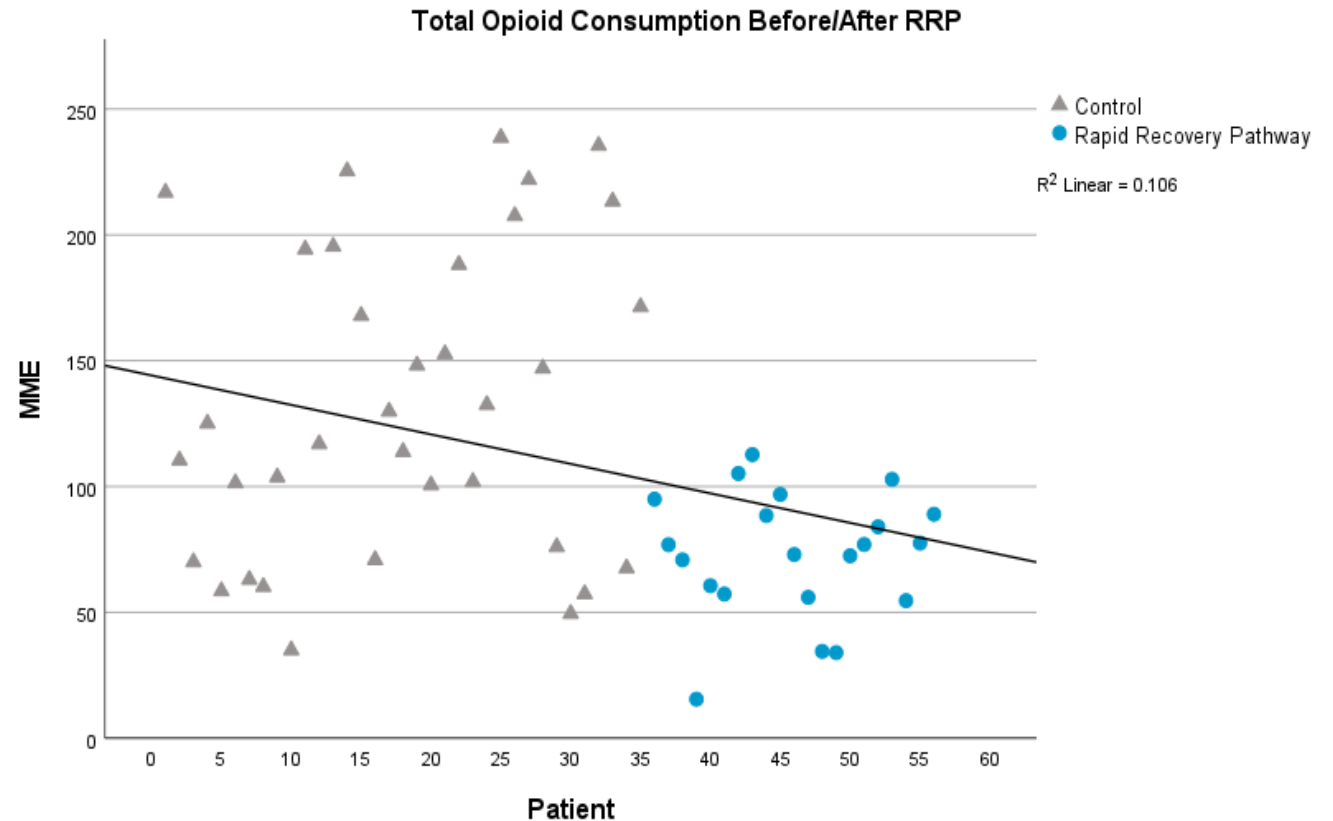


- Multimodal pain management program implemented
- One year

- Continued ICU admission postoperatively for one year

Results

- 56 patients enrolled
 - 21 RRP Pathway
 - 35 control
- MME requirements
 - significantly less in RRP cohort POD 0-3 ($p < .001$)
 - mean difference 60.3 MME
- Length of stay
 - Significantly less in RRP cohort
 - 3 days vs 4 days ($p < .001$)



Discussion

- Rapid recovery pathways case reduce MME and LOS for PSIF for AIS
- Complex protocols require
 - Open communication with staff
 - Staff ability to execute
 - Time to declare ability/validity

Barriers/Lessons Learned

- Communicate with staff
- Listen to patients and families
- Use multimodal pain regimens
- Putting in the orders doesn't ensure execution, be diligent

Next Steps

- Application of RRP to other operative procedures
- Sub-set analysis on data set

References and “Thank You”s

- Weinstein SL, Dolan LA, Cheng JC, Danielsson A, Morcuende JA. Adolescent idiopathic scoliosis. *Lancet*. 2008;371(9623):1527-37.
- Altaf F, Gibson A, Dannawi Z, Noordeen H. Adolescent idiopathic scoliosis. *BMJ*. 2013;346:f2508.
- Seki H, Ideno S, Ishihara T, Watanabe K, Matsumoto M, Morisaki H. Postoperative pain management in patients undergoing posterior spinal fusion for adolescent idiopathic scoliosis: a narrative review. *Scoliosis Spinal Disord*. 2018;13:17.
- Shah SA, Guidry R, Kumar A, White T, King A, Heffernan MJ. Current Trends in Pediatric Spine Deformity Surgery: Multimodal Pain Management and Rapid Recovery. *Global Spine J*. 2020;10(3):346-52.
- Sucato DJ, Duey-Holtz A, Elerson E, Safavi F. Postoperative analgesia following surgical correction for adolescent idiopathic scoliosis: a comparison of continuous epidural analgesia and patient-controlled analgesia. *Spine (Phila Pa 1976)*. 2005;30(2):211-7.
- Thank you to Andrew Wilson MS for statistical work