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Medical Management of the Pediatric Spinal Fusion Patient

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Objectives

- Explain the role of the pediatric hospitalist in co-managing spinal fusion patients.
- Describe three common medical complications following spinal fusion surgery.
- Discuss two approaches to prevent respiratory and gastrointestinal complications in the postoperative period.

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Pediatric Co-management of the Spinal Fusion Patient

1. Active management of chronic co-morbidities
2. Anticipatory role in management of medical complications
 - Prevention
 - Surveillance
 - Mitigation

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Common Medical Complications of Spinal Fusion Surgery

- CNS – Pain
- CV – Hemodynamic changes
- Respiratory – Atelectasis
- FEN – Electrolyte disturbance, fluid shifts
- GI – Constipation, dysmotility
- Heme – Anemia
- ID – Postoperative fever, infection
- Endocrine – Syndrome of Inappropriate ADH secretion

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Case Presentation

Anne is a 16-year-old female with idiopathic scoliosis. She has just undergone posterior spinal fusion and is recovering in the PACU. Anesthesia has initiated a morphine PCA for pain control.

What other types of pain medication should you consider?

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Case Presentation

What other types of pain medication should you consider?

- A. Intravenous ketorolac
- B. Intravenous acetaminophen
- C. Intravenous diazepam
- D. Holistic / integrative health consultation
- E. All of the above

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Pain

- Treatment
 - Effective treatment allows for earlier mobilization and overall better outcomes.
- Opioids are mainstay, but have several common adverse effects¹
 - Respiratory depression
 - Sedation
 - Nausea, vomiting
 - Pruritus
 - Urinary retention
 - Ileus
 - Constipation

Brislin RP, Rose JB. Pediatric acute pain management. *Anesthesiol Clin North America*. 2005;23(4):789–814

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Multimodal Pain Management

- **Multimodal therapy is recommended.**
 - Advantage: reduces opioid reliance and decreases opioid side effects
 - Includes adjunctive therapies
 - Integrative health
 - Emotional support
 - Includes non-opioid pain medications
 - Must consider adverse effects of each medication class

Brislin RP, Rose JB. Pediatric acute pain management. *Anesthesiol Clin North America*. 2005;23(4):789–814

Zeltzer LK, Krane EJ. Pediatric pain management. In: Kliegman RM, Stanton BF, St Geme JW III, Schor NF, Behrman RE, eds. *Nelson Textbook of Pediatrics*. 19th ed. Philadelphia, PA; 2011:360–375

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Non-Opioid IV Pain Medications

- Anti-inflammatory (NSAIDs)
 - Ketorolac
- “Weak analgesic”
 - Acetaminophen
- Muscle relaxant
 - Diazepam

Brislin RP, Rose JB. Pediatric acute pain management. *Anesthesiol Clin North America*. 2005;23(4):789–814

Yaster M, Cote CJ, Krane EJ, et al. *Pediatric Pain Management and Sedation Handbook*. 1st ed. St. Louis, MO: Mosby; 1997

Dumont AS, Verma S, Dumont RJ, et al. Nonsteroidal anti-inflammatory drugs and bone metabolism in spinal fusion surgery: a pharmacological quandary. *J Pharmacol Toxicol Methods*. 2000;43(1):31–39

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Case Presentation

- On postoperative day 1, the bedside nurse calls you because Anne has a heart rate of 130.
- Afebrile (36.5°C), blood pressure 95/65
- Appears calm, pain is currently a 3/10
- Review of urine output shows that patient has had <0.5mL/kg/hr of urine over the last shift.
- JP drain has had minimal serosanguineous drainage.

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Tachycardia

- Symptom of a problem
 - Pain
 - Anxiety
 - Fever / Infection
 - Anemia
 - Hypovolemia
 - Medication effect

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Case

■ Anne's labs

- WBC 8 K/mcL
- Hgb 8.2 gm/dL (previous postop value 9.1)
- Plts 250 K/mCL
- Na 138 mmol/L
- BUN 40 mg/dL
- Cr 0.8 mg/dL

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Anemia

- Significant blood loss is common in posterior spinal fusions.
- Surgeon should be included in discussions regarding postoperative transfusion.
- Evidence¹ supports transfusion when Hgb is <7g/dL, assuming there is no uncontrolled ongoing blood loss.

¹ Rouette J, Trottier H, Ducruet, T, et al. Red blood cell transfusion threshold in postsurgical pediatric intensive care patients: a randomized trial. *Ann Surg*. 2010;251(3):421–427





Tachycardia

- Symptom of a problem
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Fluid Shifts

- Multiple factors in fluid status of PSF patients
 - Under (or over) resuscitation in operating room
 - Third spacing of fluid following surgery
 - Anti-diuretic hormone surge
 - Syndrome of Inappropriate Anti-Diuretic Hormone secretion (SIADH)

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SIADH

- A majority of spinal fusion patients have a surge of ADH in the early postoperative period.^{1,2}
 - Clinically, this causes a decrease in urine output.
- A minority develop clinical SIADH¹, defined as the following:
 - Decrease in urine output <1mL/kg/hr
 - Serum osm <280 mOsm/L
 - Urine osm >249 mOsm/L
 - Hyponatremia (serum Na <131 mEq/L)

 **In children with SIADH, volume expansion may exacerbate the condition.**

¹Lieh-Lai MW, Stanitski DF, Sarnaik AP, et al. Syndrome of inappropriate antidiuretic hormone secretion in children following spinal fusion. *Crit Care Med.* 1999;27(3):622–627

²Bell GR, Gurd AR, Orlowski JP, et al. The syndrome of inappropriate antidiuretic-hormone secretion following spinal fusion. *J Bone Joint Surg Am.* 1986;68(720)720–724

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Case

- You order a 10 ml/kg normal saline bolus for Anne.
- Her heart rate decreases to 110 following the intervention.

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Case Presentation

- It is postoperative day 3.
 - Overnight, Anne developed an oxygen requirement of 1 liter via nasal cannula. Chest X-ray shows some streaky atelectasis but is otherwise normal.
 - In addition, Anne complains of abdominal discomfort. You notice she has not stoolled since she came to the hospital.

Could these outcomes have been prevented?





Postoperative Atelectasis

■ Prevention

- Mobilization^{1,2}
- Early respiratory therapies²: Incentive spirometry¹, breath-stacking³
- Effective pain control (avoid splinting)
- Avoid over-sedation

¹Cassidy MR, Rosenkranz P, McCabe K, et al. I COUGH: reducing postoperative pulmonary complications with a multidisciplinary patient care program. *JAMA Surg.* 2013;148(8):740–745

²Kaminski PN, Forgiarini LA Jr, Adrade CF. Early respiratory therapy reduces postoperative atelectasis in children undergoing lung resection. *Respir Care.* 2013;58(5):805–809

³McKim DA, Katz SL, Barrowman N, et al. Lung volume recruitment slows pulmonary function decline in Duchenne muscular dystrophy. *Arch Phys Med Rehab.* 2012;93(7):1117–1122

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Constipation / Dysmotility

- **Constipation** is common in the postoperative period, related to opioid use, poor mobilization
 - *Prevention*: Early mobilization, laxatives, spare opioids
- **Ileus** occurs in 5-10% of patients¹
 - Distention
 - No flatus or bowel movement
 - Pain
 - Nausea, vomiting
- **Rare, serious GI complications¹:**
 - **Ogilvie syndrome** (colonic pseudo-obstruction)
 - **Superior mesenteric artery (SMA) syndrome**

¹ Louis RG, Tabbosha MN, Shaffrey ME. Medical complications. In: Benzel EC, ed. *Spine Surgery*. 3rd ed. Philadelphia, PA: Elsevier Saunders; 2012:1897–1904

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Summary

- Pediatric medical co-management of spinal fusion patients involves
 - Prevention, surveillance, and mitigation of postoperative complications
- Adjunctive pain medications can decrease opioid-related adverse effects.
- SIADH, if unrecognized, can be a life-threatening complication of spine surgery.
- Postoperative atelectasis and constipation are common and preventable.

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