

## **Multimodal Analgesia and the Management of the Heroin Addicted Adolescent on Suboxone Maintenance Undergoing Posterior Spinal Fusion for Idiopathic Scoliosis**

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### **Objectives:**

- Recognize the incidence and epidemiology of adolescent drug abuse in the US population.
- Discuss the maintenance strategies commonly used for heroin addiction/recovery [buprenorphine/naloxone (Suboxone) and methadone] and the implications for perioperative management.
- Discuss multimodal pain management strategies for adolescents and young adults undergoing posterior spinal fusion for idiopathic scoliosis.
- Review rational and evidence for specific analgesic interventions including methadone, ketamine, intravenous acetaminophen, ketorolac and gabapentin.

### **Case History:**

You are called by the anesthesia screening nurse who reports that you have been assigned to care for an 17 year old with progressive idiopathic scoliosis for posterior spinal fusion the following day. Relevant medical history includes a history of intravenous heroin abuse which is now managed with suboxone.

### **Questions:**

What is suboxone, how does it work, and what are the implications of this drug to your anesthetic management? Should your patient continue suboxone up until the day of surgery? Are there better options for managing her opioid dependence especially in the event of a scheduled surgery? How common is heroin abuse in adolescents in the United States? Is proceeding with this surgery a good idea or should you recommend the surgery be delayed?

### **Case History (continued):**

You are concerned and decide the patient should not take the suboxone the night before surgery. You elect to contact the patient and her family to advise her to hold her dose the evening before and morning of suboxone. You plan to see her the next morning at which time you will discuss your anesthetic plan for the patient and the family.

**Questions:**

What do you do if upon questioning the patient admits that the last time she injected heroin was 2 weeks earlier? Do you have additional concerns? Is it ethical to proceed with a surgery of this magnitude in a patient with a poorly controlled heroin addiction? Further questioning reveals that she hasn't used heroin in over 6 months and her suboxone treatment is managed by her family practitioner. Is this concerning? Your patient also reports that she used heroin for chronic back pain. Is idiopathic scoliosis painful? Is posterior spinal fusion associated with chronic pain?

What exactly is your plan for this anesthetic? Is there anything you might consider giving to this patient preoperatively? What are your analgesic options? Are there regional techniques you might consider? Do you expect to be able to control her pain on the floor postoperatively?

The patient asks you why you can't just knock her out for a few days after surgery. What do you think about this request? Why are these expectations concerning to you?

**Case History (continued):**

Your case goes without complication. Blood loss is limited to 600cc with a low hemoglobin of 9.6 prior to transfusion of 180 ml of cell saver. Your patient is transferred to the PICU for monitoring and pain management overnight.

What are your post operative analgesic options? Should you consider administration of an NSAID following a posterior spinal fusion? You elected to run a ketamine infusion during the surgery. Is there any value to continuing this postoperatively?

**Discussion:**

Adolescent idiopathic scoliosis is the most common of spine deformities and is broken down into 3 categories depending on age of onset: infantile (<3 years), juvenile (3-10 years) or adolescent (>10 years). Adolescent scoliosis is more common in girls and may resolve, remain stable or progress throughout development. Curve progression requiring surgical intervention occurs in 0.2-0.5% of patients. Although recommendations are variable, surgical intervention is typically considered when the angle of curve as measure by the Cobb method is great than 40 degrees.

Perioperative management of the adolescent for posterior spinal fusion must take into account a number of factors. Preoperatively the adolescent patient and his or her family require emotional preparation for major surgery and the associated short-term disability. Intraoperative concerns include but are not limited to, hemodynamic fluctuation with the potential for massive blood loss and neurological complications related to nerve root compression and/or stretch with spinal correction. Finally postoperative concerns including rehabilitation and pain control must be adequately

addressed to facilitate a positive recovery. Pain following spine fusion is often severe and driven by multiple factors including somatic and neuropathic pathways that are acutely influenced by the patients' inherent coping skills and expectations regarding their pain management.

Drug use is not uncommon in adolescents and studies show that 19.6% of students have tried an illicit drug by eighth grade, 34.1% by 10th grade, and 47.4% by 12th grade. The vast majority of adolescents experiment with alcohol or marijuana while heroin use or addiction remains relatively uncommon in adolescents (1). As a result, the pediatric anesthesiologist may not be familiar with the management of the heroin-addicted patient in the perioperative period. The pediatric patient on opioid maintenance presents a unique challenge for the perioperative team.

Suboxone is a combination drug composed of buprenorphine and naloxone in 4:1 ratio. Buprenorphine is partial mu-opioid receptor agonist with a binding affinity 1000 times greater than morphine as well as a k-opioid receptor antagonist (2). Buprenorphine has a ceiling effect in terms of analgesic and respiratory depressant effects. With a half-life of 20-70 hours (mean 37 hours), buprenorphine blocks the opioid receptor such that subsequent administration of potent opioids such as heroin is largely ineffective. Buprenorphine is combined with the opioid antagonist naloxone to deter abuse. If taken appropriately via the oral route the naloxone is removed via first pass metabolism while, if crushed and injected, the naloxone will precipitate withdrawal in the opioid addicted patient. Ideally, suboxone should be stopped for greater than 72 hours prior to expected surgical intervention such that analgesic efficacy of postoperative opioids are maximally effective. In cases where the noxious stimulus is severe including spine fusion, consideration should be given to transitioning from suboxone to methadone for the perioperative period to enable effective pain control in the postoperative period.

Analgesic approaches to the patient undergoing posterior spinal fusion are varied and we will briefly review evidence supporting a variety of analgesic strategies. There is increasing interest in multimodal analgesic approaches to reduce the dependence on opioids for effective pain management. There is evidence that preemptive analgesia in the form of a perioperative dosing schedule of gabapentin can help improve pain management in the first several days following surgery (3). Regional anesthesia in the form of epidural catheters have been supported by some authors and programs (4). Epidural analgesia in the form of catheters placed at the time of surgery has been shown to provide better postoperative analgesia, earlier recovery of bowel function with fewer side effects compared to intravenous opioids (5). Alternatively, there is evidence that intraoperative administration of intrathecal morphine results in improved postoperative analgesia (6). In the absence of a regional technique, other authors have advocated the intraoperative use of the long acting mu-opioid receptor agonist and NMDA antagonist methadone (7). However, there is no prospective randomized data validating its use in adolescents undergoing posterior spinal fusion. Similarly, the NMDA antagonist ketamine has been suggested as an effective adjuvant in this population but sound data supporting this intervention following spinal fusion is lacking (8). Postoperatively, traditional interventions include intravenous and enteral

opioid analgesics are the foundation of management in this population. Though, there has long been hesitation concerning the use of non-steroidal anti-inflammatory drugs in orthopedic patients because of concerns about the impact on bone healing (9) more recent data suggest that bone fusion following posterior spinal fusion in adolescents is not significantly inhibited by a postoperative NSAID administration (10).

Optimizing pain management for the adolescent undergoing posterior spinal fusion for idiopathic scoliosis remains a challenge. Concurrent, opioid dependence makes this management significantly more daunting. Careful patient preparation, a multimodal pain management plan, and well-defined goals for recovery following discharge are keys to successful outcomes in this population.

#### References:

1. Schulden JD, Thomas YF, Compton WM. Substance abuse in the United States: findings from recent epidemiologic studies. *Current psychiatry reports*. 2009;11(5):353-9.
2. Orman JS, Keating GM. Buprenorphine/naloxone: a review of its use in the treatment of opioid dependence. *Drugs*. 2009;69(5):577-607.
3. Rusy LM, Hainsworth KR, Nelson TJ, Czarnecki ML, Tassone JC, Thometz JG, et al. Gabapentin use in pediatric spinal fusion patients: a randomized, double-blind, controlled trial. *Anesthesia and analgesia*. 2010;110(5):1393-8.
4. Taenzer AH, Clark C. Efficacy of postoperative epidural analgesia in adolescent scoliosis surgery: a meta-analysis. *Paediatric anaesthesia*. 2010;20(2):135-43.
5. Blumenthal S, Min K, Nadig M, Borgeat A. Double epidural catheter with ropivacaine versus intravenous morphine: a comparison for postoperative analgesia after scoliosis correction surgery. *Anesthesiology*. 2005;102(1):175-80.
6. Milbrandt TA, Singhal M, Minter C, McClung A, Talwalkar VR, Iwinski HJ, et al. A comparison of three methods of pain control for posterior spinal fusions in adolescent idiopathic scoliosis. *Spine*. 2009;34(14):1499-503.
7. Gottschalk A, Durieux ME, Nemergut EC. Intraoperative methadone improves postoperative pain control in patients undergoing complex spine surgery. *Anesthesia and analgesia*. 2011;112(1):218-23.
8. Pestieau SR, Finkel JC, Junqueira MM, Cheng Y, Lovejoy JF, Wang J, et al. Prolonged perioperative infusion of low-dose ketamine does not alter opioid use after pediatric scoliosis surgery. *Paediatric anaesthesia*. 2014;24(6):582-90.
9. Maxy RJ, Glassman SD. The effect of nonsteroidal anti-inflammatory drugs on osteogenesis and spinal fusion. *Regional anesthesia and pain medicine*. 2001;26(2):156-8.
10. Sucato DJ, Lovejoy JF, Agrawal S, Elerson E, Nelson T, McClung A. Postoperative ketorolac does not predispose to pseudoarthrosis following posterior spinal fusion and instrumentation for adolescent idiopathic scoliosis. *Spine*. 2008;33(10):1119-24.