Multimodal Pain Management After Spinal Surgery for Adolescent Idiopathic Scoliosis

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Abstract

Corrective surgery for scoliosis is an extensive procedure with well-known problems of postoperative pain control. Additional problems with nausea, vomiting, ileus, and sedation can result in delayed mobilization and a prolonged inpatient hospital stay. At our institution, a multimodal approach to pain management has been used to successfully address these issues. The use of intravenous acetaminophen has been a helpful adjunct to our armamentarium of pain medication in this patient population. We present an illustrative case of our use of multimodal analgesia beginning intraoperatively and continuing during the acute inpatient postoperative period.

Although the mainstay of treatment for adolescent idiopathic scoliosis is nonoperative, approximately 350 patients per year are treated surgically at our institution. This is extensive surgery and postoperative pain management is a difficult and complex issue for patients and providers. Potential perioperative anesthetic and surgical complications are nausea, vomiting, ileus, and sedation with respiratory depression. With many of our adolescent patients, changes in mental status and drowsiness are not well tolerated and can delay mobilization and thus lengthen their recovery and hospital stay. Parents are naturally concerned about managing their child’s pain, but they also worry about changes in their child’s behavior with the use of narcotics, as well as possible long-term deleterious effects (ie, addiction).

At our institution, we have traditionally used a multimodal approach to pain management, such as intravenous patient-controlled analgesia, opioid medication, benzodiazepines, and oral acetaminophen. We also rely on nonpharmacologic methods such as distraction and cognitive behavioral interventions.

To prevent the adverse effects of narcotics we use antiemetics, antipruritics, and routine bowel regimens. There is some controversy surrounding the use of nonsteroidal anti-inflammatory drugs (NSAIDs) after spine fusion because of concerns about bone healing. However, recent evidence indicates there is no negative impact on healing and fusion rates when NSAIDs are used after spine fusions, particularly in the pediatric population. At our institution, ketorolac is used, if needed, to optimize pain control.

Since May 2011, following the positive results of a previous IRB-approved study, we have added intravenous acetaminophen to our armamentarium of pain medications. In our experience, the benefits of intravenous acetaminophen are four-fold: it can be used while the patient is fasting, it is nonsedating, it does not cause nausea, and it may decrease narcotic use.

Case Study

This article describes the case of a 15-year-old girl diagnosed with adolescent idiopathic scoliosis. The diagnosis was made at age 11 by her pediatrician,
who later referred her for orthopedic evaluation at age 14 years and 8 months. The patient’s birth history was unremarkable. The past surgical history included an uneventful tonsillectomy at age 11. She took no medications, and had no drug allergies. There was no significant family history. She was developmentally normal, attending the 10th grade.

On physical examination, she weighed 71 kg and stood 162 cm tall. She had an obvious right thoracic scoliotic deformity, with a significant rib hump on forward bending. Her right shoulder was slightly elevated relative to her left. She had no cutaneous abnormalities. She had equal leg lengths. She was able to walk on her toes and heels. Her strength was 5/5 in all extremities and her sensation was intact. Her reflexes were normal and symmetric. The rest of her physical exam was unremarkable.

Preoperative standing posteroanterior and lateral radiographs disclosed a 73° right thoracic curve and a compensatory left lumbar curve of 39° (Figure 1).

MRI of the entire spine showed no evidence of cord compression, syrinx, Chiari malformation or intraspinal pathology.

ANESTHETIC AND OPERATIVE PROCEDURES

In the holding area, the patient was given preoperative sedation with midazolam. In the operating room, she was induced with propofol and a muscle relaxant. After the trachea was intubated, additional intravenous access and an invasive arterial monitor were placed. Diazepam was given prior to skin incision. Methadone, ketamine, and fentanyl were used for analgesia, and anesthesia was maintained with propofol and low-dose isoflurane. Antibiotics were given 30 minutes before incision and repeated every 4 hours. A Foley catheter was inserted, and baseline somatosensory evoked potentials (SSEP) and motor evoked potentials (MEP) spinal cord monitoring was performed. The patient was placed prone on a standard spine frame allowing for abdominal decompression, padded appropriately, and prepped and draped in a sterile fashion. A standard midline posterior approach was performed and subperiosteal exposure completed from T2 to L3. Implants consisting of a mostly pedicle screw construct were placed. Significant rigidity at the apex of the curvature due to ankylosis was encountered. Aggressive facet joint excisions were performed with some improvement in flexibility. Rod insertion followed by corrective forces consisting of translation, rotation, and compression/distraction were performed with satisfactory deformity correction (Figure 2). Somatosensory evoked potentials and MEP monitoring remained at baseline levels throughout the operative procedure. Therefore no Stagnara wake-up test was performed. Decortication and bone grafting followed by multiple layer closure was completed in a routine fashion.

The first dose of 1000 mg intravenous acetaminophen was given approximately 2 hours before the operation ended.
Ondansetron was administered 30 minutes before the end of the procedure. At the end of the procedure the patient was extubated without sequelae, she moved all 4 extremities on command, and was taken to the postanesthesia care unit. She denied pain upon arrival.

**Postoperative Course**
Multimodal pain management was instituted. Intravenous acetaminophen 1000 mg was administered every 6 hours postoperatively for a total of 4 doses. Thereafter, she was given 1000 mg oral acetaminophen 3 times daily. She used a hydromorphone intravenous patient-controlled pump immediately postoperatively until postoperative day 3. She was given 15 mg of intravenous ketorolac every 8 hours for 6 doses, beginning on postoperative day 3. She was also started on oral oxycodone 5 to 10 mg every 4 to 6 hours, beginning on postoperative day 1 through discharge. The average pain score for the first 24 hours postop was 3.4. The average pain score for the next 24 hours was 6.1. The average pain score on postoperative days 2 through 3 was 3.2. The average pain score was 3.75 on postoperative day 4. With this regimen, there were no gastrointestinal problems. The patient started sips of clear liquids postoperatively and advanced to a full liquid diet on postoperative day 1, when bowel sounds were present. She tolerated a regular diet by postoperative day 4, when she was discharged home.

**Discussion**
Our overall experience with intravenous acetaminophen, as part of our multimodal perioperative pain protocol, has been positive. This medication enhances analgesia without the adverse effects of opioid medication, like nausea, vomiting, or sedation. It has been helpful in the early postoperative period before our patients have transitioned to oral medications. In addition, for patients who are slow to tolerate oral pain medicines or have swallowing dysfunction, intravenous acetaminophen has been especially useful.

**References**