

Surgical Technique: Intrathecal Morphine for Pediatric Spine Surgery

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Abstract: Multiple studies have shown pain control benefits of intrathecal (IT) morphine, dating as far back as the 1980s. Other benefits of IT morphine include decreased blood loss and improved bowel function. At many institutions, the procedure is performed by the anesthesiologist preoperatively, and can take up to 30 minutes with positioning changes and logistics. We present a technique of IT morphine injection performed by the surgeon immediately prior to incision after the patient is prepped and draped. Compared to performing an IT injection in a lateral position, this technique has the benefits of avoiding an additional positioning of an anesthetized patient and possibly minimizing time under anesthesia.

Key Points:

- There are numerous anesthetic advantages to the administration of IT morphine.
- IT morphine injection can be performed by the surgeon after sterile prepping, draping, and a “time-out.”
- This technique has the benefits of saving time and avoiding an additional positioning of an anesthetized patient.

Introduction

Pain management for posterior spinal fusion patients continues to be a complex and evolving challenge for both the surgical and anesthetic teams. Multiple studies have shown the pain control benefits of IT morphine, dating as far back as the 1980s. There are also numerous anesthetic advantages to the administration of IT morphine. Additional opioid consumption is drastically reduced during the first 24 hours¹, as well as lower pain scores^{2,3} in the postoperative care unit. The lower opioid consumption can also help to reduce time to bowel function. Compared to epidural hydromorphone, IT morphine also reduced time to ambulation, time to Foley catheter removal, and length of hospital stay².

In addition to pain control benefits, the use of IT morphine has been shown to reduce blood loss during the operation^{4,5}. Various studies have used dosing regimens varying from 2 mcg/kg to 24 mcg/kg (and other studies have mentioned even higher doses). Logically, lower doses are associated with less side effects (pruritis, nausea, respiratory depression) and still show good pain control and hemodynamic benefits^{3,5}.

At the authors' institution, we use a dosing regimen of 4-5 mcg/kg with a maximum dose of 200 mcg. For children with sleep apnea or other respiratory conditions that would predispose them to respiratory depression, we will sometimes reduce the dose or choose to eliminate

the injection completely in extremely high-risk patients. For children without comorbidities, we find the standard dosing regimen of 4-5 mcg/ kg to be very well tolerated. We do recommend pulse oximeter monitoring and in-patient admission (also our standard for PCA patients), however, ICU care is not needed based on the usage of IT morphine alone⁶.

At many institutions, the IT injection is done by the anesthesiologist preoperatively, and can be up to 30 minutes including logistics and re-positioning. However, at our institution, injection is performed by the surgeon after sterile prepping, draping, and a “time-out.” The total time of the injection is usually less than one minute. Compared to performing an IT injection in a lateral position, we believe this technique has the benefits of saving time and avoiding an additional positioning of an anesthetized patient.

IT morphine can be used in patients with any diagnosis or with any spine surgery. Contraindications include concerns about the ability to extubate from a reparatory standpoint; other respiratory comorbidities, such as thoracic insufficiency syndrome, Duchenne’s muscular dystrophy, or spinal muscular atrophy; concern for hemodynamic stability or a true narcotic allergy. Even in cases of severe spinal stenosis, there is usually enough IT space to complete IT injection.

The injection is performed by the surgeon after sterile prepping, draping, and a “time-out.” While in theory, one could give the injection at the end of the case to prolong the analgesic effect, we prefer to do it at the beginning of the case to take advantage of the hypotensive effects. We do not perform the injection until adequate neuromonitoring has been confirmed, in case the surgery may need to be aborted.

The purpose of this paper will be to briefly review the technique for IT morphine injection.

Description of Method

Find the iliac crest in order to estimate the level of the L4-L5 interspace. Once there, palpate between the spinous

process. Advance the 23-gauge outer needle between the spinous processes. If you feel bone, re-direct the needle as needed until it can be fully advanced through the interspinous ligament. Beware that if the vertebrae are rotated, as in lumbar scoliosis, the needle should be advanced in line with the rotated vertebrae, which means a little towards the left in a left lumbar curve.

Next, advance the inner 27-gauge spinal needle. An up and down motion, re-directing to avoid bone and advancing in soft tissue may be helpful. The needle is advanced through the interspinous ligament and ligamentum flavum to enter the IT space. This presents as a sensation of sudden decreased resistance, or “popping” through into the IT space. Use a 5cc syringe to pull back CSF to verify the position within the IT space. In obese patients, one may not be able to palpate the spinous processes with your fingers, but the advancing needle can aid in palpating the spinous process and re-directing the needle to the inter-spinous space.

If one cannot enter the IT space at one interspace, do not hesitate to try another. In patients with significant lordosis, the spinous processes can be almost adjacent with little space between them, particularly in the lower lumbar spine. If one has trouble finding the IT space in the lower lumbar spine, consider the L3-L4 interspace, which is usually more open. Doing IT injections above L3 is more dangerous as there is a greater chance of encountering a low-lying cord. In the very unusual case in which the IT space cannot be assessed percutaneously, the injection can be done after exposing the lumbar spine.

The dose of morphine is drawn up sterilely by the attending anesthesiologist and diluted with an additional 0.5cc of sterile saline. The mixture is then passed via a needle to a labeled sterile syringe held by the surgical technician on the field. It is important that the dose is diluted enough to have sufficient volume, ideally 0.5-0.6cc, so the medication is not retained in the hub of the syringe or the needle. Inject mixture into the IT space.

There should be very little resistance, and it should go in instantly, which may be considered confirmation that the needle is in the correct position. We do not aspirate after injection to ensure the needle remained in the intrathecal space because, even if no CSF is aspirated, we would not risk giving a second dose. Remove the needle and place a finger over it with pressure for 30 seconds to prevent bleeding.

In terms of postoperative considerations, our patients with IT morphine injections are not treated any differently than those without. They follow our standard post-operative protocol: patient is followed by pain team; patient-controlled analgesics are allowed for the first 24 hours; the Foley catheter is pulled one day after surgery; patients are encouraged to sit up the night of surgery and walk the next day.

Risks of IT injection include over-somnolence. To prevent this, we prefer to err on the lower side of dosing using 4-5 mcg/kg of MSO₄ with a maximum dose of 200 mcg. With this low dose, over-somnolence is very uncommon. In the extremely unlikely scenario over somnolence is significant, a small titrated dose of Narcan can help. Epidurals may have fallen out of favor due to delayed spinal cord injury due to hypotension or inadvertent epidural epinephrine administration. We are not aware of any neurologic complications being related to an IT morphine injection, as described here. Last, we have not seen CSF leaks or CSF headache from this procedure, which should be extremely rare with a 27-gauge needle.

Comparison to Other Methods

At many institutions, IT morphine injection is done by the anesthesiologist preoperatively, either sitting or in the lateral decubitus position. In the pediatric population, the patient is often first anesthetized and placed in the lateral positions. Anesthesia will proceed with the IT injection. The patient is then repositioned in the prone position for surgery. The process can take up to 30 minutes when considering repositioning and other logistics.

Summary

IT morphine injection is performed by the surgeon after sterile prepping, draping, and a “time-out.” Compared to performing an IT injection in a lateral position, we believe this technique has the benefits of saving time and avoiding an additional positioning of an anesthetized patient.

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