

Paraplegia Following an Intrathecal Hydromorphone and Bupivacaine Pump Removal

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BACKGROUND: Intrathecal analgesia is a valuable treatment option for patients experiencing intractable pain that have failed more conservative management. While generally safe and well-tolerated, there are significant risks associated with the placement and use of an intrathecal drug delivery system. The implantation and removal of pumps and catheter systems may lead to injury of the nervous tissue within and around the spinal cord. Infection, as with any interventional procedure, and leaking of cerebrospinal fluid can also occur. Catheters are susceptible to fracturing, kinking, and migrating, which can result in over- or under-delivery of the medication. Problems with cessation of medication suddenly as well as large volumes of medications can also lead to significant issues. Furthermore, certain drugs have been linked to the development of granulomas, which are inflammatory masses that may form at the catheter tip.

CASE: A 36-year-old female with history of T12-S1 interbody fusion and chronic back pain managed with intrathecal hydromorphone and bupivacaine that had significantly reduced efficacy following a fall onto her back. Her pump was deemed fully functional via dye test and she subsequently was scheduled for extension of thoracolumbar fusion and pump replacement.

Intraoperatively, the pump catheter was found to be broken with an underlying collection of clear fluid, thought to be either medication or cerebrospinal fluid, was subsequently removed by suction.

After removal of the previous fusion hardware, intraoperative fluoroscopy revealed pump catheter migration 6 centimeters cephalad. Before completion of the fusion extension, intraoperative EMG revealed reduced somatosensory evoked potentials (SSEPs) and absent motor evoked potentials (MEPs) in the bilateral lower extremities and the operation was terminated early.

Post-operatively, CT and MRI of the spine did not show any specific injury to the spinal cord, however, visualization of distal thoracic cord was limited by artifact from hardware, although these images did confirm catheter migration as seen in Image 1 and Image 2.

Although rare, patients can experience adverse events in relation to intrathecal pump placement and removal, including spinal cord injury. Here, we present a case of incomplete paralysis in a patient during an intrathecal pain pump removal. This emphasizes the significance of recognizing and managing the potential complications associated with intrathecal therapy for pain management.

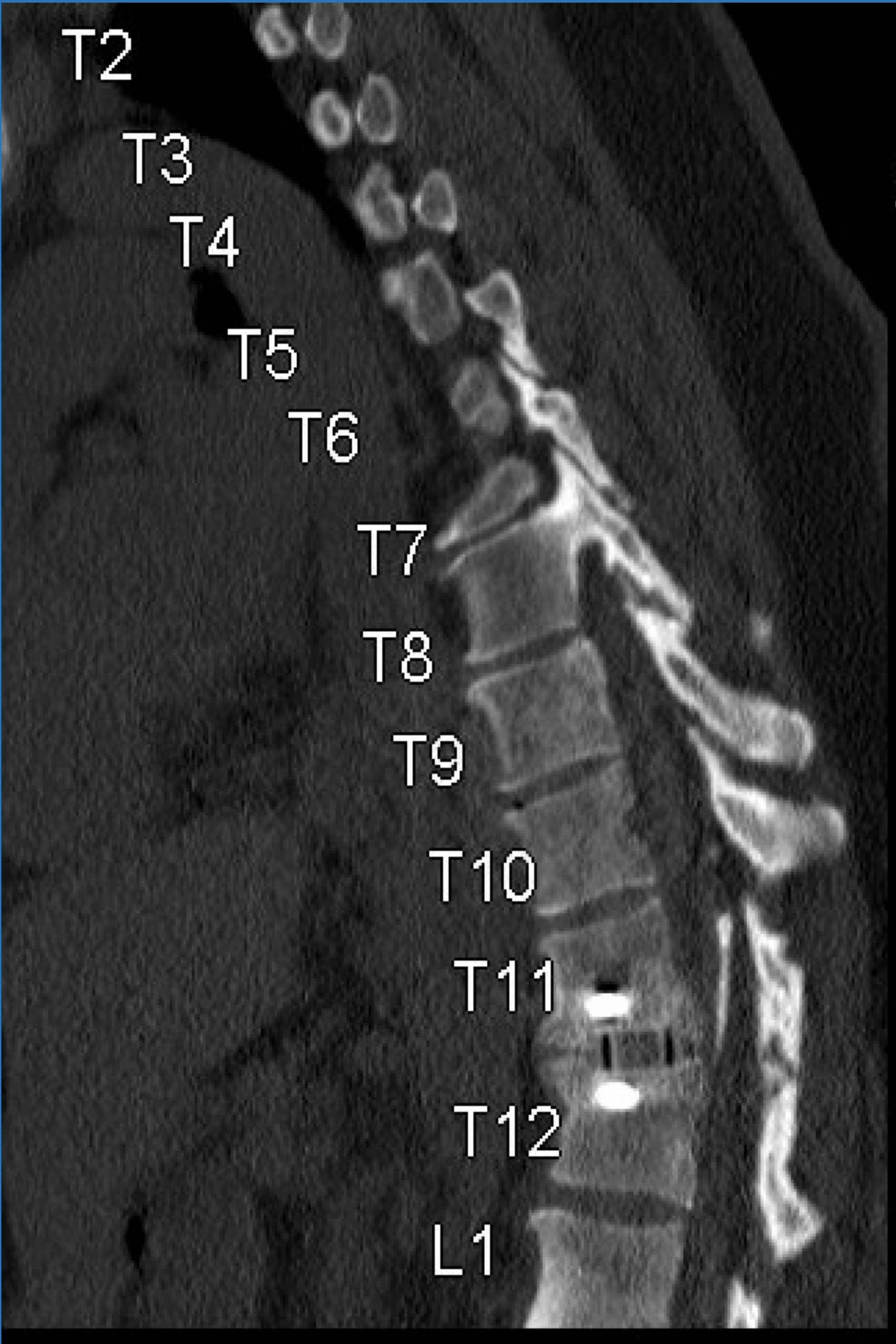


Image 1: CT T-Spine Pre-Op



Image 2: CT T-Spine Post-Op Pump Removal

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Her physical exam following surgery correlated to the SSEPs and MEPs noted intraoperatively with bilateral lower extremity weakness, loss of sensation, and lower motor neuron signs. Twelve days post-operation, the patient was classified as T12 AIS (American Spinal Injury Association (ASIA) Impairment Scale) B spinal cord injury (SCI). She was subsequently transferred to receive comprehensive SCI rehabilitation program at acute inpatient rehabilitation facility and one-month post-operation, repeat spinal cord evaluation showed L1 AIS C classification with some return of sensorimotor function.

DISCUSSION: As with any implantable device, there are potential complications during implantation or removal, and neurological tissue damage represents one of the most serious adverse outcomes of intrathecal therapy. In this case, intraoperative loss of electrophysiologic signal was initially hypothesized to be a negative-pressure influx of local anesthesia into the intrathecal space, similar to a “pump dump”. However, the persistence of her sensorimotor deficits in the following days suggested an alternative cause of injury. The placement of intrathecal catheters has been associated with spinal cord injury, nerve injury, and cauda equina injury.[3]

A 2021 review of 1001 reports using the FDA Manufacturer and User Facility Device Experience database from February 2018 to August 2020 found the following prevalence's of catheter-associated complications [4]:

- Catheter damage (8.2%)
- Catheter migration (3.7%)
- Fluid collection around the catheter and pump (2.6%)
- Development of granulomas (1.9%)

During the implantation and removal of intrathecal catheters, direct damage to the nerve roots or spinal cord itself could result in neurologic deficits. Other mechanisms of neurological injury seen in intrathecal drug delivery systems include the development of a syrinx (a fluid filled cyst) or even a granuloma.[3] An injury in either of these manners, however, is unlikely in our patient given the chronicity seen in these complications versus the acute onset of her neurologic change. Additionally, these diagnoses would require supporting evidence through imaging, which cannot be utilized in our patient due to hardware artifact in the region of spinal cord in question. Unlike this case, severe injuries are typically from maintenance rather than surgical device procedures (66% vs 26%).[5]

