Opioid-Induced Intrathecal Catheter Tip Granuloma via Pain Pump in a Patient with Chronic Pain Syndrome: A Case Report

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Introduction

The use of intrathecal pain pumps (ITP) has been increasingly prevalent in patients with chronic refractory pain. Morphine is widely used as the first-line agent [3]. However, other opiates such as hydromorphone, fentanyl, and alfentanil have also been prescribed. A major complication related to intrathecal delivery of opiates has been the development of intrathecal catheter tip granulomas (ICTG). These can develop at any point in time and may be due to the concentration of opiate infused. Limited cases have been reported regarding hydromorphone-related ICTG. Here, we report the case of a 62-year-old male with an intrathecal pain pump infusing hydromorphone and spinal cord stimulator (Boston Scientific) who presented with intractable low back pain with worsening radiculopathy two years following pain pump implantation. Imaging of the patient's lumbar spine revealed an intrathecal filling defect at the level of the ITP which was representative of a granuloma. The patient has undergone conservative therapy with saline infusions with later plans for surgical removal of the granuloma. To date, there has been a 30% reduction in size of the patient's granuloma. Granuloma formation is a rare but serious complication of intrathecal pump implantation. Physicians should be vigilant in evaluating patients with ITP for new onset or worsening back pain with or without neurologic symptoms with imaging including computed tomography (CT), myelogram, and magnetic resonance imaging (MRI) to increase the chance of detecting granuloma formation and intervening early in it's formation. Further clinical trials are recommended to evaluate the benefit of early surgical management.

The Case

Patient is a 62-year-old male with history of a three-level laminectomy in 2017 for severe lumbar spinal canal stenosis and failed epidural injections who presented to a pain clinic in 2018 with chronic, constant right-sided low back pain with radiation into his right leg. He denied bowel or bladder incontinence, weakness, or falling. Patient underwent spinal cord stimulator trial successfully in 2018 with greater than 70% reduction in pain and proceeded to move forward with permanent implantation at T12-L1. Unfortunately, the stimulator treatments began to fail 5 months following implantation. The patient found himself requiring repeated doses of his Oxycodone-Acetaminophen 10-325 mg tablets for breakthrough pain. He denied any new symptoms at this time. At subsequent visits, patient was prescribed Oxycodone Hcl 20 mg tablet three times daily along with his Oxycodone-Acetaminophen 10-325 mg tablet as needed and underwent left L2-L3 intrathecal morphine injections for a pain pump trial in addition to his spinal cord stimulator.

By 2019, the patient was requiring higher doses of oral opioid medication for uncontrolled back pain. At this time, it was advised the patient proceed with implantation of an intrathecal pain pump at L2-L3 level which provided some improvement in his low back pain. Due to lack of response to morphine, patient received hydromorphone (10 mg/mL) via intrathecal pain pump with an initial infusion rate of 2.3 mg/day and subsequently increased by 50% at a follow up appointment. Patient continued to follow up at the pain clinic for his lower back pain with only mild improvements in his pain. Infusion rates were slowly increased with each visit to reduce risk of overdosing. While he did endorse improvement in symptoms with increased activity levels, patient still required breakthrough pain medication two to three times a day. By mid-2020, daily infusion rate was increased to 3.296 mg/day with bolus maximum activations of five times daily. Patient presented to the pain clinic one month later describing a burning sensation on his right lower back which was sharp in nature with numbness in his right foot. His pain was associated with recurrent radicular symptoms in his lower extremities, however no bowel or bladder incontinence was reported. The patient was using increased boluses of his pump during this time. His pump was increased by 20% at this visit with a maximum daily dose of 6.312 mg. By 2022, the patient was receiving a maximum daily dose of 13.097 mg with some improvement in his pain.

Due to worsening pain and increasing pain pump requirements, a lumbar myelogram and CT lumbar spine with contrast were obtained. This demonstrated an intrathecal filling defect extending from the T12-L1 disc space inferolaterally, filling much of the right thecal sac and causing severe right spinal canal stenosis. This was identified as a granulomatous response to crystallization of hydromorphone at the tip of the ITP catheter. The patient elected to undergo conservative management before surgical removal of the granuloma. The hydromorphone was replaced with saline in order to reduce the size of the mass. Repeat imaging again demonstrated the catheter fragment which appeared to enter the spinal canal at the L2-L3 level and then coursed anteriorly to L1. The enlarging surrounding filling defect about the catheter continued to be visualised to the right of midline emanating from a punctate metallic density at L1, which had a 30% reduction in size. The patient continued to have severe radiculopathy but no obvious deficit, so it was decided by his interdisciplinary team that they would continue conservative management before surgical removal of the mass. To date, the patient has undergone the Intracept procedure at L4 with some improvement in his pain. Future plans include the Intracept procedure at other levels and explantation of the pain pump.

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Patient Imaging

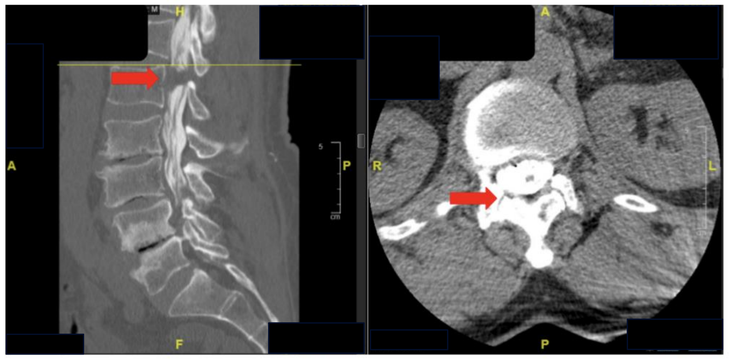

Figure 1: CT Lumbar Spine with contrast. Filling defect in lumbar thecal sac at level of L1 associated with intrathecal cather tip.

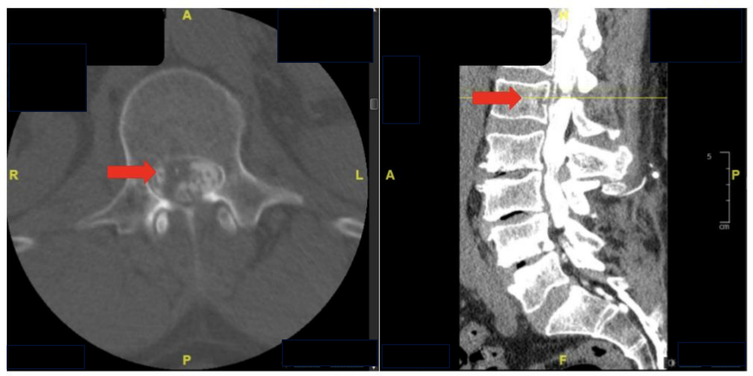

Figure 2: CT Lumar Spine with contrast. Filling defect at superior margin of L1. Enlarging surrounding filling defect about catheter, right to midline extending posteriorly on the right.

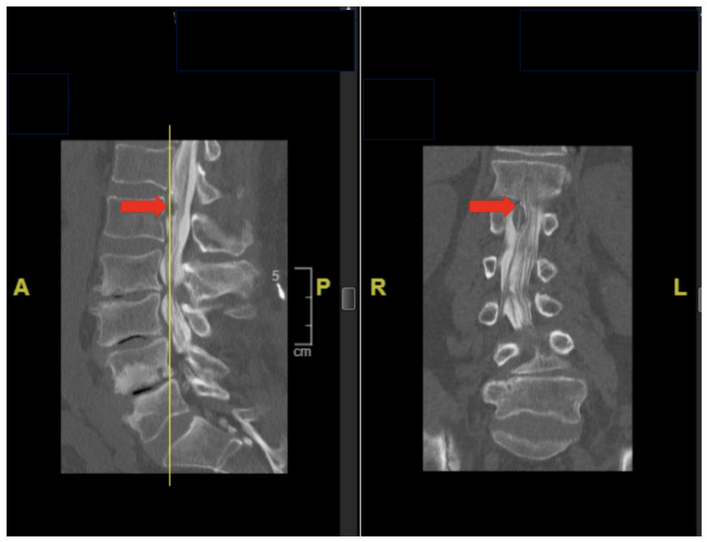

Figure 3: Mild interval decrease in the size of the bilobed mass in the spinal canal at the L1 level at the tip of the epidural catheter compared to prior studies with extradural and intrathecal components.

Discussion

- Chronic pain due to failed back syndrome is now one of the main indications for intrathecal opioid administration. With the advent of intrathecal administration of opioids came the phenomenon of intrathecal granuolomas.
- To our knowledge, there have been minimal documented reports demonstrating an association of hydromorphone with intrathecal granulomas. The first clinical report of such an association was published in 2016 [5].
- The first single-arm study assessing the safety of hydromorphone by intrathecal administration, in 2021, demonstrated granuloma formation in 3.3% of the studied 364 participants [9].
- The first randomized control trial determining the safety and efficacy of hydromorphone by intrathecal administration was published in 2021 [8]. This study did not prove statistically significant in the use of hydromorphone in terms of safety and efficacy compared to the control [8].
- Dose and concentration have a role in the development of intrathecal catheter granulomas. This form of drug delivery creates a high drug concentration within the spinal cord compared to systemic absorption.
- Local inflammatory reactions may play a large role in granuloma development. Drugs at the catheter tip may be at concentrations found within the pain pump itself, which attenuate the localized inflammatory reactions at the low flow rates found within the cerebrospinal fluid (CSF). This in turn may cause disruption of local CSF flow [5].
- Although location may play some role in granuloma formation, Fernandez et al. discredited the notion that placing the catheter tip below the conus medullaris would fully protect a patient from developing a ICTG [6].
- Treatment of intrathecal granulomas in patients with chronic pain includes both surgical and nonsurgical methods.
- Pump refill and reprogramming clinic visits are critical points for re-evaluation of patients' neurologic and sensory exams.

Conclusion

Granuloma formation is a rare but serious complication of intrathecal catheter opioid delivery. Imaging studies including CT myelogram and MRI with contrast are indicated following changes in neurologic status consistent with spinal cord compression. This case supports the notion that granuloma formation may still occur using hydromorphone. Future control studies may benefit from evaluating the outcome of early surgical decompression versus conservative management in the treatment of intrathecal granulomas.

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