

Retained Intrathecal Catheter Fragment After Spinal Drain Insertion

Steps for Prevention and Management

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Background and Objectives: The placement of lumbar spinal drains is being done with increasing frequency to facilitate high-risk surgical procedures. One risk associated with these procedures is catheter shearing, resulting in a retained foreign body in the intrathecal space. Unlike retained epidural fragments, there are no guidelines on the management of this complication. The purpose of this article was to synthesize the literature on this subject to come up with guidelines for preventing and managing this complication.

Methods: Case report and review of all published cases.

Results: Most cases of retained catheters are associated with difficulty inserting or advancing the catheter. Among those cases treated conservatively, approximately one third of patients developed symptoms. Factors that must be considered when weighing the decision to surgically remove the retained catheter include patient comorbidities and desires, size and location of the fragment, infectious risk, the presence of neurologic symptoms, and scheduled surgical procedure.

Conclusions: A retained intrathecal catheter can be managed conservatively in certain contexts. Periodic follow-up visits, with or without repeat imaging, are recommended in these circumstances.

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Intrathecal catheters and drains are inserted with increasing frequency by anesthesiologists to facilitate a wide range of surgical procedures such as aortic aneurysm repairs and craniotomies.^{1,2} One recognized risk of intrathecal catheter insertion is catheter shearing leading to retained catheter fragments. Although there have been many published cases and at least 1 set of guidelines written about retained epidural catheters,^{3–5} literature regarding intrathecal catheter fragments is scarce. Currently, there is no consensus regarding the management of retained spinal catheter fragments. This article evaluates all published information on the topic, illustrates conservative management in 1 case, and describes steps for prevention and management.

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CASE PRESENTATION

A 67-year-old woman with a medical history significant for hypertension, diabetes, chronic obstructive pulmonary disease, gastroesophageal reflux, and peripheral vascular disease presented to the pain management center for placement of a lumbar spinal drain in preparation for repair of a thoracoabdominal aortic aneurysm the next day. With the patient positioned prone on the fluoroscopy table, a 17-gauge Tuohy needle was introduced into the intrathecal space at L4–5. Under fluoroscopic guidance, a nonstyletted, 19-gauge, intraspinal, closed-tip catheter with a spring-wound inner coil (Medtronic, Minneapolis, Minn) was advanced cephalad. As it approached T12, the catheter was observed to coil back upon itself. A decision was made to slightly withdraw the catheter to straighten the coil, insert the stylette, and then readvance the catheter up to T10. Advancement was difficult, so the styletted catheter was fully withdrawn from the Tuohy needle. Upon removal of the catheter, examination revealed that a portion of the lumbar catheter had been sheared, leaving a 30-mm portion of the stylette exposed.

After briefly discussing the complication with the patient and surgical team, a decision was made to proceed with lumbar drain placement and the planned surgery. Using the same Tuohy needle that was still in the intrathecal space, a different styletted catheter was advanced in the intrathecal space under live fluoroscopy to T10–11. The stylette was removed from the intraspinal catheter, which was secured to the patient with sutures.

To better evaluate the location of the retained catheter, a computed tomogram (CT) of the lumbar spine without contrast was obtained. The CT scan revealed the presence of a 30-mm catheter fragment in the intrathecal space extending from the inferior endplate of L3 to the inferior endplate of L4. It did not traverse the dura. The intact intrathecal catheter was adjacent to the retained fragment and extended to the upper border of T11 (Figs. 1 and 2).

After the CT scan was obtained, the neurosurgical service was consulted. Their recommendation was that there was no benefit to surgically removing the retained intrathecal catheter fragment unless neurologic symptoms developed. The following day, the patient had an uneventful repair of her thoracoabdominal aneurysm. Her postoperative course was prolonged secondary to a chyle leak and infected hematoma, but there were no adverse effects related to her retained lumbar drain. A follow-up visit 5 months after the surgery revealed no neurologic signs or symptoms.

DISCUSSION

Intrathecal catheters are placed for the management of a wide range of medical and surgical conditions. The use of lumbar spinal drains has been advocated during thoracic aortic aneurysm repairs and craniotomies (eg, tumor resection, arteriovenous malformation resection) as a means of reducing intrathecal pressure, thereby enhancing spinal cord perfusion pressure and improving exposure.^{2,6} The rate of neurologic complications has

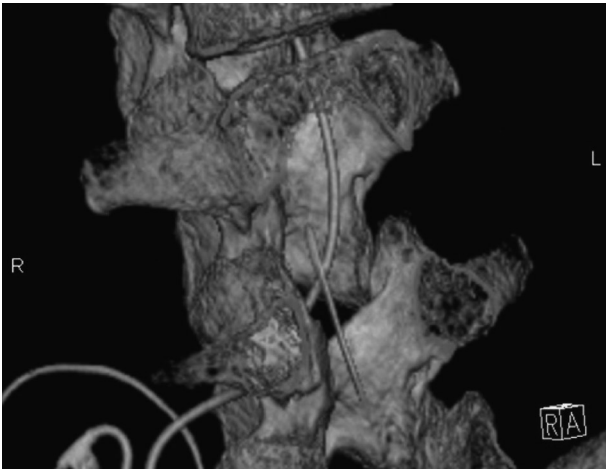


FIGURE 1. Lateral oblique view from reconstructed CT scan demonstrating functional intrathecal catheter and retained fragment.

been reported to be as high as 32% for thoracic aortic aneurysms,⁷ but 2 recent randomized controlled studies found that cerebrospinal fluid drainage may significantly reduce this incidence.^{1,8} In the face of increased reliance on lumbar drains to minimize the risk of neurologic deficits, it is imperative that physicians familiarize themselves with potential complications that may arise during catheter use.

The frequency with which intrathecal catheters shear is difficult to estimate because of the paucity of prospective literature, but anecdotal reports cite incidence rates ranging between 0% and 1.8%.^{1,9} Whereas only a small percentage of catheters break, these complications can have extensive ramifications. Understanding how to appropriately manage retained intrathecal catheters may prevent delays in urgent surgical procedures, reduce the likelihood of neurologic sequelae, and avert unnecessary removal procedures.

There have been many reports of retained epidural catheter fragments in the literature,^{3–5,10} but only a few published cases of retained intrathecal catheter fragments. To date, there is no consensus on the optimal management of these complications. Although many early reports described conservative management of retained microcatheters used for surgical anesthesia,^{11,12} a majority of recent cases involving larger lumbar spinal drains were removed surgically (Table 1).

It is our belief that the management of retained intrathecal fragments should be individualized. In cases where there is pain or other neurologic symptoms, prompt surgical removal of the retained fragment is warranted. Similar grounds for surgical intervention might be made for low-risk surgical candidates in other scenarios (Table 2). Despite our patient's infectious complications after surgery, the presence of a retained lumbar drain fragment did not adversely affect her recovery. Her multiple coexisting morbidities, desire to avoid an additional surgical procedure, and lack of neurologic or psychologic sequelae from the complication all weighed into our management decision.

Several tips for prevention and management of a retained intrathecal catheter can be gleaned from these findings. First, a stylette should not be reinserted into an indwelling spinal catheter because it cannot be inspected in situ. If a catheter is unintentionally withdrawn to a lower spinal level during the removal of a stylette, the physician should carefully weigh the

risk-benefit ratio of reinserting the stylette versus proceeding with a lower lumbar spinal drain (Table 3). Second, retained fragments seem to be associated with difficult catheter insertion (Table 1). Should this occur, clinicians are strongly advised to consider placing a new catheter at a different spinal segment.

If catheter shearing should occur, consultations should be conducted with neurosurgery, the patient's primary care physician, the anesthesiology service, and the primary surgical team to determine the best course of action. Only after input is received by all concerned providers can the patient make a truly informed decision. The only absolute indications for surgical removal are serious or progressive neurologic symptoms related to the retained fragment and infectious risk. Establishing a link between symptoms and a foreign body may be difficult, because neuropathic back pain affects between 5% and 10% of the population, and a majority of asymptomatic patients have radiologic spine abnormalities.¹³ The best way to ascertain such a relationship is via a comprehensive neurologic examination, imaging to rule out other causes, and, if necessary, electrodiagnostic testing.

If the sheared catheter fragment is ferromagnetic, as has been reported numerous times after epidural neurolysis,¹⁰ leaving the piece in place may pose additional risks should magnetic resonance imaging be needed. These risks include object migration, dislodgement, thermal injury, and image corruption.^{14,15} However, spinal magnetic resonance imaging has been safely performed in the presence of residual epidural ferromagnetic catheter fragments, albeit with degraded visibility.¹⁰

In the event a decision is made to conservatively manage the complication, the patient should be educated to monitor himself or herself for signs of complications related to the retained fragment, including meningitis and radiculopathy. No evidence exists to support or refute repeat imaging in such circumstances, but this should be considered several months after the procedure to determine the immovability of the foreign body, even if no neurologic symptoms develop. Similar to surveillance for cancers in remission, follow-up visits with or without repeat imaging can be done on an annual basis for the first few years and on a biannual basis thereafter, with the proviso that patients seek immediate evaluation should symptoms occur at any time point. Having a patient with cognitive impairment or one who may be noncompliant with follow-up does not automatically demand surgical intervention, but should



FIGURE 2. Sagittal view from reconstructed CT scan demonstrating intact and sheared intrathecal catheters.

TABLE 1. Published Cases Involving Retained Intrathecal Catheters and Their Management

Authors, year	Case Description(s)	Treatment	Comments
Vodapally et al ¹⁶	Intrathecal pump placed for complex regional pain syndrome; patient experienced worsening pain after pump battery change; distal end of intrathecal catheter found to be broken; 4 mo later, pump replaced; pseudomeningocele subsequently developed from pericatheter leak	Pseudomeningocele initially managed conservatively (ie, blood patch and abdominal binder), but repeated large accumulation of CSF led to surgical removal	Development of tension pseudomeningocele led to concerns about meningitis and subsequent laminectomy with duroplasty; pseudomeningocele not related to broken catheter
Olivar et al ¹⁷	5 Cases of retained intrathecal catheter fragments after lumbar spinal drain placement	2 Removed preemptively without symptoms; 2 removed after radicular symptoms developed (24 hrs and 2 mo later); 1 was left in place	Difficulty encountered advancing catheter in 4 of 5 cases; no follow-up period noted in patient whereby catheter was left in place; radicular symptoms resolved in both cases where there was surgical indication
Orr and Thomas ¹⁸	IDET catheter broken off in disk after heating phase; 6 mo later, patient developed new radicular symptoms, and fragment was noted to be intrathecal	IDET electrode removed after radicular symptoms developed	Difficulty encountered advancing electrode leading to kinking; radicular symptoms resolved after surgery; IDET electrode larger and more rigid than catheter
Ugboma et al ¹⁹	Epidural catheter placed for surgical anesthesia; catheter found to be intrathecal and sheared off during removal	Catheter found to traverse dura and was surgically removed preemptively before symptoms developed	Difficulty encountered advancing catheter; sheared catheter 9 cm in length; CSF found leaking from catheter tip and site when removed
Simmerman and Fahy ²⁰	2 Cases of retained intrathecal catheter fragments after lumbar spinal drain placement	One removed preemptively because of persistent hydrocephalus requiring serial lumbar punctures and long-term shunt; the second catheter was left in place	Difficulty encountered in catheter advancement in 1 patient; patient in whom catheter left in place was symptom-free at 6-mo follow-up
Pasquariello and Betz ²¹	1 Case of retained catheter used for postoperative analgesia after spine surgery	Initially treated conservatively, but concerns over CSF drainage and meningitis if a surgical infection occurred led to removal on postoperative day 4	Unclear if catheter traversed dura; retained catheter segment was 6 cm, 27-gauge; found on exploration to be wrapped around a spinal rod
Baxter ¹¹	1 Case of retained catheter used for spinal anesthesia	Treated conservatively	Treated conservatively; follow-up period not noted; catheter size 5–6 cm, 27-gauge
Hurley and Lambert ¹²	2 Cases of retained catheters during continuous intrathecal analgesia	Both cases treated conservatively	Follow-up period not noted; 32-gauge microcatheters used; in 1 case, catheter tore when it became stuck to bed linen when patient moved

CSF indicates cerebrospinal fluid; IDET, intradiscal electrothermal therapy.

TABLE 2. Demographic and Clinical Variables That Can Influence the Decision for Management of Retained Intrathecal Catheters

Factors	Implications
Surgical risk category (American Society of Anesthesiologists status)	Higher surgical risk raises threshold for surgical intervention
Serious or progressive neurologic symptoms	Warrants surgical intervention
Size of fragment	Larger-size (length or diameter) fragments may be more likely to result in symptoms
Infectious risk	Pseudomeningocele warrants surgical removal; VP shunts or need for repeated lumbar punctures may lower threshold for surgical removal
Scheduled spine surgery	A scheduled spine procedure at the same level(s) lowers the added risk for surgery; however, surgical-site infection may increase risk for meningitis
Catheter location/migration on repeated imaging	A catheter fragment migrating from the lumbar into the thoracic or cervical region may increase the risk of surgery
Patient desires/psychologic implications	Retained surgical items may enhance anxiety in select patients; patient wishes should be strongly considered in management decisions

VP indicates ventriculoperitoneal.

TABLE 3. Potential Problems Associated With a Sheared Spinal Drain and Recommended Solutions and Considerations

Potential Problem	Considerations/Recommended Solutions
Difficulty advancing catheter/coiled catheter	If stylette is in place, try to withdraw and advance in different plane; consider leaving a functioning catheter at a lower spinal level; if not feasible, remove catheter and insert at a more cephalad level
Sheared catheter noted	Consult with patient, primary surgical service, primary care physician and neurosurgery and anesthesiology services to determine best course of action; baseline history and neurologic examination should be documented; a CT scan with multidimensional reformations should be done to localize fragment
Patient desires conservative management	Subsequent CT scan in 3–6 mo to document stability or discern migration; thereafter, follow-up visits, with or without periodic CT scans, can be done on an annual or biannual basis if no symptoms develop
Catheter found to migrate at follow-up visit in asymptomatic patient managed conservatively	Reconsult with patient, primary care physician, and neurosurgery service so that a new risk-benefit analysis can be done
Patient managed conservatively develops new-onset neurologic symptoms	Rule out other pathologic process (eg, herniated disk, herpes zoster) as the cause of symptoms with neurologic examination, imaging (ie, spine MRI), and other ancillary tests (electromyography/nerve conduction studies) as needed; debilitating or progressive neurologic symptoms warrant surgical removal

MRI indicates magnetic resonance imaging.

be factored into the equation. Cephalad migration to a higher lumbar region secondary to bulk upward flow of cerebrospinal fluid might warrant reevaluation for preemptive removal before the fragment reaches the thoracic region, where the chances of ensuing neurologic symptoms are increased, and the risks of surgical removal are higher.

CONCLUSIONS

The shearing of intrathecal catheter is an underappreciated complication that is likely to increase as spinal drains are inserted more frequently in an effort to reduce surgical complications. There are no current guidelines on how to best manage retained catheter fragments. In our opinion, the management of a retained intrathecal fragment should not be reduced to a uniform strategy. Instead, it should be contingent on the individual demographic and clinical variables reviewed in this article and the accessible information on this topic, with the caveat that this may change when more data are available.

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