LETTER TO THE EDITOR

Epidural Hematoma Following Implantation of a Permanent Spinal Cord Stimulator Paddle

TO THE EDITOR:

Neurologic injury is the most feared complication of spinal cord stimulator implantation. Unfortunately, this topic has received little attention in the literature, making it difficult to assess the causes and possible strategies to avoid these injuries. This is a report of a case of incomplete spinal cord injury and epidural hematoma that developed in a patient 36 hours after implantation. It is hoped that the lessons learned in this case will help others avoid or promptly recognize and treat this dreaded complication.

CASE REPORT

The patient was a 56-year-old white male who developed back pain radiating circumferentially into both lower extremities after lifting weights in high school. His pain increased with sitting, standing, walking, and bending. He obtained relief from laying in a recliner. He had numbness and paresthesias in both calves and generalized body weakness. He had been treated with pain medications and injections without improvement. He had a spinal cord stimulator trial performed by his pain management physician with 50% improvement in his pain. When questioned by the author during his preoperative visit, the patient gave a past history that was significant only for gout and myocardial infarction. He did not acknowledge a history of hepatitis on his preoperative intake form. He was not on any anticoagulant medications. On physical exam his lumbar spine was not tender to palpation. Deep tendon reflexes were depressed symmetrically in the lower extremities. He had no ankle clonus. Pinprick sensibility and manual motor testing of the lower extremities were normal. A magnetic resonance imaging (MRI) of his lumbar spine showed degenerative disc disease from L3 to S1 without evidence of herniated disc or stenosis.

The pain management physician requested that a Medtronic tri-pole lead (Medtronic, Minneapolis, MN, USA) be implanted to cover the patient’s back and leg pain. The patient underwent implantation of a Medtronic tri-pole permanent spinal cord stimulator at T8 and T9 and placement of a rechargeable battery above the left hip on October 5, 2012. As was common in the author’s experience with this particular lead, the implant could not be passed through a simple laminotomy, and a laminectomy at T9 was performed. The patient was kept overnight for IV antibiotics and pain control. Neurologic testing was performed by the nursing staff every two hours. No neurologic deficits were noted. On the morning of October 6, 2012, the patient ambulated 300 feet independently, voided without difficulty, and was discharged home. At 1:00 AM on October 7, 2012, the patient walked into his local emergency department, which is three hours away from the author’s facility, complaining of increasing back pain. While there, he developed weakness of his left lower extremity and urinary retention.

The patient was brought back to the author’s facility where physical exam revealed a very small amount of blood on the thoracic dressing with no significant swelling or erythema around the incision. Deep tendon reflexes were depressed symmetrically in the lower extremities. Pinprick sensibility was intact from the nipple line to the inguinal creases bilaterally and in the left anterior thigh. It was decreased in the remainder of the lower extremities. Manual motor testing showed all motors on the right to be 5/5; those on the left were 0/5. The patient had an episode of urinary incontinence during the exam. A Foley catheter was placed, and 1200 cc of urine was obtained. A rectal exam showed excellent rectal tone with no active contractions or sensation. An AP X-ray of the thoracic spine, Fig. 1, showed no change in the position of the lead compared with the X-ray obtained intraoperatively on October 5, 2012, Fig. 2.

The implant was considered a contraindication for an MRI. Because of the relative suddenness of the onset of the neurologic deficit and the time it would have taken to obtain a computed tomography-myelogram, especially on a Sunday, the patient was returned to the operating room immediately for removal of the implant and exploration of the thoracic wound to rule out an epidural hematoma. It was in the preoperative area where the patient revealed that he had a distant history of hepatitis C, which was in remission. Laboratory work revealed a PT of 18.1 and an INR of 1.5. His platelet count was 63.

At surgery, the patient was found to have a moderate subfascial hematoma extending into the epidural space. The stimulator and implanted pulse generator were removed, and the hematoma was evacuated. Internal medicine and hematology consults were obtained postoperatively, and the patient’s coagulopathy was treated with vitamin K, calcium, magnesium, and phosphorus supplementation. His PT improved to 15, INR to 1.2, and platelets to 125. The motor strength in his left lower extremity improved a full grade each day. He was discharged home on October 12, 2012, fully ambulatory with no numbness or saddle anesthesia. He continued to have urinary retention, which resolved over the next six weeks. The patient has declined reimplantation of the stimulator.

DISCUSSION

Levy et al. (1) performed a systematic review of the literature “to find reports of complications that could lead to or have caused...”
neurologic injury." They found "that many case series do not report SCS complications." The manufacturers’ data bases revealed an incidence of neurologic injury of 0.54%, assuming that all neurologic complications were reported to the manufacturers. Of 44,587 cases, 83 (0.19%) were reported to have developed an epidural hematoma. Of these, 68 (82%) had some form of motor deficit. An additional 59 patients developed motor deficits postoperatively without an epidural hematoma. The rate of recovery of motor function was higher in patients who had an epidural hematoma, suggesting that the patients without a hematoma had sustained a direct injury to the spinal cord during the implantation procedure.

Glotzecker et al. (2) conducted a systematic review of the incidence of epidural hematoma in postoperative spine patients. He found the incidence to range from 0 to 0.7% in studies where patients received chemical anticoagulation and from 0 to 1% in all studies, reflecting a small incidence of this particular complication. The current author has performed roughly 700 permanent spinal cord stimulator paddle implantations over the past four years. This is the first case of neurologic deficit the author has experienced with this procedure. This would be an incidence of 0.1%.

The author believes that the use of the Medtronic tri-pole lead, which is the largest paddle lead the author has seen (and was chosen by the pain management physician who performed the trial), and the failure of the patient to reveal his history of hepatitis C (and associated coagulopathy), created a perfect storm for the development of an epidural hematoma. Levy et al. (1) believed that "the risk of neurologic injury is related to the volume (thickness × width × length) and stiffness of the electrode as well as to the angle of insertion. If acute blunt trauma to the cord occurs, the cord will react by swelling. The presence of a large-volume electrode will then contribute to further ischemia and subsequent spinal cord damage." It is unknown whether a smaller implant would have protected this patient in light of his coagulopathy. Likewise, it is unknown whether correction of the coagulopathy preoperatively would have decreased the bleeding enough to prevent a neurologic deficit with such a large implant in the canal. The current author has only implanted about a dozen Medtronic tri-pole leads and has not been able to insert any without at least a one-level laminectomy, as was necessary in this case.

Kou et al. (3) compared 12 patients who developed epidural hematomas after lumbar surgery with 404 patients who did not. Multilevel procedures and the presence of a preoperative coagulopathy were the only factors significantly associated with the development of an epidural hematoma. Age, body mass index, dural tears, and postoperative drains were not found to be risk factors. The patient reported here required a laminectomy, and he had a coagulopathy secondary to hepatitis C.

The use of drains in spine surgery has been controversial. Scuderi et al. (4) reported on 85 patients who underwent single-level lumbar fusions without drains. One patient developed a deep infection, one developed cellulitis, and one developed a hematoma requiring surgical decompression. Kanayama et al. (5) studied 560 patients who underwent single-level discectomy or decompression, of whom 298 received drains and 262 did not. They found no difference in the rate of infection or hematoma between the two groups. It is the current author’s practice not to use drains for stimulator cases. This has proved successful for the other 699 patients treated by this author. In the case described here, it is unknown whether a drain would have been of benefit or whether it would have only delayed the onset of the neurologic deficit. If a drain had been used, it would have been removed prior to discharge on October 6, 2012. The patient did not become symptomatic until more than 12 hours later.

The guidelines of the American Society of Anesthesiologists (6) do not call for the routine use of the PT and/or INR unless the patient has a history of coagulopathy or anticoagulant use. The routine use of preoperative MRIs of the thoracic spine when implanting paddle leads is recommended by some surgeons. Currently, there are no studies that show how often such studies change the surgical plan in patients who have no history of stenosis, tumor, or thoracic spine injury. It is not known how tight is too tight to implant a paddle in the thoracic area. The current author has a very low threshold for performing laminectomies and has even switched to smaller

Figure 1. Postoperative X-ray, October 7, 2012.

Figure 2. Intraoperative X-ray, October 5, 2012.
implants during the procedure three times in the past. Epidural dissectors are not used by the author. If the implant does not slide into the canal smoothly without force, or, if the fluoroscopic images show the implant consistently deviating to one side, another laminotomy is performed at the next cephalad level as recommended by Levy et al. (1). An attempt is made to preserve the lamina for the stability of the paddle. If this fails to remove the impediment, the author then completes the laminectomy at the original level. With or without a preoperative MRI, a laminectomy did not protect the patient reported here.

The treatment of an epidural hematoma is not controversial. Lawton et al. (7) reported on 30 patients who underwent surgical decompression for epidural hematomas. They found that the preoperative neurological status and the rapidity of surgical intervention correlated with the neurologic outcome. Scavarda et al. (8) and McQuarrie (9) also found that early decompression was associated with greater neurologic recovery. The only delay in the present case was due to the distance the patient had to be transported to return to the treating facility. Other than a single AP X-ray to document the position of the implant, no other radiologic studies were obtained as the results would not have altered the treatment.

As a result of this case, the author now queries all surgical patients about a history of hepatitis and orders a PT and INR for all patients who answer in the affirmative. The Medtronic 2 × 8 lead is now used by this author in place of the tri-pole lead. As was true prior to this case, the author takes all complaints of neurologic deterioration seriously. There is no explanation for the unilateral symptoms exhibited in this case as the compression was clearly over dorsum of the spinal cord. The rectal exam has proven very useful in the author’s experience to ferret out true neurologic deficit. The value of imaging studies and their ability to change the treatment plan should be weighed against the inevitable delay to definitive treatment. This patient made a full recovery. The only negative to this narrative is that the experience has made him reluctant to undergo reimplantation, and he is, therefore, left to live with his pain.

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REFERENCES