Case Report

Inadvertent Disk Injection during Transforaminal Epidural Steroid Injection: Steps for Prevention and Management

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ABSTRACT

Objectives. To report two cases of disk injection during transforaminal epidural steroid injection, and to discuss ways to prevent and manage this under-appreciated complication.

Design. Case reports and literature reviews.

Patients. Two patients with radicular symptoms underwent transforaminal epidural steroid injections under fluoroscopic guidance. The needle in both cases was placed in the center of the intervertebral foramen, about 1 cm above the inferior endplate. Injection of contrast in both cases revealed diskographic spread. Repeat magnetic resonance imaging revealed a large foraminal disk herniation in both patients.

Results. A literature search identified three studies whereby the use of a single-needle technique to perform diskography was clearly noted in conjunction with the number of infectious complications. Comparing these data with the incidence of diskitis when a double-needle approach was used found the infectious risk to be considerably higher. There are no data regarding whether imaging studies affect outcomes following epidural steroid injections.

Conclusions. These cases and similar complications following transforaminal epidural steroid injections provide anecdotal evidence that recent imaging studies, repeated not only for qualitatively new symptoms but after a sustained quantitative increase in pain, may reduce the complication risk. Data extrapolated from studies on diskitis suggest that administering parenteral, and possibly also intradiskal antibiotics, immediately after inadvertent disk injection is appreciated, may reduce the infectious risk.

Key Words. Complication; Diskitis; Epidural Steroid Injection; Infection; Magnetic Resonance Imaging

Introduction

Lumbar epidural steroid injections (ESI) are the most commonly performed procedures in pain treatment centers [1]. In the past few years, the use of transforaminal delivery of corticosteroids has increased over 400%, partly at the expense of interlaminar ESI [1]. Yet, this procedure is not without risk. Albeit rare, significant neurological complications have been reported [2–5]. Although the preponderance of attention

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1Dr. Cohen receives salary support from the John P. Murtha Neuroscience and Pain Institute, Johnstown, PA, and the Army Regional Anesthesia & Pain Medicine Initiative, Washington, DC.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Dept. of the Army or the Dept. of Defense.
has been focused on these neurological complications, unanticipated disk entry has also been documented [6]. The present report describes two additional cases of inadvertent disk entry and discusses the implications of such an encounter.

**Case Reports**

**Patient 1**

The patient was a 75-year-old male with a past medical history significant for hypertension and a previous myocardial infarction who presented to the pain clinic with low back pain radiating down his left leg to the medial ankle of 10 years duration. One year after his pain started, he underwent an L4–5 laminectomy that attenuated, but never eradicated his pain. His pain had progressively worsened over the past 2 years to the extent that it was difficult for him to ambulate one block. He denied weakness, but did report numbness and paresthesias in a left L4 dermatomal distribution. On a 0–10 numerical pain scale, he rated his pain as “4.” His only analgesic medication was ibuprofen 400 mg “as needed.”

On physical examination, the patient was found to have reduced deep tendon reflexes in the left knee, and diminished sensation to temperature and pinprick along the L4 distribution. A magnetic resonance imaging (MRI) report from 18 months prior was notable for grade I anterolisthesis at L4–5, marked degeneration of the L5–S1 disk, moderate central spinal stenosis, and small bilateral foraminal disk protrusions more severe on the left, with slight indentation of the exiting L4 nerve root. Based on the patient’s history and exam, the recommendation was made to begin treatment with gabapentin and proceed with a left transforaminal epidural steroid injection (TFESI).

Six days after the initial consultation, an uneventful left L4–5 TFESI was performed in routine fashion using fluoroscopic guidance. The patient obtained almost 90% pain relief as well as significant functional improvement for several weeks after the procedure, after which his pain returned. During his follow-up visit, he reported that his pain was of a similar quality to that during his initial presentation, albeit more intense. The decision was therefore made to proceed with a repeat injection. Using an oblique approach, a 5-in. 22-gauge spinal needle was placed at the inferior aspect of the junction of the left transverse process and vertebral body (Figure 1). In an anteroposterior view, the needle position was noted to be approximately 1 cm above the inferior endplate of the L4 vertebral body at the 6:30 position on the face of a clock. In the lateral view, the position was two-thirds deep into the foramen. One mL of contrast was injected revealing an L4–5 diskogram, with diffuse spread throughout the degenerated disk (Figure 2). The needle was withdrawn several mm and contrast reinjected, which this time portrayed spread around the exiting L4 nerve root with epidural diffusion (Figures 3 and 4). Following negative aspiration, a 3-mL solution containing bupivacaine and corticosteroid was administered.

No complications were noted from the inadvertent diskogram. The patient was subsequently referred for a repeat lumbar MRI that revealed a very large L4–5 left foraminal disk herniation (Figures 5 and 6). Two months after his second TFESI, the patient continued to report complete eradication of his leg pain.

**Patient 2**

A 73-year-old man with a medical history significant for cardiac disease was referred from neurosurgery for an L4–5 TFESI. The patient had a 5-year history of right buttock pain radiating to his distal thigh, but rarely below the knee. This pain
Figure 2  Anteroposterior fluoroscopic image demonstrating intradiskal contrast injection without nerve root or epidural spread.

Figure 3  Anteroposterior fluoroscopic image demonstrating nerve root and epidural contrast spread after the needle is withdrawn several mm.

Figure 4  Lateral fluoroscopic image demonstrating intradiskal and epidural contrast injection.

Figure 5  Sagittal T2-weighted magnetic resonance imaging demonstrating a large left foraminal L4–5 disk hernation.
was exacerbated with activity and relieved by rest. He denied numbness or tingling. On a 0–10 scale, he rated his pain as a “5.” Physical examination was notable for intact muscle strength and sensation, symmetrical reflexes and an equivocal straight leg raising test on the right. He did not bring his MRI with him, but as per written report he had degenerated disk disease at multiple levels, mild central and lateral recess stenosis, a right paracentral disk protrusion at L4–5, and grade I spondylolisthesis at the same level. The only medication he took for pain was ibuprofen.

Under sterile conditions, a right-sided L4–5 TFESI was attempted with a 5-inch 22-gauge spinal needle. Using oblique, lateral, and AP fluoroscopic images, the tip was placed in the center of the foramen, approximately 0.5 cm above the inferior endplate of the L4 vertebral body. On an AP view, the needle tip was at a 6:00 position under the pedicle. To minimize needle movement and enable real-time contrast visualization, connecting tubing was used. The first 0.5 mL enveloped the L4 nerve root with some proximal epidural spread, but any subsequent volume resulted in intradiskal spread. The needle was withdrawn slightly, but subsequent injection still resulted in a diskogram. The needle was immediately removed and cefazolin 1 g was administered intramuscularly. A right-sided interlaminar L4–5 epidural steroid injection was then performed without difficulty. The patient reported no complications and 80% relief of his pain 2 months after the procedure. As the old MRI could not be obtained, a new MRI was ordered that revealed a right foraminal L4–5 protruding disk.

Discussion

There are several important points to be gleaned from these cases. The foremost is that based on these cases and subsequent discussion with other pain physicians, inadvertent disk injection during TFESI is not an uncommon occurrence. It is therefore surprising that only one case report on this subject has ever been published [6]. Increased awareness of this potential complication is incumbent upon interventional pain physicians, who can take several steps to prevent and manage this potentially devastating complication [7].

The first way these complications have changed our practice is to lower the threshold whereby we order MRIs before TFESI. There are no standard guidelines as to whether viewing an actual film is superior to reading a report before ESI, nor as to what constitutes justification for repeating an MRI in patients with chronic back pain. In accordance with diagnostic guidelines [8] and the absence of outcome data, we formerly usually chose the latter. Yet as these complications occurred, we now require viewing an actual image before attempting a TFESI. Similarly, the trigger for us to order a repeat MRI in patients with chronic low back and/or extremity pain had previously been qualitatively new symptoms. But in patients with far lateral disk herniations, we now repeat the MRI before performing a TFESI in any patient who experiences a quantitative increase in their symptoms, as a herniation encroaching far into a foramen will preclude us from entering the epidural space at that level via a foraminal approach. We are also more cognizant about directing our needle just below the midpoint of the pedicle, an approach previously advocated to reduce the risk of nerve root injury and radiculomedullary artery injection [9], and avoiding deep needle placement against the vertebral body. Although the safety of

Figure 6 T2-weight magnetic resonance imaging demonstrating almost complete obliteration of the left L4–5 foramina by herniated nucleus pulposus.
this “safe triangle” has subsequently been questioned [10], placing the needle tip in the anterosuperior aspect of a foramen is less likely to result in inadvertent annular penetration.

Our second practice change involves our algorithm for managing inadvertent disk injection. Perhaps the most concerning complication following disk penetration is diskitis, owing to its refractoriness to treatment and potential for permanent neurological complications [11]. The incidence of postdiskographic lumbar diskitis averages between 0.1% and 0.3% per patient and 0.05%–0.1% per disk [12], but these numbers may significantly underestimate the risk following disk penetration during ESI. The reasons for this are multifactorial, but primarily revolve around the lack of precautions designed to prevent disk infection (i.e., the use of either adhesive skin covering or a double-needle technique so that the needle entering the disk is smaller and not the same one piercing the skin, and routinely wearing sterile gowns and hats in the room) and the local injection of corticosteroid [13]. Following its inception in the late 1940s, a through-and-through double-needle technique has been increasingly utilized in the past few decades. Although this approach was initially proposed to reduce the risk of disk injury, a subsequent study found it reduced the incidence of diskitis almost four-fold [14] (Table 1). A review of the literature identified only three lumbar diskography studies whereby the methodology clearly stated that a single needle was employed for the procedure and the results section reported complications (Table 1). A review of the literature identified only three lumbar diskography studies whereby the methodology clearly stated that a single needle was employed for the procedure and the results section reported complications (Table 1). Based on these studies, it is likely that the incidence of diskitis during inadvertent disk penetration during ESI is considerably higher than that cited for diskography. Diskitis has previously been reported following interlaminar ESI and epidural anesthesia, but never during TFESI [15,16].

The prophylactic use of systemic antibiotics during diskography has been advocated by most [11,17], but not all experts [18]. Other investigators have endorsed intradiskal antibiotics as a reasonable alternative [19,20], though there is a paucity of data to support this position. In an in vitro experiment by Klessig et al. [19], the authors determined that low concentrations of the antibiotics cefazolin, clindamycin, and gentamycin remained effective in the presence of contrast medium. In fact, the use of iohexol alone resulted in the inhibition of bacterial growth, which led the authors to conclude that mixing intradiskal antibiotics with contrast might be an alluring alternative to systemic administration. In a preclinical sheep model, Osti et al. [20] found that mixing the antibiotic cefazolin with contrast medium just prior to disk injection was equally effective to preemptive intravenous antibiotics in preventing diskitis.

In the surgical literature, whereas the most effective way to prevent surgical site infections is to administer antibiotics within one hour of skin penetration, there is strong evidence that administering systemic antibiotics after skin incision but prior to closure can also reduce infection [13,21–23]. In a recent ovine study of diskography-induced diskitis, whereas systemic cefazolin administered prior to disk inoculation prevented radiographic and histological evidence of disk infection in over 70% of animals, initiation of treatment 1 week after infection failed to prevent erosive lesions [24]. Similar results were reported by Fraser et al. [25] in sheep given systemic antibiotics either prophylactically or 1–3 weeks after infection was induced. Whereas no animal given parenteral antibiotics developed any evidence of diskitis, the administration of intravenous antibiotics several weeks after inoculation failed to prevent radiographic or pathological disk degeneration. Together, these studies underscore the importance of prompt and aggressive measures to prevent adverse sequelae after inadvertent disk entry.

The clinical studies reporting the relative risk of diskitis were conducted using austere precautions designed to prevent infection, including but not limited to the double-needle technique. As such, the true risk of diskitis during inadvertent disk entry is difficult to estimate. As no medication is devoid of risk, the cost/benefit ratio of administering prophylactic antibiotics can be estimated by

Table 1  Reported incidence of lumbar postdiskography diskitis using a single-needle technique

<table>
<thead>
<tr>
<th>Study</th>
<th>Number of Patients</th>
<th>Number of Disks Injected</th>
<th>Cases of Diskitis</th>
<th>Percent Incidence by Disk (Patient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraser et al., 1987 [14]</td>
<td>222</td>
<td>463</td>
<td>6</td>
<td>1.3 (2.7)</td>
</tr>
<tr>
<td>Mcculloch and Waddell, 1978 [26]</td>
<td>1,500</td>
<td>Not applicable</td>
<td>3</td>
<td>(0.2)</td>
</tr>
<tr>
<td>Wiley et al., 1968 [27]</td>
<td>1,092</td>
<td>2,517</td>
<td>1</td>
<td>0.04 (0.09)</td>
</tr>
</tbody>
</table>
weighing the likelihood of infection, which in this context is low, and the consequences of the sentinel event, which can be catastrophic. After reviewing the literature and discussing these cases with a multidisciplinary team of experts, we have concluded that the potential benefits of giving parenteral antibiotics immediately following this complication clearly outweigh the risks. Whether or not the possibility of further reducing the likelihood of infection by administering intradiskal antibiotics outweighs the added risk incurred by increasing disk exposure to the needle as the antibiotics are being reconstituted is another question requiring careful deliberation. In the only preclinical study evaluating intradiskal antibiotics, the drug was administered into the center of the nucleus pulposus [20]. Advancing a bacteria-ridden needle into the center of the disk to administer antibiotics would be controversial, as the inoculum was presumably deposited in the periphery. Such an approach also carries its own inherent risks as biochemical assays conducted in animals have shown that systemically-administered antibiotic concentrations are higher in the annulus fibrosus than the nucleus pulposus [24]. But weighing the relative risks involved, administering both systemic and intradiskal antibiotics, especially in patients at high risk for infection (e.g., diabetics or immunocompromised individuals), may be warranted.

In conclusion, we report two cases of inadvertent disk injection during technically successful TFESI, suggesting this complication is both underreported and under-appreciated. Steps that can be taken to prevent this complication are discussed, along with measures that can prevent adverse sequelae.

References