Analysis of Inadvertent Intradiscal Injections during Lumbar Transforaminal Epidural Injection

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Background:
Recently, there have been several case reports and retrospective studies about the incidence of intradiscal (ID) injection during transforaminal epidural steroid injection (TFESI). Inadvertent ID injection is not a rare complication, and it carries the risk of developing discitis, although there has been no report of discitis after TFESI. We prospectively evaluated the incidence of inadvertent ID injection during lumbar TFESI and analyzed the contributing factors.

Methods:
Ten patients received 2-level TFESI, and the remaining 229 patients received 1-level TFESI. When successful TFESI was performed, 2 ml of contrast dye was injected under real-time fluoroscopy to check for any inadvertent ID spread. A musculoskeletal radiologist analyzed all magnetic resonance images (MRIs) of patients who demonstrated inadvertent ID injection. When reviewing MRIs, the intervertebral foramen level where ID injection occurred was carefully examined, and any anatomical structure which narrowing the foramen was identified.

Results:
Among the 249 TFESI, we identified 6 ID injections; thus, there was an incidence of 2.4%. Four patients had isthmic spondylolisthesis, and the level of spondylolisthesis coincided with the level of ID injection. We further examined the right or left foramen of the spondylolisthesis level and identified the upward migrated disc material that was narrowing the foramen.

Conclusions:
Inadvertent ID injection during TFESI is not infrequent, and pain physicians must pay close attention to the type and location of disc herniation. (Korean J Pain 2014; 27: 168-173)

Key Words:
intradiscal injection, spondylolisthesis.
INTRODUCTION

Transforaminal epidural steroid injection (TFESI) is one of the most widely used interventional treatment for the relief of radicular pain secondary to lumbar spinal stenosis, lumbar discogenic disease, or failed back surgery syndrome. The mechanism of treatment is believed to be the attenuation of inflammation around the irritated nerve root [1,2]. Moreover, TFESI has the benefit of delivering therapeutic medication closer to the ventral epidural space, which is known to have abundant pain substances [3,4]. In spite of these therapeutic advantages, inadvertent intradiscal (ID) injection can occur not infrequently during TFESI.

In our previous report [5], we demonstrated an incidence of inadvertent ID injection during TFESI of 2.3%, higher than the results reported by Candido et al. [6] and Plastaras et al. [7].

Inadvertent ID injection is not a rare complication, and it carries the risk of developing diskitis, although there has been no report of diskitis after TFESI. Therefore, a thorough understanding of contributing factors of inadvertent ID injection is important.

Plastaras et al. [7] reported that the most common findings in inadvertent ID injection cases were ipsilateral foraminal stenosis (60%), central stenosis (26.7%), and spondylolisthesis (20%). They suggested that ipsilateral foraminal stenosis is a factor associated with inadvertent ID injection. However, their study had a retrospective design covering the period July 2000 to May 2008, and they obtained data from electronic archives and databases of operation notes; thus, there was the risk of missing much relevant data. Moreover, in their review of radiographic findings for each ID injection, they used radiology reports and did not perform an independent review of the magnetic resonance imaging. For those reasons, although they found an association between inadvertent ID injection and ipsilateral foraminal stenosis, they could not suggest the exact cause of foraminal narrowing. In contrast to Plastaras et al. [7], Cohen et al. [8] reported that far lateral disc herniation might be a cause of ID injection.

In this study, we prospectively evaluated the incidence of inadvertent ID injection during lumbar TFESI and analyzed the contributing factors.
Injection was observed, needle repositioning was repeated two or three times if necessary. If an ID contrast pattern still remained, the needle tip was withdrawn slowly and repositioned more superiorly within the neural foramen. Patients who showed ID dye appearance were given intravenous antibiotics (cephazolin, 1 gm). Once a satisfactory epidural spread pattern was observed, the treatment medication was injected. When an ID injection was unavoidable in spite of repeated attempts at needle repositioning, injecting any medication at that level was abandoned.

The collected data included patient demographics, dominant symptoms for TFESI, history of spine surgery, radiographic findings, presence of accidental ID injection based on real-time fluoroscopic images, patient perception of improvement, spinal levels at which TFESI was performed, and any other complications. A musculoskeletal radiologist analyzed all magnetic resonance images (MRIs) and simple lumbar spine X-rays of patients who demonstrated inadvertent ID injections. When reviewing MRIs, the intervertebral foramen level where ID injection occurred was carefully examined, and any anatomical structure which narrowing the foramen was identified. Also, the incidence of ID injection with lumbar TFESI was calculated.

## RESULTS

A total of 249 TFESI were performed with 239 patients having a mean age of 62.5 years (range: 26–90 years). Ten patients received 2-level TFESI, and each injection was considered a separate procedure for our analyses; the remaining 229 patients received 1-level TFESI. Among those injections, 120 were on patients’ right sides, and 129 were on the patients’ left sides. One hundred thirty patients were diagnosed with spinal stenosis, 100 patients with herniation of the nucleus pulposus, 6 patients with compression fractures, and 3 patients with failed back surgery syndrome.

The sites of TFESI were between the L1 and S1 spinal levels. The most frequently injected levels were L4 (113 cases) and L5 (75 cases) (Table 1).

Among the 249 TFESI, we could identify 6 ID injections (Fig. 1), with an incidence of 2.4%.

Among the six patients with ID injection, four had TFESI at the L4–5 level, and the remaining two had TFESI at the L5–S1 and L3–4 levels, respectively. No patients had a history of prior spine surgery.

We analyzed all MRIs of patients who showed ID injection. Four patients had isthmic spondylolisthesis and the level of spondylolisthesis coincided with the level of ID injection (Table 2). We further examined the right or left foramen of the spondylolisthesis level and identified the upward migrated disc material in each of the four patients (Fig. 2). The remaining two patients had subarticular disc herniation without spondylolisthesis.

### Table 1. Distribution of Disease and Spinal Level of Lumbar Transforaminal Epidural Steroid Injections

| Disease distribution          | Number of patients |
|-------------------------------|--------------------|
| Spinal stenosis               | 130                |
| Herniated nucleus pulposus    | 100                |
| Compression fracture          | 6                  |
| Failed back surgery syndrome  | 3                  |
| Spinal Level                  |                    |
| L1                            | 6                  |
| L2                            | 10                 |
| L3                            | 30                 |
| L4                            | 113                |
| L5                            | 75                 |
| S1                            | 5                  |

Fig. 1. Anteroposterior fluoroscopic image showing intradiscal dye spread.
Table 2. Clinical Characteristics of Patients with Inadvertent Intradiscal Injections during Lumbar Transforaminal Epidural Steroid Injections

| Patient | Age | Sex | Symptoms                          | Previous surgery | Magnetic resonance imaging       | Side/Level | Result                                      |
|---------|-----|-----|-----------------------------------|------------------|----------------------------------|------------|--------------------------------------------|
| A       | 58  | F   | Right buttock pain on walking     | None             | Anterolisthesis of L4 on L5, degenerative type | Right/L4-5 | Pain relief, of symptom recur after 6 month |
| B       | 78  | F   | LBP and both leg pain for 3 month | None             | Spondylolisthesis of L4 on L5, degenerative type | Right/L4-5 | Pain relief, and reduction of symptom for 5 months |
| C       | 64  | F   | Rt side calf pain                 | None             | Spondylolisthesis of L5 on S1    | Right/L5-S1| Pain relief, and reduction of symptom for 2 weeks |
| D       | 60  | F   | Left leg pain on walking          | None             | Lt. subarticular disc extrusion at L3-4 | Left/L3-4  | Pain relief and reduction of symptoms for 3 months |
| E       | 80  | F   | Right side leg pain on walking    | None             | Spondylolisthesis of L4 on L5, degenerative type | Right/L4-5 | Complete relief of pain and reduction of symptoms |
| F       | 78  | M   | Rt side buttock pain              | None             | Rt. Subarticular disc extrusion at L4-5 Spondylolisthesis of L5 on S1, degenerative type | Right/L4-5 | No improvement                              |

Fig. 2. Sagittal view of magnetic resonance imaging showing upward migrated disc material into foramen level. White arrow indicates the protruded disc material.

DISCUSSION

In this prospective study, the overall incidence of ID injection was 2.4%, similar to our previous report [5]. Our incidence of ID injection is nearly 10 times higher than that reported by Candido et al. [6] (0.25%). This large discrepancy may be attributed to other studies’ underestimation of the ID injection rate and the fact that retrospective studies are limited in their ability to probe complications uniformly. According to our study, inadvertent ID injection during TFESI is not very rare, and pain physicians performing TFESI must be aware of this potential complication and take steps to prevent and minimize the complication.

Among the six patients with ID injections, four had isthmic spondylolisthesis at the level of TFESI, and we tried to determine why ID injection is easily observed in patients with spondylolisthesis. Lumbar degenerative spondylolisthesis is typically characterized by the forward slippage of a vertebra causing spinal instability and stenosis [9]. Significant morphological and anatomical changes can occur to the spinal canal and intervertebral foramen due to the slippage of superior vertebrae to below vertebra. This leads to symptoms of spinal stenosis, which induces low back pain, radicular lower leg pain and neurogenic claudication [10]. It is well known that the pathognomonic change of degenerative spondylolisthesis starts with disc degeneration, followed by ligamentum flavum hypertrophy and facet laxity, which results in severe spinal stenosis with or without intervertebral disc herniation at the level of spondylolisthesis [9,10]. In isthmic spondylolisthesis, pseudodisc bulging is easily identified, and central canal stenosis is rare. As the slippage occurs mostly at the L4–5 intervertebral disc level, the disc material often protrudes to the intervertebral foramen of the spondylolisthesis level [10,11]. Kim et al. [11] reported that 38 out of 120 (31.7%) patients with isthmic spondylolisthesis had pseudodisc bulging with
According to Candido et al. [6], the incidence of inadvertent ID injection was significantly lower with the interlaminar technique than with the transforaminal technique.

Many pain physicians choose the transforaminal technique rather than the interlaminar technique due to its advantage of easy delivery of medication to the anterior epidural space. However, parasagittal interlaminar epidural injection is effective in delivering medication to the anterior epidural space and has proven therapeutic efficacy. Candido et al. [15] reported that 100% (29/29) of patients in a parasagittal interlaminar group and 75% (21/29) of patients in a transforaminal group demonstrated anterior epidural spreading. Ghai et al. [16] reported that the lateral parasagittal technique was significantly more effective than the midline approach for pain relief and improvement in disability in the management of low back pain with radicular leg pain.

In conclusion, inadvertent ID injections during TFESI is not infrequent. Before pain physicians perform TFESI, they must pay close attention to the type and location of disc herniation. If TFESI is planned in patients with spondylolisthesis, pain physicians should confirm whether foraminal disc herniation is also present.

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