Epidural spinal injections can be administered via a translaminar or transforminal route, depending on the clinical scenario. When it is more desirable to target a specific nerve root, a transforminal approach is typically used, and when the target is more diffuse, a translaminar method is chosen. Both are commonly used and can be utilized similarly in the lumbar or cervical spine. However, it is essential that the clinician understand the risks and benefits of these injections. In the lumbar spine, both translaminar epidural steroid injections (TLESI) and transforminal epidural steroid injections (TFESI) have been shown to provide up to 6 months of pain relief, though long-term benefits are less reliable. In the cervical spine, translaminar injections may provide longer relief and have a lower complication rate than cervical transforminal injections. Proper technique is essential to minimize the rate of these rare but occasionally severe complications.

Spinal epidural steroid injections can be given in a translaminar or transforminal fashion. Translaminar epidural steroid injections (TLESI) are more appropriate for patients with axial neck or lower back pain or spinal stenosis, while transforminal epidural steroid injections (TFESI) are more appropriate for isolated lumbar or cervical nerve root irritation. Several studies have been performed to evaluate the efficacy of these injections, and there have been a number of reported complications of each type. Clinicians should be aware of the range of complications in order to best counsel their patients (Table 1).

Lumbar TLESI
Lumbar injections are commonly used in the nonoperative management of lower back pain with or without radiculopathy as well as for lumbar spinal stenosis. Contraindications such as previous laminectomy or active infection should be familiar to the practicing clinician. While the literature is still emerging with regard to efficacy, there are several valid randomized controlled trials that have sought to establish whether or not these injections should be used.

Carette and colleagues conducted a randomized controlled double blind trial of 158 patients with herniated nucleus pulposis randomized to steroid or saline lumbar TLESI. At 3 weeks, the steroid group had better Oswestry scores and finger-floor distance as well as less pain. At 6 weeks, the steroid group had less pain, with no difference in any of the other outcome measures assessed in this study. By 3 months, there were no differences found between the two groups. Additionally, the same percentage of patients in both groups went on to surgery.

The WEST Study, published in Rheumatology in 2005, was a multi-center, double-blind, randomized, placebo-controlled, parallel-group trial that consisted of 288 patients that all had unilateral sciatica. Patients were randomized into two groups; one group received three Lumbar TLESI
with steroid, and the other group received an injection with interligamentous saline. They used the Oswestry low back pain disability questionnaire to evaluate outcomes. The investigators found that at 3 weeks 12.5% of steroid injection group and 3.7% of interligamentous saline groups had 75% or more improvement, which was a significant difference between the two groups. However, outcomes from 6 to 52 weeks failed to show any benefit in the group the received the lumbar TLESI with steroid compared to the group that was given injections with interligamentous saline.

These two studies demonstrated that there is excellent short-term relief in patients injected with lumbar TLESI. However, consistent long term relief is lacking. Supporting this idea was a study by Wilson-Macdonald and associates. They studied 93 patients who were randomized to receive either an intramuscular steroid and anesthetic injection or lumbar TLESI for a compressed nerve root. They found a significant reduction in pain early on with TLESI without any long-term difference.

Recently, a systematic review of lumbar TLESI with or without steroid injections was conducted by Parr and coworkers. The review was performed using the Cochrane Musculoskeletal Review Group criteria for interventional techniques for randomized trials and the Agency for Healthcare Research and Quality criteria for observational studies. Short-term relief was classified as that lasting less than 6 months while long-term was considered relief for greater than 6 months. There is level II-2 positive evidence for pain relief from disc herniation and radiculitis. A significant limitation that they noted was that all studies involved injections that were “blind,” meaning that no fluoroscopy was used for localization. Blind injections were subject to problems including extra epidural placement of the needle, intravascular placement of the needle, preferential cranial flow of the solution, preferential posterior flow of the solution, and difficult placement, all of which could affect the results following lumbar TLESI. Fluoroscopic imaging is strongly recommended, as injections without the use of fluoroscopic assistance may have a rate of erroneous needle placement in as high as 30% to 40% of cases.

There have been a number of complications reported during the use of lumbar TLESI, such as infections (e.g., epidural abscess, meningitis, and discitis), epidural hematomas, seizures, transient blindness, hiccups, flushing, and gas emboli. Additionally, there are known side effects that are related to the use of steroids in the lumbar spine, such as pituitary suppression, osteonecrosis, osteoporosis, and weight gain, although these side effects are extremely rare when the recommended doses are used in the lumbar spine. Most large series have no reported serious complications, however, and only case reports exist regarding these complications. Injections, therefore, are generally thought to carry a very low risk.

**Lumbar TFESI**

Lumbar TFESI has the benefit of being highly selective, especially in the treatment of lumbar radiculopathy, and it can be utilized in a diagnostic capacity in the preoperative patient to help identify symptomatic nerve roots. Fortunately, several high-quality randomized controlled trials regarding lumbar TFESI have been performed.

Kolsi and colleagues conducted a prospective, randomized, double-blind study consisting of 30 patients with refractory nerve root pain. Patients were randomized to lumbar TFESI or interspinous sham injection. They were followed for 4 months, and pain on a 0 to 100 scale was used as the primary outcome. Pain relief was similar in both groups, going from 70 to 26 in the group that received a nerve root injection and from 63 to 23 in the interspinous group. Notable limitations in this study included short follow-up, unknown number of injections, and crossover.

A prospective, randomized, controlled, double-blinded trial conducted by Riew and associates supports the use of TFESI as a nonoperative modality that has the potential of avoiding surgery for lumbar radiculopathy. This study followed 55 patients who requested operative treatment with lumbar radicular pain (4 spine surgeons) with 13 to 28 month follow-up. Of these 55 patients, 9 of the 27 (33%) patients injected with bupivacaine alone decided to not have surgery while 20 of the 28 (71%) of patients injected with steroids decided to not have surgery (p < 0.004).

Additional studies have shown that lumbar TFESI injections have good short-term outcomes in the setting of lumbar disc herniation and spinal stenosis. These studies all support the use of these injections, but these benefits must be weighed against the risk of complications.
Complication rates in studies have ranged from 0% to 1.9%. One serious event, retroperitoneal hematoma in a patient on anticoagulation treatment, was noted. Given the rarity of complications, there is no study to date with adequate power to detect the actual incidence of these problems. Several case reports exist of which the practitioner should be aware. Houten and Errico reported on a case series of three patients who suffered sudden paraplegia after lumbar (two patients) or sacral (one patient) nerve root block.11 The hypothesized mechanism was arterial injection into an anatomic variant of the artery of Adamkiewicz, which runs from T9-L2 in 85% of patients. In that study, one patient improved to 3-4/5 strength in both lower extremities, the second had no recovery at 8 month follow-up, and the third had no recovery at 5 year follow-up.

Other reported complications include infection, allergic reaction, and dural puncture. Suggested measures to reduce risk include monitoring patients for 15 to 20 minutes after their injections, the utilization of particulate free steroids, testing for intra-arterial injection with digital subtraction angiography, and preliminary injection of a local anesthetic. With good technique, serious complications can be minimized.

Cervical TLESI

Cervical radiculopathy is a relatively common problem facing the spinal surgeon, with an incidence of 83.2 per 100,000 people.26 When initial nonoperative treatment fails, the treating physician can consider a cervical steroid injection. The use of cervical TLESI has been increasing. There are several studies that have investigated its use.

While most investigators have found improvement with cervical TLESI, Castagnera and associates12 did not. They performed translaminar cervical injections in 34 patients. Fourteen patients received a steroid injection while 10 were injected with morphine. Similar outcomes were seen, as both groups had 79% to 80% success rate at one year.

Stav and coworkers13 compared 25 patients with cervical TLESI to 17 patient with steroid injections into the posterior neck muscles. Results at 1 week demonstrated pain relief in 76% of patients injected with translaminar cervical epidural steroid compared to only 36% pain relief in patients injected in their deep neck muscles. Furthermore, significant differences were seen between these two groups at 1 year, with excellent pain relief in 68% of the TLESI group and only 12% of the deep neck muscles group.

Ferrante and colleagues14 performed a retrospective review of 100 patients with cervical TLESI. They used multiple regression analysis to determine predictors of outcome after cervical TLESI. Of all the factors studied, radicular pain was highly predictive of a good outcome (p = 0.0004).

In a retrospective review of 45 cervical TLESI in 25 patients, Rowlingson and Kirschbaum15 studied patients who failed a long trial of nonoperative management. Sixty-four percent of these patients had a good or excellent long-term result, showing that cervical TLESI remains a viable option for patients in whom prolonged nonoperative treatment has remained ineffective.

Benjamin and associates16 carried out an extensive review using the Cochrane Musculoskeletal Review Group criteria. They concluded that there is level II-1 (with a grade 1C “strong recommendation”) evidence for the use of cervical TLESI for both chronic neck and upper extremity pain. Cervical TLESI is an excellent option that has the potential for long-term benefits, especially in patients with radiculopathy as opposed to isolated neck pain.

As in all types of epidural spinal injections, the benefits must be weighed against the risk of complications. Waldman and associates17 in a prospective study of 790 blocks in 215 patients, found two dural punctures, two episodes of vasovagal syncope, and one late superficial infection. This study used only loss of resistance, not fluoroscopy, to localize the injections. In contrast, Botwin and coworkers18 reported on a retrospective cohort analysis of 345 fluoroscopically guided injections in 157 patients. A much higher overall complication rate of 26.8% was reported. These investigators noted increased neck pain in 6.7% of cases and headache for less than 24 hours in 4.6% of cases. Transient insomnia, vasovagal reactions, and facial flushing all occurred at a rate of under 2%. It is likely that the high overall rate of complications in this study was related to the sensitivity of labeling an event a “complication,” as the mentioned complications were relatively safe and temporary.

However, there have been other reports of more serious complications. Epidural hematoma has been reported six times in the literature. Most occurrences were in patients who were also undergoing anticoagulation regimens. These patients generally went on to have laminectomies, and recovery ranged from full recovery to paraplegia, urinary retention, or long-term neck pain.

Dural punctures with reported rates ranging from 0.25% to 2.65% have been reported. Other severe reported complications include neuropathic syndromes, pneumocephalus (found with use of air for loss of resistance in one case), venous air embolism, cervical epidural abscess, Cushing’s syndrome, and death (only one report in the literature; in this case, a spinal hematoma led to acute meningitis that ultimately resulted in a cardiac arrest).

Abbasi colleagues19 conducted an extensive review on cervical TLESI. They reported that the consensus is that cervical TLESI is a safe procedure. While one study reported a complication rate of 16.8%, all of the complications were transient. Other studies reported lower complication rates. The incidence of vasovagal reactions, however, may be higher than for lumbar TLESI. Ultimately, while severe complications exist, they are rare and can be minimized by good technique.

Cervical TFESI

Use of a transforaminal approach can allow the practitioner to perform a diagnostic and therapeutic selective nerve root
Scanlon and coworkers\(^2\) sent out 287 surveys to physicians and reported much more serious adverse outcomes. For instance, one study of 1,036 injections in 844 patients found an overall complication rate of 1.64%.\(^2\) In that study, there were five headaches, six transient neurologic deficits (pain or weakness), one hypersensitivity reaction, one vasovagal reaction, and one incident of transient global amnesia. In another study, Shipman and colleagues found three dural punctures, one vasovagal bradycardic response, one allergic reaction to local anesthetic leading to unresponsiveness, two allergic responses to contrast, and one posterior interosseous syndrome in their series of 888 procedures.

While the complications in the study conducted by Ma and associates\(^2\) were generally transient, others have reported much more serious adverse outcomes. For instance, Scanlon and coworkers\(^3\) sent out 287 surveys to physicians and found 78 complications, of which 70 involved corticosteroids. Complications included 16 vertebrabasilar brain infarcts, 12 cervical spinal cord infarcts, and two combined brain and spinal cord infarcts. Additionally, there were five deaths of unspecified etiology, three high spinal anesthesias, three transient ischemic attacks, two seizures, two severe headaches, two spinal cord edemas, one brainstem edema with herniation, one brain edema with reversible ischemic neurologic deficit, one cortical blindness due to air embolus, one cervical epidural hematoma, one paraspinal hematoma, one peripheral neurapraxia, and one vasovagal response. While this type of study likely includes a very large number of patients and does not allow us to know what the incidence of these injuries is, they are nevertheless serious complications and the practicing surgeon must be aware of the risks associated with this procedure.

**Conclusion**

There is good evidence that both transforaminal and translaminar epidural steroid injections can provide reliable pain relief for up to 6 months. In the lumbar spine, both TLESI and TFESI are relatively safe and efficacious. The exact complication rates of these injections are difficult to know given the existing literature but are thought to be low. In the cervical spine, there is good evidence to support TLESI, and reliable pain relief has been demonstrated at one year or longer in some studies. In contrast, cervical TFESI are used less often, and there is a paucity of literature evaluating these injections. There is to date no reliable studies demonstrating their efficacy, and there have been a number of potentially devastating complications reported. Since cervical radiculopathy can also be treated with TLESI, we urge caution before proceeding with cervical TFESI.

**Disclosure Statement**

The authors have no financial or proprietary interest in the subject matter or materials discussed, including, but not limited to, employment, consultancies, stock ownership, honoraria, and paid expert testimony.

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