

Cross-Sectional Survey

Variations in Epidural Steroid Injection Practice Patterns by Pain Medicine Physicians in the United States

Nishan Bingham, MD, Raymon Dhall, MD, Michael Montuori, MD,
Kristoffer Padjen, MD, PhD, Christopher Gharibo, MD, and Lisa Doan, MD

From: Department of Anesthesiology, Perioperative Care and Pain Medicine, New York University, Langone Health, New York, NY

Address Correspondence:
Lisa Doan, MD
Department of Anesthesiology, Perioperative Care and Pain Medicine, New York University, Langone Health
550 1st Avenue
New York, NY 10016
Email: lisa.doan@nyumc.org

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Background: Epidural steroid injections (ESI) are one of the most commonly performed pain procedures; however, there has been variation in techniques and approaches amongst pain physicians in the United States. The formation of a multidisciplinary working group was made with considerations to help guide ESI practice.

Objective: Pain medicine physicians in the United States were surveyed in order to provide an update on current practices for both transforaminal and interlaminar ESI.

Study Design and Setting: This was a cross-sectional survey of pain medicine physicians in the United States.

Methods: This study was approved by the institutional review board of our institution. Based on the American Society of Interventional Pain Physicians membership database, an email list was generated, and a web-based survey was sent to interventional pain physicians at academic centers, private practices, government hospitals, and community settings across the United States. Cervical, lumbar, and caudal ESI sections were divided into questions regarding preferences for fluoroscopic views, injectates, and techniques.

Results: A total of 261 responses were analyzed. All but one used fluoroscopy for lumbar ESI. There were variations in methods to detect intravascular uptake, choice of injectate, and the use of particulate steroids for lumbar transforaminal epidural steroid injection (TFESI).

Limitations: The response rate is a limitation, and thus the results may not be representative of all pain medicine physicians in the United States.

Conclusions: Since the 2015 multidisciplinary pain workgroup recommendations were made for ESI, there appears to be a trend towards following these guidelines compared to prior surveys looking at ESI practices. However, our survey shows there continues to be variations in ESI practice that deviates from these guidelines.

Key words: Epidural steroid injections, transforaminal epidural injection, interlaminar epidural injection, interventional pain, survey, lower back pain, neck pain

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Low back and neck pain are common, with a lifetime prevalence for each of approximately 40-50% (1,2). Epidural steroid injections (ESI) are one of the most commonly performed spinal procedures, providing short to intermediate-term relief of low back and neck pain (3-6). In the interlaminar approach, injection to the epidural space is performed

between two adjacent laminae. The transforaminal approach allows for a more direct approach to the neuroforaminal space.

Though generally safe, there have been rare instances of catastrophic complications associated with ESIs. Transforaminal ESIs (TFESIs) have been implicated in serious neurologic injury from intravascular injection,

particularly cervical TFESIs. Particulate steroid injection may cause embolization if given intravascularly and lead to stroke or spinal cord infarct. Although there have been dozens of cases of catastrophic complications with TFESIs, two-thirds of cases involving spinal cord injury in the American Society of Anesthesiologists (ASA) Closed Claims Project occurred during ILESI rather than TFESI (7). Mounting concerns regarding safety led to a Food and Drug Administration (FDA) warning in 2014 regarding the potential for neurologic adverse events with ESIs (8). The FDA coordinated a multidisciplinary working group to develop recommendations to minimize risks with ESIs. The multidisciplinary working group published a 2015 statement including 17 considerations to guide ESI practice habits (9). A consensus was not reached on all suggestions, and the FDA has not modified its initial warnings based on feedback from the working group.

The multidisciplinary working group collaboration and case review reported that ILESI rarely resulted in serious complications, and the majority of case reports with adverse outcomes were due to TFESI involving particulate steroid. Consequently, this group concluded that nonparticulate steroid should be used for cervical TFESI while allowing there may be appropriate indications for particulate steroid use in lumbar TFESI. Other suggestions that were offered included the use of fluoroscopic imaging, including lateral views, while performing an ESI, as well as the use of light (as opposed to heavy) sedation during ESI due to cases in which severe neurologic injury occurred in patients who were under deep sedation (9).

Several survey studies have been conducted to determine ESI practice techniques. In 2002, Cluff et al published results of a national survey showing a lack of consensus regarding approach as well as wide variation within "almost every technical aspect of ESI" (10). Our group surveyed ESI practices prior to the publication of the consensus opinions from the multidisciplinary working group on safeguards during ESIs. The purpose of this follow-up study is to further chronicle changes in practice patterns in response to changes in training and recent literature recommendations.

METHODS

This study was approved by the institutional review board of our institution. A 24-item questionnaire was created to obtain information on practices related to ESI, comprised largely of closed-ended questions. The survey included 3 sections: cervical ESI practices, lumbar

and caudal ESI practices, and provider primary specialty and work environment. The ESI sections were further divided into questions regarding preferences for fluoroscopic views, injectates, and techniques. The survey is included as supplementary material.

The survey was distributed using Qualtrics survey software via email to 2421 pain medicine physicians at academic centers, private practices, government hospitals, and community settings across the United States. The email list was based on the American Society of Interventional Pain Physicians (ASIPP) membership database. Participants were informed that their responses were anonymous and were provided with de-identified links to the Qualtrics survey. Two reminder emails were sent out at 2-month intervals. The survey was open between May 6, 2020, and August 9, 2020. Participants were instructed to respond as they would have under normal practice conditions, excluding the conditions of the coronavirus 2019 pandemic, which was ongoing at the time of the survey distribution. The data was stored on Qualtrics and accessible by the principal investigator and members of the research team.

Descriptive analysis was performed using Microsoft Excel and Qualtrics' data analysis tools.

RESULTS

Demographics

Out of 2421 who received emails with a link to the survey, 261 pain medicine physicians participated, for a response rate of 11%. The most common primary specialty identified by participants was anesthesiology with 172 (66%) respondents, followed by physical medicine and rehabilitation with 41 (16%). Other primary specialties included neurology, orthopedics, radiology, and internal medicine. Of all respondents, 160 (61%) reported working in private practice, 44 (17%) in academic settings, and 17 (7%) in public or government hospitals; 40 marked other or did not report practice setting. More than half of the respondents (144 (55%)) were in practice for more than 20 years.

Cervical ESI Practices

There were 198 respondents for questions regarding the use of fluoroscopic views during interlaminar injections. Of these, 74% of respondents use at least 2 views, with 36% always using anteroposterior (AP) and lateral views and 38% always using AP and contralateral oblique (CLO) views. Of the 194 who responded to questions about the use of contrast, 54% always use

contrast with real-time fluoroscopy. Of the respondents who variably use contrast with real-time fluoroscopy, 33% always use contrast without real-time fluoroscopy. Regarding the use of a catheter to inject medications, of those who responded, 9% always use a catheter, while 42% often or sometimes use a catheter. For patients with a documented contrast allergy, 87% of respondents would proceed with cervical ILES.

For interlaminar injections, the majority (79%) of respondents preferred the loss of resistance technique to identify the epidural space.

There were 233 respondents for questions regarding the level of injection for cervical interlaminar injections. Of these, 7%, 15%, 26%, 62%, and 92% reported performing injections at C3-4, C4-5, C5-6, C6-7, and C7-T1 levels, respectively; 74% reported performing injections only at C6-7 or C7-T1.

There were 222 who responded as to whether they performed cervical TFESI; of these, 40% reported performing cervical TFESI. Regarding techniques to detect intravascular entry during cervical TFESI, of 88 respondents, 78% always use aspiration while 11% never do. Of 84 respondents, 73% always use extension tubing, while 12% never do. Of 83 respondents, 35% always use a blunt and/or short bevel needle, while 34% never do. Of 83 respondents, 19% always use a local anesthetic test dose, while 28% never do. Seventy-five responded to all 3 questions about the use of imaging to detect intravascular entry during cervical TFESI. Of these, 20% always use contrast followed by fluoroscopy, 70% always use contrast with real-time fluoroscopy, and 23% always use digital subtraction angiography.

Lumbar ESI Practices

When asked which approach is generally used first in the lumbar spine in a patient without prior spine surgery with unilateral symptoms, the majority (~59%) reported choosing the transforaminal route first. In a patient without prior spine surgery with bilateral symptoms, 62% reported using the interlaminar route, followed by 28% using a bilateral transforaminal approach. For a post-laminectomy patient with a same-level disc recurrence, the majority (66%) reported using first the transforaminal route, followed by 15% using a caudal approach, and 9%, 6%, and 4% using an interlaminar approach below, above, and at the level of the disc recurrence, respectively.

There were 198 respondents for questions regarding the use of fluoroscopic views during interlaminar injections: all but one used image guidance for lumbar

interlaminar injections. Of respondents who use image guidance, 61% always use AP and lateral views, and 16% always use AP and CLO views. Of those who responded to questions about the use of contrast, 55% always use contrast with real-time fluoroscopy. Of the respondents who variably use contrast with real-time fluoroscopy, 51% always use contrast without real-time fluoroscopy. In a patient with a documented contrast allergy, 93% of respondents would perform lumbar ILES without contrast. Regarding the use of a catheter to inject medications, of those who responded, 47% never use a catheter, while 6% always use a catheter. For interlaminar injections, the majority (88%) of respondents preferred the loss of resistance technique to identify the epidural space.

There were 173 respondents to all 3 questions regarding whether supraneural, infraneural, or posterolateral approaches are used for lumbar TFESI; 44% often or sometimes use all 3 approaches. For lumbar TFESI, 31% of respondents always use a supraneural approach, while 6% and 3% always use a posterolateral and infraneural approach, respectively. Regarding techniques to detect intravascular entry during lumbar TFESI, of 217 respondents, 74% always use aspiration while 9% never do. Of 204 respondents, 59% always use extension tubing, while 20% never do. Of 205 respondents, 35% always use a blunt and/or short bevel needle, while 41% never do. Of 205 respondents, 7% always use a local anesthetic test dose, while 47% never do. One hundred ninety-six responded to all 3 questions about the use of imaging to detect intravascular entry during lumbar TFESI. Of these 196, 40% always use contrast followed by fluoroscopy, 66% always use contrast with real-time fluoroscopy, and 3% always use digital subtraction angiography. In a patient with a documented contrast allergy, 40% of respondents would perform TFESI.

Injectate Preferences

Injectate preferences for cervical and lumbar ILES and TFESI are listed in Tables 1 and 2.

DISCUSSION

This survey provides an update on the practices of ESI amongst pain medicine physicians and provides details on specifics of how pain physicians perform these procedures.

Fluoroscopy

The use of fluoroscopy for ESI has shown some

Table 1. Respondents that prefer each local anesthetic in injectate.

	Cervical ILESI (n = 224)	Cervical TFESI (n = 91)	Lumbar ILESI (n = 224)	Lumbar TFESI (n = 224)
None	99 (44%)	8 (9%)	54 (24%)	23 (10%)
Lidocaine	84 (38%)	56 (62%)	90 (40%)	100 (45%)
Bupivacaine	34 (15%)	21 (23%)	71 (32%)	90 (40%)
Ropivacaine	6 (2%)	5 (5%)	9 (4%)	10 (4%)
Mepivacaine	1 (1%)	1 (1%)	0	1 (1%)

Table 2. Respondents that prefer each steroid in injectate.

	Cervical ILESI (n = 224)	Cervical TFESI (n = 90)	Lumbar ILESI (n = 221)	Lumbar TFESI (n = 223)	2nd lumbar TFESI (n = 222)
Betamethasone	35 (16%)	3 (3%)	28 (13%)	21 (9%)	26 (12%)
Dexamethasone	85 (38%)	74 (82%)	45 (20%)	116 (52%)	109 (49%)
Methylprednisolone	73 (32%)	5 (6%)	106 (48%)	48 (22%)	53 (24%)
Triamcinolone	31 (14%)	5 (6%)	42 (19%)	38 (17%)	34 (15%)
None	0	3 (3%)	0	0	0

variation amongst providers in the past. In 2002, Cluff et al noted only 49% of practices used fluoroscopy for ESI (10). In that survey, for lumbar ESI, there was a significant difference in private practice groups (77%) vs academics (38%) with regard to the use of fluoroscopy. Similarly, 73% of respondents reported using fluoroscopy for cervical ESI in private practice compared to 39% in academic practice. In 2015, the multidisciplinary pain group emphasized its recommendations for the use of fluoroscopy (9).

In 2018 and 2019, there were 2 surveys that we sent and were reviewed regarding practice variations in ILESI (11) as well as practice variations in TFESI (12). These surveys were sent out before the recommendations of the multidisciplinary working group. Regardless, all physicians in those surveys used image guidance for cervical and lumbar ILESI and TFESI. For this survey, all but one physician reported using fluoroscopic views for lumbar ESI.

Lateral and/or oblique views are essential for needle depth insertion, particularly for cervical ILESI (9). Interestingly in 2018, when reviewing lumbar ILESI, 26.2% always used AP and lateral views, while 9.6% used AP and CLO views. The results of this survey show a change with a trend toward using 2 views, with 61% always using AP and lateral views and 16% always using AP and CLO views.

In our survey in 2018, 69.6% of respondents used more than one view all the time for cervical ILESI, with 35% using AP + lateral, 26.6% using AP + CLO, and

8% using all 3. From this survey, about 4.4% more respondents reported using at least 2 views, and there was a general trend towards using CLO views more, with 38% always using AP and CLO views.

TFESI vs ILESI

Between 1997 and 2014, 90 serious and sometimes fatal events after ESI were reported to the FDA's Adverse Events Reporting System. The majority of these complications were due to either direct spinal cord injury or infarctions associated with TFESIs (8).

In our survey, it was found that in patients with the post-laminectomy syndrome, TFESI was the technique selected by 66% of physicians. TFESI was also utilized more than ILESI when patients presented with both unilateral and bilateral radicular symptoms.

Spinal cord infarctions were attributed to intravascular particulate steroid injection, arterial injury, or plaque dislodgement resulting in embolism. The majority of serious adverse events occurred during cervical and thoracic TFESIs; ILESI and lumbar TFESIs had a lower rate of complication (13).

According to the ASA closed claims database from 2005 to 2008, out of the 9 cases that were associated with spinal cord infarction or stroke from a cervical pain procedure, 5 cases were spinal cord infarcts secondary to a cervical TFESI with particulate steroid, while 3 cases resulted in stroke secondary to intra-arterial injection of particulate steroids during TFESI. Direct needle trauma was actually found to be more common during cervical ILESI (7).

In this survey, 74% reported performing interlaminar injections only at C6-7 or C7-T1, compared to 63.3% from our survey findings in 2018 (11). This is possibly based on reports that at other cervical levels, the epidural space can be more narrow and thus more prone to injury (9).

The use of extension tubing was recommended by the multispecialty working group for cervical TFESI to detect intravascular injection. In this study, 73% always used the extension tubing in this survey compared to 69.4% in the 2019 survey (12).

The other techniques to prevent intravascular injection were acknowledged but not officially recommended by the multidisciplinary pain working group for cervical TFESI, which did not show much of a difference compared to our findings in 2019 (9,12). This includes the use of aspiration, which was always performed by 78% of the respondents, and the use of a blunt and/or short bevel needle, which less than half of the respondents utilized. A local anesthetic test dose did not appear to have a general trend amongst the physicians: 19% always use a local anesthetic test dose while 28% never do.

Injectate Preferences

The 2015 multidisciplinary pain workgroup had published recommendations for ESI, recommending against the use of particulate steroids for cervical TFESI (9).

With regards to cervical TFESI, 40% reported doing this procedure compared to our findings in 2019 of 34%. In this survey, 82% reported using dexamethasone during cervical TFESI, and 3% reported no steroid use, with 15% using particulate steroids. Our findings in 2019 showed that 72.3% preferred using dexamethasone for cervical TFESI, and 4.8% preferred no steroids (12). The Clements et al study in 2019 reported 9% of physicians who responded reported the use of particulate steroids for cervical TFESI (14).

There was more variation in terms of particulate use for lumbar compared to cervical TFESI. From the multidisciplinary pain working group, while most agreed that the use of dexamethasone compared to particulate steroids should be used in initial lumbar TFESI, there was unanimous agreement that there were instances where particular steroids could be used, such as a failed treatment with a nonparticulate steroid (9). In the Clements study of 2019, 41% reported using particulate steroids as opposed to dexamethasone during lumbar TFESI at some point (14). Our findings in 2019 revealed that 36% of respondents preferred dexamethasone for lumbar TFESI (12). This is in contrast to our current results, which show that when steroids were used for lumbar TFESI, 52% used dexamethasone. For a second lumbar TFESI, 49% used dexamethasone.

With regards to cervical ILESI, 44% reported not using any local anesthetic for this procedure, which is similar to the 46% we found in 2018 (11). This compares to the Clements et al study of 2019, which noted that 44% of those surveyed use local anesthetic (14). Although no recommendations were made by the multidisciplinary workgroup, local anesthetic in cervical

ILESI has been linked to subdural block and high spinal with loss of consciousness (15).

Triamcinolone, a particulate steroid, has labeling that specifically states that is not to be used for neuraxial use, including epidural (16,17), however, it is widely used clinically.

In 2019 we found that 2.4% used triamcinolone in cervical TFESI, while our current study interestingly showed that it is used 14% of the time. For cervical ILESI, 15.6% used triamcinolone in 2018 compared to 14% for our current study. For lumbar TFESI, the results between 2019 and now were similar at approximately 17%. For lumbar ILESI, it is used 19% compared to 22.7% in 2018 (11,12).

Use of Contrast

In regards to the use of contrast, the multidisciplinary pain workgroup recommendations include the use of live fluoroscopy for all cervical and lumbar TFESI procedures. This appears to be done routinely among providers for both lumbar and cervical TFESI, whether it was contrast followed by fluoroscopy, always using contrast in real time, and always using digital subtraction angiography (9).

If a patient has a documented allergy to contrast, the majority would still proceed with cervical ESI. In the past, the use of contrast for lumbar ESI has been a point of no general consensus agreement; however, in this survey, the majority of physicians reported that if a patient has a documented contraindication to contrast, they would still perform lumbar interlaminar ESI. With regards to TFESI, in the event of a documented contrast allergy, only 23% would still not perform TFESI.

Limitations

In an effort to improve our response rate, it is important to consider the length of time respondents would need to spend to complete the survey. A relevant topic that was not addressed in this survey is the use of sedation, particularly for cervical ESI. The 2015 multidisciplinary group agreed that if sedation were to be used, the patient should be able to communicate pain or other adverse events that could be related to the procedure (9). It has been found that the use of sedation and general anesthesia during cervical procedures has been linked to higher rates of spinal cord injury (7).

Recall bias is always a potential limitation as the physicians responding to this survey are relying on their memory to answer these questions. Additionally, reasons for a physician's preference for injectate or tech-

nique were not surveyed, which could be important to understanding the differences in certain practice techniques.

In regards to nonresponse bias, there was a response rate of 11% out of 2421 pain medicine physicians. There was no clear reason as to why certain physicians responded while others did not. In terms of

demographics, the majority of physicians were from private practice, as compared to academic settings or from public/ government hospitals. More than half were in practice for more than 20 years. Thus, it is possible that the survey tended to reflect the practices of more experienced private practice pain physicians.

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