



Establishing a common language for lumbar transforaminal epidural steroid injections

Ryan Berger¹, Landon Bulloch^{2^}, Alexander Hysong², Brandon Huggins¹, Nicholas Horan¹, Ronald Van Der Noord¹, Bradley Segebarth¹

¹OrthoCarolina Spine Center, Charlotte, NC, USA; ²Atrium Health, Department of Orthopaedic Surgery, Carolinas Medical Center, Charlotte, NC, USA

Contributions: (I) Conception and design: R Berger; (II) Administrative support: N Horan, R Van Der Noord, B Segebarth; (III) Provision of study materials or patients: L Bulloch; (IV) Collection and assembly of data: A Hysong, L Bulloch, B Huggins; (V) Data analysis and interpretation: R Berger; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: Landon Bulloch, MD. Atrium Health, Department of Orthopaedic Surgery, Carolinas Medical Center, P.O. Box 32861 Charlotte, NC 28232, USA. Email: LANDON.BULLOCH@atriumhealth.org.

Background: Patients presenting to spine surgeons for lumbar radiculopathy often undergo initial conservative treatment including medications, therapy, and lumbar transforaminal epidural steroid injections. Despite a growing number of spinal injections performed, there is a lack of available data regarding the occurrence of wrong-site injections. However, when examined, the discrepancies between ordering level and level of epidural steroid injection performed are immense. To aid with this issue, we propose that instead of ordering a lumbar transforaminal epidural steroid injections at a given level, it should be ordered to address a specific nerve root with laterality. This has the potential to reduce wrong-site procedures and improve patient outcomes.

Methods: Retrospective chart review of 60 patients at a private orthopaedic spine practice under the care of spine surgeons or physician assistants over a 1-year period. The progress note, injection order form, procedure note, and procedural fluoroscopy were reviewed. If there were inconsistencies between one or more of these steps, it was deemed a failure. Results were analyzed to assess for any differences in outcomes between the two groups. We calculated our sample size prior to the study and powered it at 90%; descriptive statistics, Chi-square, Fisher's exact test, Student's *t*-test, and Wilcoxon rank sum tests were used where appropriate utilizing SAS v9.4.

Results: Thirty-seven patients (37/60, 61.6%) were considered a failure. There were no failures when ordering an S1 nerve root injection. We identified one wrong-site procedure and one wrong-level order that was identified and corrected by the interventionalist.

Conclusions: There were multiple inconsistencies identified at various steps in the injection ordering process. This indicates a need to standardize the language used in this process to avoid wrong-site procedures. There were no inconsistencies in ordering an S1 injection, likely because this injection could only be ordered at the nerve root. It is also critical to utilize and save a localization film to ensure accuracy and accountability. We propose indicating the affected nerve root in all cases rather than the level of disc pathology would avoid confusion.

Keywords: Pain; spine-low back; quality improvement; patient safety

Submitted Jul 30, 2021. Accepted for publication Nov 22, 2021.

doi: 10.21037/jss-21-71

View this article at: <https://dx.doi.org/10.21037/jss-21-71>

[^] ORCID: 0000-0003-2274-6957.

Introduction

The process of ordering lumbar transforaminal epidural steroid injections (LTFESIs) can create confusion between spine surgeons and pain management physicians. Unlike the cervical spine, a lumbar paracentral disc herniation, lateral recess stenosis, or central pathology can affect the traversing nerve root at a given level. For example, an L4/L5 right-sided paracentral disc herniation would affect the right L5 nerve root. The pain management physician would inject into the right L5 foramina at the L5/S1 level to target this pathology. However, perhaps because a surgeon would perform a microdiscectomy at the L4/L5 level for this pathology, the surgeon may be inadvertently prone to order an L4/L5 injection. To eliminate this confusion, we propose that instead of ordering a lumbar injection at a given level, the injection is simply ordered to address a specific nerve root with a specified laterality (ex. right L5 nerve root). This is significant because it has the potential to eliminate wrong-site procedures and improve patient safety, communication, and positive outcomes.

Despite a growing number of spinal injection procedures, there exists a paucity of evidence on wrong-site injections. A 2010 analysis identified 13 cases of wrong-site injections out of roughly 49,000 pain management procedures, five of which were transforaminal epidural steroid injections (1). The authors

identified multiple lapses of universal protocol in most cases. However, these cases were identified by reviewing quality improvement records. As such, it is likely that these are under-reported. Additionally, it is unclear if an injection would be identified as wrong-site if it was consistent with the injection order, despite the order being incorrect. To our knowledge, there is no such study specifically analyzing the communication and ordering process for spinal injections initiated by the spine surgeon and inconsistencies in ordering patterns.

The purpose of this study is to analyze the ordering process and language of LTFESIs with the main objective of proposing a common language between spine surgeons and pain management physicians for ordering LTFESIs.

We present the following article in accordance with the STROBE reporting checklist (available at <https://dx.doi.org/10.21037/jss-21-71>).

Methods

We conducted a retrospective chart review of prospectively collected data of 60 patients at a single, private, orthopaedic spine practice under the care of spine surgeons or physician assistants over a 1-year period. Patients with missing documentation and younger than age 18 were excluded. Demographics can be found in *Table 1*. The progress note, injection order form, procedure note, and procedural

Table 1 Demographics

Variables	Failure			P value
	Overall (N=60)	Yes (n=37)	No (n=23)	
Age (in years) at injection, median (IQR)	59 (45.5, 70.5)	62 (48, 72)	54 (37, 68)	0.181
BMI, median (IQR)	28.5 (24, 34)	28 (26, 34)	29 (22, 34)	0.648
Sex, n (%)				0.920
Female	37 (61.7)	23 (62.2)	14 (60.9)	
Male	23 (38.3)	14 (37.8)	9 (39.1)	
Race, n (%)				0.357
White	39 (65.0)	22 (59.5)	17 (73.9)	
Black, African American	17 (28.3)	13 (35.1)	4 (17.4)	
Declined/unknown	4 (6.7)	2 (5.4)	2 (8.7)	
Ethnicity, n (%)				>0.99
Not Hispanic or Latino	49 (81.7)	30 (81.1)	19 (82.6)	
Declined	6 (10.0)	4 (10.8)	2 (8.7)	
Hispanic or Latino	5 (8.3)	3 (8.1)	2 (8.7)	

Table 2 Failure rates

Method of failure	Failure (total n=60)		
	Yes (n=37)	Overall	Failures
Taxonomy*	17	28.30%	45.90%
Order vs. image [#]	18	30.00%	48.60%
Procedure note vs. image [§]	8	13.30%	21.60%

* , taxonomy discrepancy between the original plan outlined in the ordering physician's note versus the injection order form; [#] , differences in the level written on the Injection order form versus the level seen on intra-operative fluoroscopy; [§] , discrepancies between the procedural note available after epidural steroid injection versus the level seen on intra-operative fluoroscopy.

Table 3 Order information

Physician orders and patient outcomes	Failure			P value
	Overall (n=60)	Yes (n=37)	No (n=23)	
Order description, n (%)				0.766
Ordered at level	40 (66.7)	26 (70.3)	14 (60.9)	
Ordered at nerve root	15 (25.0)	8 (21.6)	7 (30.4)	
Ordered at level and nerve root	5 (8.3)	3 (8.1)	2 (8.7)	
Outcome, n (%)				0.822
Provoked pain	54 (90.0)	34 (91.9)	20 (87.0)	
No effect	4 (6.7)	2 (5.4)	2 (8.7)	
No complications	2 (3.3)	1 (2.7)	1 (4.3)	

fluoroscopy were reviewed. Procedural fluoroscopic images were reviewed by the primary author of this paper and vertebral levels were counted using the methods described in Spinal Deformity Study Group's radiographic measurement manual (2). If there were inconsistencies between one or more of these steps, it was deemed a failure (Table 2). Failures were then categorized into subtypes to differentiate whether the discrepancies were found in the taxonomy used between the ordering physician's intended injection level as described in previous office visit documentation versus the injection order itself, the injection order versus the fluoroscopic imaging, or procedure note in comparison to the fluoroscopic imaging.

Statistical analysis

Statistical analysis was then performed by the lead author to assess for any differences in outcomes between the groups and significance of the findings. We calculated our sample size prior to the study and powered it at 90%; Descriptive

statistics, Chi-square, Fisher's exact test, Student's *t*-test, and Wilcoxon rank sum tests were used where appropriate utilizing SAS v9.4. The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Ethical statement

The study was conducted in accordance with Declaration of Helsinki (as revised in 2013). The study was approved by ethics board of OrthoCarolina Research Institute (IRB#01-21-03E) and individual consent for this retrospective study was waived.

Results

Thirty seven out of sixty encounters (61.6%) were considered a failure (Table S1). A breakdown of the order and outcome associated with failure can be found in Table 3. Additionally,

a further analysis of the different modes of failure can be seen in *Table 2*. There were no failures when ordering an S1 nerve root injection. We identified one wrong-site procedure (laterality) and one wrong-level order that was identified and corrected by the interventionalist. There was a higher rate of failure if the injection was ordered by a mid-level provider versus a physician ($P=0.009$) (*Table 4*). There were no statistically significant differences noted in patient outcomes regarding provoked pain during the procedure or complications.

Discussion

There were no inconsistencies in ordering an S1 injection, likely because this injection could only be ordered at the nerve root (*Figure 1*). Fortunately, no additional complications were noted in patients who had a failure versus those without. Although not intended, there may also be a diffuse effect of the LTFESI that may provide relief even in the setting of a wrong-site procedure. The most common method of failure was differences in the injection order form and the level notated by the intra-operative fluoroscopy as seen in *Figures 2,3*. Next most common error was differences in language used in the ordering physician's plan and the injection order form itself. Overall, significant variation is seen throughout the charting process and this is likely attributing to the high volume of deemed failures. Additionally, one obstacle to implementing a common LTFESI language is the fact that some insurers require notating a level (ex. L4/L5) for approval.

Lastly, it is critical to utilize and save a localization film to ensure accuracy and accountability. The interventionalist plays an important role in ensuring the accuracy of orders and correlating patient imaging with the intended injection site. To attempt to prevent medical errors, the World Health Organization's Surgical Safety Checklist includes a component regarding displaying pertinent imaging during procedures (3). Another critical checkpoint not discussed in the literature is in the case of the interventionalist evaluates the patient and imaging for him/herself and decides to inject at a different site than originally received from the referring physician. This factor could lead to intentional targeting of an adjacent nerve root and although deemed as a failure in our study, is in fact not a medical error but rather a part of the medical decision making process. Reasons for changing

injection levels could include variations in symptomatology of the patient or anatomic structures visible on MRI that restrict injection such as osteophyte formation or worsening foraminal stenosis.

Limitations

This is a single center study with inherent limitations due to its retrospective design. For example, it does not take into account if other practices are already using this nomenclature. There is also subjectivity in defining a failure as no strict definition exists beyond a wrong-site procedure. Furthermore, we did not review any imaging data except for the procedural fluoroscopy. Additionally, procedural fluoroscopy was not cross referenced with lumbar MRI imaging. Additionally, full body spinal imaging was not available for review. This does not allow for identification of lumbar sacralization and therefore does not ensure we accurately nor consistently numbered the vertebral bodies in comparison to the previous reviewers (4). Lastly, there was no patient follow-up beyond the date of the initial injection.

Conclusions

There were multiple inconsistencies identified at various steps in the injection ordering process. This study also suggests a significantly higher incidence of wrong-site and near-miss procedures than previously reported. This indicates a need to standardize the language used in this process to avoid wrong-site procedures, as well as provide education to those involved in the ordering process. We propose indicating the affected nerve root in all cases rather than the level of disc pathology to avoid confusion. For example, the surgeon would indicate the left L5 nerve root instead of notating a left L5/S1 injection on an order form. The one near-miss procedure in this study may have been prevented if this was implemented. Beyond this direct application of semantics regarding ordering of a nerve root injection, the idea behind standardization of certain medical practices is the foundation to preventing medical errors. By standardizing this process, we can enable more providers to work together towards better patient care and error prevention. Further studies are necessary to assess the effectiveness of updating injection order forms to reflect this new nomenclature.

Table 4 Injection information and patient history

Diagnosis and description of prior surgical procedures	Failure			P value
	Overall (n=60)	Yes (n=37)	No (n=23)	
Diagnosis, n (%)				0.994
Lumbar radiculopathy	33 (55.0)	20 (54.1)	13 (56.5)	
Low back pain	7 (11.7)	4 (10.8)	3 (13.0)	
Spinal stenosis	5 (8.3)	2 (5.4)	3 (13.0)	
Lumbar disc herniation	5 (8.3)	3 (8.1)	2 (8.7)	
Lumbar degenerative disc disease	2 (3.3)	1 (2.7)	1 (4.3)	
None	1 (1.7)	1 (2.7)	0 (0.0)	
Lumbar radiculopathy	1 (1.7)	1 (2.7)	0 (0.0)	
Lumbar radiculopathy and spinal stenosis	1 (1.7)	1 (2.7)	0 (0.0)	
Lumbar stenosis	1 (1.7)	0 (0.0)	1 (4.3)	
Right L4/5 and left L5/S1	1 (1.7)	1 (2.7)	0 (0.0)	
Lumbar disc herniation and lumbar radiculopathy	1 (1.7)	1 (2.7)	0 (0.0)	
Spondylolisthesis	1 (1.7)	1 (2.7)	0 (0.0)	
Lumbar degenerative disc disease, spinal stenosis	1 (1.7)	1 (2.7)	0 (0.0)	
Prior surgery, n (%)				0.137
No	46 (76.7)	26 (70.3)	20 (87.0)	
Yes	14 (23.3)	11 (29.7)	3 (13.0)	
If yes, describe, n (%)				>0.99
Left L3/L4 far lateral microdiscectomy	1 (1.7)	1 (2.7)	0 (0.0)	
X stop L4/L5 and L5/S1	1 (1.7)	1 (2.7)	0 (0.0)	
Left L5/S1 decompression	1 (1.7)	1 (2.7)	0 (0.0)	
Unknown	1 (1.7)	0 (0.0)	1 (4.3)	
Right L5/S1 laminotomy	1 (1.7)	0 (0.0)	1 (4.3)	
Left L5/S1 laminotomy with microdiscectomy	1 (1.7)	0 (0.0)	1 (4.3)	
L4/5 instrumented fusion	1 (1.7)	1 (2.7)	0 (0.0)	
Right L5/S1 hemilaminectomy	1 (1.7)	1 (2.7)	0 (0.0)	
L4/L5 microdiscectomy	1 (1.7)	1 (2.7)	0 (0.0)	
Left L5/S1 mircordisc	1 (1.7)	1 (2.7)	0 (0.0)	
L4/S1 decompression and fusion	1 (1.7)	1 (2.7)	0 (0.0)	
Left L5/S1 microdiscectomy	1 (1.7)	1 (2.7)	0 (0.0)	
L4/L5 decompression and fusion and L5/S1 lumbar spine surgery (not specified)	1 (1.7)	1 (2.7)	0 (0.0)	
L5/S1 decompression and fusion	1 (1.7)	1 (2.7)	0 (0.0)	

Table 4 (continued)

Table 4 (continued)

	Failure			P value
	Overall (n=60)	Yes (n=37)	No (n=23)	
Side, n (%)				0.867
Right	32 (53.3)	20 (54.1)	12 (52.2)	
Left	20 (33.3)	13 (35.1)	7 (30.4)	
Bilateral	8 (13.3)	4 (10.8)	4 (17.4)	
Ordering provider type, n (%)				0.009
Pa	40 (66.7)	20 (54.1)	20 (87.0)	
Attending	20 (33.3)	17 (45.9)	3 (13.0)	

Consult / Evaluation

PHYSIATRY PROCEDURE SCHEDULING

Date: _____ Insurance: _____ Acct # _____
 Patient: _____ SS#: _____ DOB: _____
 Telephone: _____ Mobile: _____ Clinical: _____
 Diagnosis: _____ ICD 10: _____ Male Female
 Referring Provider _____ Signature: _____

Follow up Appointment with: _____ or PRN

Prior Injections: Date of last injection: _____ Duration of relief: _____ day(s) / week(s) % of relief: _____

Height _____ Weight _____ lbs BMI _____ Allergies- Medications: Yes / No _____
 Are you Diabetic: Yes / No Flu Shot Yes / No Date _____ Lidocaine: Yes / No Contrast Dye: Yes / No
 Currently taking Antibiotics? Yes / No _____ Heart Stents: Yes / No _____
 Currently take: Pain Meds / NSAIDS / Aspirin / Coumadin / Blood Thinning Medication _____
 Managing provider for blood thinners: _____

Laterality: **Level:** **Physician:** **Location:**

Right = 1 unit C1-C2 L1-L2
 Left = 1 unit C2-C3 L2-L3
 Bilateral = 2 unit C3-C4 L3-L4
 C4-C5 L4-L5
 C5-C6 L5-S1
 C6-C7 S1
 C7-T1

Please Indicate # of Procedure(s) Requested:

Transformaminal ESI / Selective NRB
 Lumbar _____ 64483 (1st level), _____ 64484 (# of add'l levels)
 Cervical / Thoracic _____ 64479 (1st level), _____ 64480 (# of add'l levels)

Interlaminar ESI (Midline injection, do not indicate laterality)
 Lumbar _____ 62323
 Cervical / Thoracic _____ 62320 w imaging _____ 62321

Facet Joint Cortisone Injection / Diagnostic Facet Joint Medial Branch Nerve Block (2 consecutive appts)
 Lumbar _____ 64493 (1st level) _____ 64494 (2nd level) _____ 64495 (3rd level)
 Cervical / Thoracic _____ 64490 (1st level) _____ 64491 (2nd level) _____ 64492 (3rd level)

Radiofrequency Ablation Facet Joint (Not Covered by Medicare or Medicaid in ASCs)
 Lumbar _____ 64635 (1st level) _____ 64636 (# of add'l levels)
 Cervical / Thoracic _____ 64633 (1st level) _____ 64634 (# of add'l levels)

Sacroiliac Joint Injection _____ 27096 (Not Covered by Medicare or Medicaid in ASCs)
Hip Injection Diagnostic _____ 27093 -injection procedure for hip arthrogram (Not covered by Medicare at a ASCs)
Hip Injection Therapeutic _____ 20610 & 77002 - hip injection/aspiration under fluoroscopic guidance
Thoracic Kyphoplasty _____ 22513 (1st level) _____ 22515 (add. level)x's _____ (Kyphoplasty Not Covered by Medicaid in ASCs)
Lumbar Kyphoplasty _____ 22514 (1st level) _____ 22515 (add. level)x's _____ (Kyphoplasty Not Covered by Medicaid in ASCs)

Other: _____
 Please email coding for any unknown codes

INJECTIONS
 Failure to provide notification of a cancellation within 24 hours of scheduled appointment may result in a \$100.00 deposit prior to rescheduling. I have been advised of this policy.

Figure 1 Injection order form.

Managing provider for blood thinners: N/JH

Laterality:	Level:	Physician:	Location:
Right = 1 unit	C1-C2 L1-L2	___ First Available OC Provider	___ First Available Location ___ OC Shelby
<u>Left</u> = 1 unit	C2-C3 L2-L3	___ Chasnis (82)	___ OC Ballantyne ___ OC Spine
Bilateral = 2 unit	C3-C4 L3-L4	___ Ciaccia (19A)	___ OC Concord ___ Charlotte Surgery Center
	C4-C5 L4-L5	___ Fiore (515) (No cerv.)	___ OC Gastonia ___ Matthews Surgery Center
	C5-C6 <u>L5-S1</u>	___ Gonchikar (54A)	___ OC Hickory ___ Edgewater
	C6-C7 S1	<input checked="" type="checkbox"/> Lazeski (773)	___ OC Huntersville
	C7-T1	___ O'Connell (66A)	___ OC Lake Norman
		___ Parikh (906)	___ OC Matthews
		___ VanDerNoord (72)	___ OC Monroe

Please Indicate # of Procedure(s) Requested:

Transforaminal ESI / Selective NRB
 Lumbar 64483(1st level), ___ 64484 (# of add'l levels)
 Cervical / Thoracic ___ 64479(1st level), ___ 64480 (# of add'l levels)

Interlaminar ESI (Midline injection, do not indicate laterality)
 Lumbar ___ 62323
 Cervical / Thoracic ___ 62320 w imaging ___ 62321

Facet Joint Cortisone Injection / Diagnostic Facet Joint Medial Branch Nerve Block (2 consecutive appts)
 Lumbar ___ 64493 (1st level) ___ 64494 (2nd level) ___ 64495 (3rd level)
 Cervical / Thoracic ___ 64490 (1st level) ___ 64491 (2nd level) ___ 64492(3rd level)

wants to do in August

Figure 2 Completed injection order form.

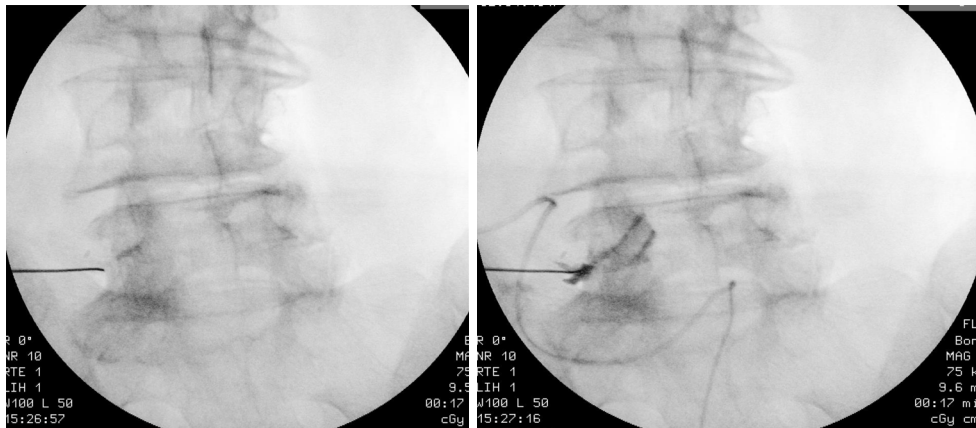


Figure 3 Intra-operative fluoroscopy corresponding with Figure 2.

Acknowledgments

Funding: This study was supported by OrthoCarolina Research Institute (OCRI).

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at <https://dx.doi.org/10.21037/jss-21-71>

Data Sharing Statement: Available at <https://dx.doi.org/10.21037/jss-21-71>

Conflicts of Interest: All authors have completed the ICMJE

uniform disclosure form (available at <https://dx.doi.org/10.21037/jss-21-71>). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolves. The study was conducted in accordance with Declaration of Helsinki (as revised in 2013). The study was approved by ethics board of OrthoCarolina Research Institute (IRB#01-21-03E) and individual consent for this retrospective study was waived.

Open Access Statement: This is an Open Access article distributed in accordance with the Creative Commons

Attribution-NonCommercial-NoDerivs 4.0 International License (CC BY-NC-ND 4.0), which permits the non-commercial replication and distribution of the article with the strict proviso that no changes or edits are made and the original work is properly cited (including links to both the formal publication through the relevant DOI and the license). See: <https://creativecommons.org/licenses/by-nc-nd/4.0/>.

References

1. Cohen SP, Hayek SM, Datta S, et al. Incidence and root cause analysis of wrong-site pain management procedures: a multicenter study. *Anesthesiology* 2010;112:711-8.
2. O'Brien MF, Kiklo T, Blanke KM, et al. (editors). Radiographic measurement manual. Memphis, USA: Medtronic Sofamor Danek Inc., 2008.
3. Haynes AB, Weiser TG, Berry WR, et al. A surgical safety checklist to reduce morbidity and mortality in a global population. *N Engl J Med* 2009;360:491-9.
4. Lian J, Levine N, Cho W. A review of lumbosacral transitional vertebrae and associated vertebral numeration. *Eur Spine J* 2018;27:995-1004.

Cite this article as: Berger R, Bulloch L, Hysong A, Huggins B, Horan N, Van Der Noord R, Segebarth B. Establishing a common language for lumbar transforaminal epidural steroid injections. *J Spine Surg* 2021;7(4):467-474. doi: 10.21037/jss-21-71

Table S1 Raw data

Raw data	Plan	Injection order	Injection note	Injection fluoro level	Frequency
Yes	Right L5 TFESI	Right L5/S1 TFESI	Right L5/S1 TFESI	Right L5/S1	4
Yes	Right L5 TFESI	Right L5/S1 TFESI	Right L5-S1 TFESI	Right L5/S1	1
Yes	Right L5 TFESI	Right L5 TFESI	Right L5/S1 TFESI	Right L5/S1 TFESI	1
Yes	Right S1 TFESI	Right S1 TFESI	Right S1 TFESI	None	1
Yes	Left L5 TFESI	Left L5/S1 TFESI	Left L5/S1 TFESI	Left L5/S1	1
Yes	Left L5 TFESI	Left L5 TFESI	Left L5/S1 TFESI	Left L5/S1	1
Yes	Left L5 TFESI	Left L5 TFESI	Left L5/S1 TFESI	Left L5/S1 TFESI	1
Yes	N/a	Right I5/s1 tfesi	Right I5/s1 tfesi	Right I5/s1	1
Yes	N/a	Right I5/s1 tfesi	Right I5-s1 tfesi	Right I5/s1	1
Yes	N/a	Bilateral I5/s1 tfesi	Bilateral I5/s1 tfesi	Bilateral I5/s1 tfesi	1
Yes	N/a	Right I3/I4 and right I4/I5 tfesi	Right I3/I4 and right I4/I5 tfesi	Right I3/I4 and right I4/I5	1
Yes	Right L5/S1 TFESI	Right L5/S1 and S1 TFESI	Right L5/S1 TFESI and right S1 TFESI	L5/S1 and S1	1
Yes	Right L4/L5 TFESI	Left L3/L4 and L4/L5 TFESI	Left L3/L4 TFESI and left L4/L5 TFESI	Left L3/L4 and left L4/L5	1
Yes	Left L5 and S1 TFESI	L5 and S1 TFESI	Left L4/L5 and L5/S1 TFESI (top of note); left L5/S1 and left S1 TFESI (bottom of note)	Left L5/S1 and left S1	1
Yes	Left L5 and S1 TFESI	Left L5 and S1 TFESI	Left L4/5 and left L5/S1 TFESI (at the bottom of the note it mentions L5/S1 TFESI and S1 TFESI)	Left L5/S1 and left L5/S1	1
Yes	Right L4 TFESI	Right L4 TFESI	Right L4/L5 TFESI	Right L4/L5	1
Yes	Right L4 TFESI	Right L4/L5 TFESI and right L4 TFESI	Right L4/L5 TFESI	Right L4/L5	1
Yes	Bilateral L3 TFESI and bilateral L4 TFESI	Bilateral L3/L4 TFESI	Bilateral L3/L4 TFESI	Bilateral L3/L4	1
Yes	Bilateral L5-S1 (targeting the L4-L5 lateral recess) TFESI	Bilateral L4/L5 and L5/S1 TFESI	Bilateral L4/L5 and L5/S1 TFESI	Bilateral L4/L5 and L5/S1	1
Yes	Left L1 TFESI	Left L1 TFESI	Left L1/L2 TFESI	Left L1/L2	1
Yes	Left L2 TFESI	Left L2/L3 TFESI	Left L2/L3 TFESI	Left L3/L4 TFESI	1
Yes	Left L3 nerve root	Left L3 TFESI	Left L3/L4 TFESI	Left L3/L4 TFESI	1
Yes	Left L3/L4 TFESI	Left L3/L4 TFESI	Left L3/L4 TFESI	Unable to localize	1
Yes	Left L4 TFESI and left L5 TFESI	Left L4/5 and L5/S1 TFESI	Left L4/L5 and L5/S1 TFESI	Left L4/L5 and L5/S1	1
Yes	Left L4 and left S1 TFESI	Left L4/L5 and left S1 TFESI	Left L4/L5 and left S1 TFESI	Left L4/L5 and left S1	1
Yes	Left L4/5 TFESI	Left L4/5 TFESI	Left L5/S1 TFESI	L5/S1	1
Yes	None	Bilateral I3/I4 tfesi	Bilateral I3/I4 tfesi	Not saved	1
Yes	Right L3/L4 TFESI and right L3/L4 facet joint injections	Right L3/L4 TFESI and right L3/L4 facet joint injections	Right L3/L4 TFESI and right L3/L4 facet joint injections	Unable to localize	1
Yes	Right L4 TFESI and L5 TFESI	Right L4 TFESI and right L5 TFESI	Right L4/5 TFESI and right L5/S1 TFESI	Right L4/5 and right L5/S1	1
Yes	Right L4 TFESI and right L5 TFESI	Right L4 TFESI and right L5 TFESI	Right L4/5 and right L5/S1 TFESI	Right L4/5 and right L5/S1	1
Yes	Right L4 and right L5 TFESI	Right L4 and right L5 TFESI	Right L4/L5 TFESI and right L5/S1 TFESI	Right L4/L5 TFESI and right L5/S1	1
Yes	Right L4/L5 TFESI to target right L4 nerve root	Right L4/L5 TFESI	Right L5/S1 TFESI	Right L5/S1	1
Yes	Right L5 TFESI and left S1 TFESI	Right L5 TFESI and left S1 TFESI	Right L5/S1 TFESI and left S1 TFESI	Right L5/S1 and left S1	1
Yes	Right L5 and right S1 TFESI	Right L5/S1 and right S1 TFESI	Right L5/S1 and right S1 TFESI	Right L5/S1 and right S1	1
No	Right S1 TFESI	Right S1 TFESI	Right S1 TFESI	Right S1	4
No	Left L5 TFESI	Left L5 TFESI	Left L5 TFESI	Left L5 TFESI	1
No	Right L5/S1 TFESI	Right L5/S1 TFESI	Right L5/S1 TFESI	Right L5/S1	1
No	Right L5/S1 TFESI	Right L5-S1	Right L5/S1 TFESI	Right L5/S1	1
No	Right L5/S1 TFESI	Right L5/S1 TFESI, right L5 nerve root block	Right L5/S1 TFESI	Right L5/S1	1
No	Left L5/S1 TFESI	Left L5/S1 TFESI	Left L5/S1 TFESI	Left L5/S1	2
No	Left L5/S1 TFESI	Left L5/S1 TFESI	Left L5/S1 TFESI	Left L5/S1 TFESI	1
No	Right L4/L5 TFESI	Right L4/L5 TFESI	Right L4/L5 TFESI	Right L4/L5	2
No	Bilateral L5/S1 TFESI	Bilateral L5/S1 TFESI	Bilateral L5/S1 TFESI	Bilateral L5/S1	2
No	Left S1 TFESI	Left S1 TFESI	Left S1 TFESI	Left S1	2
No	S1 tfesi	Right s1 tfesi	Right s1 tfesi	Right s1	1
No	Bilateral L4/L5 TFESI	Bilateral L4/L5 TFESI	Bilateral L4/L5 TFESI	Bilateral L4/L5 TFESI	1
No	Bilateral S1 TFESI	Bilateral S1 TFESI	Bilateral S1 TFESI	Bilateral S1	1
No	Left L4/L5 and L5/S1 TFESI	Left L4/L5 and L5/S1 TFESI	Left L4/5 and L5/S1 TFESI	Left L4/5 and L5/S1	1
No	Right L5-S1 TFESI	Right L5-S1	Right L5/S1 TFESI	Right L5/S1	1
No	Right L5/S1 and right S1 TFESI	Right L5/S1 and right S1 TFESI	Right L5/S1 and right S1 TFESI	Right L5/S1 and right S1	1