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Assessing the effectiveness of fluoroscopy-guided transforaminal and caudal epidural steroid injections in alleviating chronic pain post-spinal surgery

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Abstract
Background: Chronic Pain following Spinal Surgery (CPSS), formerly known as Failed Back Surgery Syndrome, is characterized by persistent or recurring back pain or leg pain occurring beyond three months post spinal surgery (TLIF/PLIF) CPSS patients experience significant functional disability and report a lower quality of life compared to individuals with other chronic pain conditions. The objective of this study is to compare the advantages, safety, and mid-term effects of fluoroscopy-guided transforaminal (TF) epidural steroid injection (ESI) to caudal (CA) epidural steroid injection in patients experiencing chronic pain after spinal surgery (CPSS). The study aims to assess the effectiveness of pain relief and improvement in functionality resulting from these two approaches.
Materials and Methods: This was a retrospective study that included 30 patients who underwent fluoroscopy-guided transforaminal (TF) or caudal epidural steroid injection (CESI) for the diagnosis CPSS between April 2022 and December 2022.The frequencies of complications, adverse events, treatment effects, and functional improvements were compared between the two procedures with a follow up period of 6 months.
Results: Oswestry Disability Index (ODI) scores demonstrated improvement in both groups at 6 months period, without meaningful difference between groups. Patients in TFESI group had an ODI score with an average of 18.1 ranging from 16 to 22, while the CESI group averaged 18.7 ranging from 12 to 22. The amount of time used for the injection procedure was shorter in CESI group than in TFESI group. All patients were happy with the procedure and the functional outcome.
Conclusion: The results of the present study indicate that fluoroscopy-guided cervical interlaminar epidural steroid injection (CESI) and transforaminal epidural steroid injection (TFESI) are equally effective in reducing pain and improving function in patients with cervical radicular pain. Patients experience less discomfort during the injection and report higher satisfaction with the CA approach. Both methods are effective, but the CA approach tends to provide better patient satisfaction and a shorter procedure time.

Keywords: Epidural block, transforaminal, caudal, fluoroscopy, CESI, TFESI

Introduction
Chronic Pain following Spinal Surgery (CPSS), formerly known as Failed Back Surgery Syndrome, is characterized by persistent or recurring back pain or leg pain occurring beyond three months post spinal surgery (TLIF/PLIF) [1, 2]. This condition commonly arises after spinal stenosis or disc herniation surgeries [1-4]. Approximately 20% of patients who undergo lumbar spinal surgery develop pain that requires additional interventions to alleviate symptoms [1-5]. CPSS patients experience significant functional disability and report a lower quality of life compared to individuals with other chronic pain conditions [1-3]. Possible contributing factors include epidural fibrosis, acquired stenosis, sacroiliac joint pain, and facet joint pain [6]. When conservative management and medication fail to provide relief, CPSS is often managed with epidural steroid injections (ESIs) [6-9]. Previous studies have demonstrated the effectiveness of Caudal (CA)-ESI, resulting in improved functional status in over 55% of patients and significant pain relief in 60% to 70% of chronic back pain patients, including those with CPSS [8]. Transforaminal (TF)-ESI, administered under fluoroscopy (FL) guidance,

offers a precise and effective route of administration, targeting the irritated nerve root as a potential pain source [10]. TF-ESI also provides better ventral epidural spreading compared to CA-ESI [10]. However, there is limited research directly comparing the two injection methods in CPSS patients. Therefore, this retrospective comparative study aims to assess the mid-term treatment effects and safety of 100 FL-guided TF-ESIs and CA-ESIs in CPSS patients with unilateral lower lumbar radicular pain, while also exploring potential factors influencing treatment outcomes.

Materials and Methods

This was a retrospective study that included 30 patients who underwent fluoroscopy-guided transforaminal (TF) or caudal epidural steroid injection (CESI) for the diagnosis CPSS between April 2022 and December 2022 at our Department of Orthopedics. The study focused on patients with unilateral radicular pain in the lower extremities and back pain caused by CPSS, who were referred to the outpatient department during the study period. Eligible participants were 18 years or older and had experienced radiating pain that did not respond to anti-inflammatory medications, analgesics, or physical therapy for at least 3 months following spine surgery (TLIF/PLIF). Multiple level fixation done (2 or 3 levels) for the patients included in the study Patients with sacroiliac joint or facet joint pain, psychiatric disorders, and systemic inflammatory diseases such as rheumatoid disorders were excluded. A minimum of 3-month period, post spinal surgery was considered before including them in the study. All procedures were performed on an outpatient basis. The clearance had been obtained from ethical committee. Patients were randomized using lots to split them between the two interventions.

During fluoroscopy-guided CESI, patients were positioned prone on a fluoroscopic table with a pillow under their hips to tilt the pelvis. After sanitizing the sacrococcygeal area, the tip of the coccyx was located through palpation with sterile gloves. A 22-gauge, 3.5-inch length spinal needle was then inserted into the epidural space under the guidance of an image intensifier. To confirm correct needle placement in the epidural space, a small amount of contrast media was injected before the drug injection. Following the injection of a 1-2 mL test dose of 1% lidocaine, a drug mixture containing 20 mL of 0.5% lidocaine and 2 mL of 10 mg dexamethasone was administered.

For fluoroscopy-guided TF epidural steroid injection (TFESI), patients were positioned prone with a pillow between the lower abdomen and iliac crest. The target point directly inferior to the pedicle was determined after confirming the trajectory view from the oblique view of the C-arm. After sanitizing the needle insertion site, a 23-gauge, 3.5-inch spinal needle was gradually advanced from the 6 o'clock direction toward the target inferior to the pedicle under radiologic guidance. The needle was then advanced in an anterior and superior direction of the neural foramen, and optimal needle placement in the anterior epidural space was confirmed by injecting a small volume of radio contrast media under intermittent fluoroscopic imaging. Following the test dose of 1% lidocaine, a mixture containing 1 mL of 0.5% lidocaine and 2 mL of 10 mg dexamethasone was injected.

In both groups, the treatment effect and satisfaction with the procedure were assessed two weeks after the first injection, and if conditions were met, a second injection was administered. Functional outcome was evaluated using the Oswestry Disability Index (ODI) six months after the last injection, ranging from 0 to 100. The collected data was analyzed using IBM SPSS Version 22.0. The Chi-square test, Fisher's exact test, and Mann-Whitney U method were employed to compare the baseline demographic characteristics between the two groups. The Chi-square test was used to assess differences in proportions, with a P-value of less than 0.05 considered statistically significant.

Results

30 patients with chronic pain following spinal surgery (CPSS) who underwent fluoroscopy-guided transforaminal (TFESI) or caudal epidural steroid injection (CESI) were studied between April 2022 and December 2022.Of these ,15 patients underwent TFESI and the other 15 patients underwent CESI. There were 6 males and 24 female patients in our study (Figure 1). The mean age of the patients was 65.1 years ranging from 56 to 70 years. The average BMI of patients was 25.1 ranging from 23 to 27 (Table 2). Patients included in this study had chronic pain for an average of 5.7 months ranging from 4 to 8 months. Spinal surgery performed were either TLIF or PLIF and fixation was done at 2 levels (L3-L4, L4-L5) or 3 levels (L2-L3-L4). L4-L5 level was most commonly involved as seen in 15 patients (Figure 2). L4 nerve root was noted to be the most targeted as found in 17 patients. Oswestry Disability Index (ODI) demonstrated improvement in both groups at 6month period, without meaningful difference between the two groups. Patients in TFESI group had an ODI score with an average of 18.1 ranging from 16 to 22, while the CESI group averaged 18.7 ranging from 12 to 22 (Table 1). The amount of time used for the injection procedure was shorter in CESI group than in TFESI group. During the two-week period following the procedure, none of the patients had severe headaches suggestive of post lumbar puncture syndrome, nor did they experience other systemic complications like decompensated heart disease or diabetes. No adverse events such as infection or hematoma were documented in this period. None of our patients were lost to follow up.

Discussion

Pain of spinal origin and its associated symptoms are a widespread cause of suffering and disability worldwide, carrying significant social, clinical, and economic implications [11, 12]. Among these, chronic pain following spinal surgery is particularly debilitating, resulting in a lower quality of life compared to other chronic pain conditions. The origin of back pain can be attributed to various tissues, including vertebrae, intervertebral discs, ligaments, dura, nerve root sleeves, facet joint capsules, fascia, and muscles. Sensations of pain are transmitted through nociceptors and mechanoreceptors, which can be activated by mechanical irritation, compression, or postoperative inflammation [13, 14]. While patients with preexisting chronic pain often experience referred pain rather than localized or diffuse pain, postoperative pain tends to be more localized. In cases where referred pain persists, individuals may have higher visual analog scale (VAS) scores. The intensity of postoperative pain is directly related to the number of vertebrae involved in the surgery, while the region of surgery does not significantly impact the severity of pain. Unlike chronic pain, postoperative pain is temporary and gradually improves over time, making it more amenable to medical treatment.

The present study evaluated the effects of fluoroscopy-guided caudal epidural steroid injection (CESI) and transforaminal epidural steroid injection (TFESI) on pain and functional outcomes. The results showed clinically significant and

statistically meaningful improvement in both pain and functional outcomes at the end of the follow-up period. Therefore, both FL-guided CESI and TFESI were equally effective in reducing pain and improving functionality. However, the TF approach required longer fluoroscopy time compared to the CA group due to technical difficulties associated with this method. Complications such as anatomic variations and degenerative changes were encountered more frequently with the TF approach, leading to longer procedure times and increased exposure to radiation. The TF approach also carried the risk of spinal cord infarction caused by puncturing the Adamkiewicz artery or radiculo medullary artery. Intravascular injection of steroids during the procedure could lead to thrombosis or embolism, resulting in ischemia [11]. Pain and discomfort during the procedure were higher in the TFESI group compared to the CESI group, as the TF approach was more likely to contact and irritate the nerve root or dorsal root ganglion within the neural foramen.

However, the CESI approach also has its limitations when compared to TFESI. Since the steroid is injected through the caudal hiatus, there is a possibility that it may not reach the desired level of the spinal lesion. To address this, a larger volume of 20 ml was administered. Previous studies have reported that a volume of 20 ml reached S1 in 100% of patients, L5 in 89-91% of patients, and L4 in 28.3-48% of patients [12, 13]. If the diameter of the sacral hiatus is 2 mm or less, needles larger than 22G cannot be used.

In this study, none of the patients had a sacral hiatus diameter less than 2 mm or a closed sacral hiatus.

Hanu-Cernat *et al* reported the fluoroscopy time in 17 patients who underwent fluoroscopy-guided lumbar or caudal epidural injections, with the range being 7–31 seconds (mean, 16 ± 6.98 s) [15]. When comparing both the transforaminal and caudal approaches of ESIs, they noted a longer fluoroscopy time in the transforaminal than in the caudal approach. Our study followed a similar pattern with CESI requiring shorter fluoroscopy time. Manchikanti *et al.* reported that over 55% of patients showed improvement in functional status and 60% to 70% experienced significant pain relief after caudal epidural injections for chronic function-limiting low back pain in FBSS/CPSS population without facet joint pain [16-22]. This correlates with the significant improvement in functional outcome noted in patients with CPSS involved in our study. Nonetheless, the study had several limitations, including a relatively small sample size and lack of potential heterogeneity among the subjects included. Additionally, the study did not consider whether patients received other treatments such as medication or physical therapy during the follow-up period.

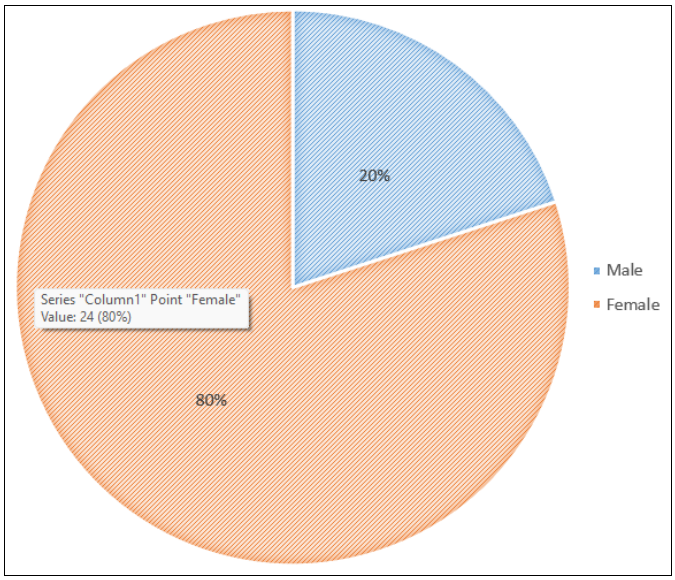

Fig 1: Distribution of gender among participants

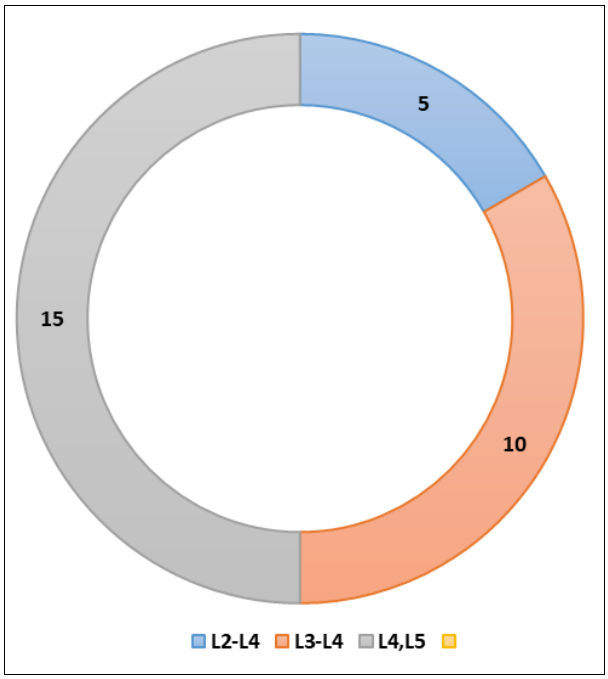

Fig 2: Level of fixation involved in study participants

Table 1: ODI score from baseline to 6 months follow up period

	Baseline	6 Months
CESI	30	18.1
TFESI	31	18.7

Table 2: Patient Demographics and data

TFESI vs CESI									
S. No	**Age**	**Sex**	**BMI**	**Surgery**	**Pain duration (months)**	**Target root**	**Level of fixation**	**Injection method**	**ODI (6 Months)**
1	66	M	24	TLIF	5	L4	L4, L5	TF-ESI	16
2	68	F	25	PLIF	6	L5	L4, L5	TF-ESI	16
3	56	F	24	TLIF	4	L4	L3, L4	TF-ESI	18
4	64	M	26	PLIF	5	L4	L2, L3, L4	CESI	12
5	58	F	23	PLIF	7	L4	L4, L5	TF-ESI	18
6	62	F	24	PLIF	4	L5	L4, L5	CESI	14
7	68	F	25	TLIF	8	L5	L4, L5	TF-ESI	16
8	54	F	24	PLIF	5	L4	L3, L4	TF-ESI	22
9	58	F	26	TLIF	4	L5	L4, L5	CESI	20
10	62	F	25	TLIF	7	L5	L4, L5	CESI	22
11	70	F	25	PLIF	5	L5	L4, L5	CESI	18
12	68	F	24	PLIF	6	L4	L2, L3, L4	TF-ESI	18
13	66	F	25	TLIF	5	L4	L3, L4	CESI	20

14	62	F	26	PLIF	8	L5	L4, L5	TF-ESI	22
15	58	M	27	TLIF	4	L4	L3, L4	CESI	18
16	64	F	26	PLIF	6	L4	L2, L3, L4	TF-ESI	20
17	62	F	24	TLIF	4	L4	L3, L4	TF-ESI	16
18	68	M	25	PLIF	5	L5	L4, L5	CESI	18
19	66	F	25	PLIF	7	L5	L4, L5	TF-ESI	16
20	70	F	27	TLIF	5	L5	L4, L5	TF-ESI	20
21	68	F	26	TLIF	4	L4	L3, L4	CESI	22
22	54	F	25	PLIF	8	L4	L3, L4	CESI	16
23	58	F	25	TLIF	4	L5	L4, L5	TF-ESI	18
24	60	F	26	PLIF	7	L4	L2, L3, L4	CESI	22
25	68	M	26	PLIF	6	L4	L3, L4	CESI	18
26	68	F	25	TLIF	7	L4	L2, L3, L4	TF-ESI	16
27	64	M	27	PLIF	5	L4	L3, L4	CESI	18
28	70	F	24	PLIF	8	L5	L4, L5	CESI	20
29	62	F	25	PLIF	6	L4	L3, L4	CESI	22
30	56	F	24	TLIF	6	L5	L4, L5	TF-ESI	20

Conclusion

In conclusion, the results of the present study indicate that fluoroscopy-guided cervical interlaminar epidural steroid injection (CESI) and transforaminal epidural steroid injection (TFESI) are equally effective in reducing pain and improving function in patients with cervical radicular pain. However, CESI offers advantages such as shorter procedure time, resulting in reduced radiation exposure. Additionally, patients experience less discomfort during the injection and report higher satisfaction with the CA approach. Both methods are effective, but the CA approach tends to provide better patient satisfaction and a shorter procedure time.

Declarations

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Conflict of Interest: None declared
Ethical Approval: Not required

References

1. World Health Organization. ICD-11 for mortality and morbidity statistics (ICD-11 MMS). 2018 version. World Health Organization. 2018. Available from https://icd.who.int/dev11/f/en#http%3a%2f%2fid.who.int%2ficd%2fentity%2f345002890. Accessed July 5, 2021.
2. Slipman CW, Shin CH, Patel RK, *et al*. Etiologies of failed back surgery syndrome. Pain Med. 2002;3:200–214.
3. Hussain A, Erdek M. Interventional pain management for failed back surgery syndrome. Pain Pract. 2014;14:64–78.
4. Javid MJ, Hadar EJ. Long-term follow-up review of patients who underwent laminectomy for lumbar stenosis: A prospective study. J Neurosurg. 1998;89:1–7.
5. Chan C-W PP. Failed back surgery syndrome. Pain Med. 2011;12:577–606.
6. Manchikanti L, Singh V, Cash KA, Pampati V, Datta S. A comparative effectiveness evaluation of percutaneous adhesiolysis and epidural steroid injections in managing lumbar post-surgery syndrome: A randomized, equivalence-controlled trial. Pain Phys. 2009;12:E355–68.
7. Abdi S, Datta S, Trescot AM, *et al*. Epidural steroids in the manage- ment of chronic spinal pain: A systematic review. Pain Phys. 2007;10:185–212.
8. Manchikanti L, Singh V, Cash KA, Pampati V, Datta S. Preliminary results of randomized, equivalence trial of fluoroscopic caudal epidural injections in managing chronic low back pain: Part 3. Post-surgery syndrome. Pain Phys. 2008;11:817–831.
9. Conn A, Buenaventura RM, Datta S, Abdi S, Diwan S. Systematic review of caudal epidural injections in the management of chronic low back pain. Pain Phys. 2009;12:109–135.
10. Park KD, Lee J, Jee H, Park Y. Kambin triangle versus the supra- neural approach for the treatment of lumbar radicular pain. Am J Phys Med Rehabil. 2012;91(12):1039–1050.
11. Lyders EM, Morris PP. A case of spinal cord infarction following lumbar transforaminal epidural steroid injection: MR imaging and angiographic findings. Am J Neuroradiol. 2009;30:1691–1693.
12. Blanchais A, Le Goff B, Guillot P, Berthelot JM, Glemarec J, Maugars Y. Feasibility and safety of ultrasound-guided caudal epidural glucocorticoid injections. Joint Bone Spine. 2010;77:440–444.
13. Park Y, Lee JH, Park KD, Ahn JK, Park J, Jee H. Ultrasound-guided vs. fluoroscopy- guided caudal epidural steroid injection for the treatment of unilateral lower lumbar radicular pain: a prospective, randomized, single-blind clinical study. Am J Phys Med Rehabil. 2013;92:575–586.
14. Kim SJ, Lee MH, Lee SW, Chung HW, Lee SH, Shin MJ. Radiation exposure for fluoroscopy-guided lumbosacral epidural steroid injec- tions: comparison of the transforaminal and caudal approaches. J Spinal Disord Tech. 2014;27:E37–40.
15. Mendoza-Lattes S, Weiss A, Found E, Zimmerman B, Gao Y. Comparable effectiveness of caudal vs. trans-foraminal epidural steroid injections. Iowa Orthop J. 2009;29:91-6.
16. Manchikanti L, Singh V, Pampati V, *et al*. Comparison of the efficacy of caudal, interlaminar, and transforaminal epidural injections in managing lumbar disc herniation: is one method superior to the other? Korean J Pain. 2015;28:11–21.
17. Liu J, Zhou H, Lu L, Li X, Jia J, Shi Z, Yao X. The Effectiveness of Transforaminal Versus Caudal Routes for Epidural Steroid Injections in Managing Lumbosacral Radicular Pain: A Systematic Review and Meta-Analysis. Medicine (Baltimore). 2016 May;95(18):e3373
18. Lutz GE, Vad VB, Wisneski RJ. Fluoroscopic transforaminal lumbar epidural steroids: an outcome study. Arch Phys Med Rehabil. 1998;79:1362–1366.
19. Taskaynatan MA, Tezel K, Yavuz F, *et al*. The effectiveness of transforaminal epidural steroid injection

in patients with radicular low back pain due to lumbar disc herniation two years after treatment. J Back Musculoskelet Rehabil 2015; 28:447–451.
20. Buenaventura RM, Datta S, Abdi S, *et al*. Systematic review of therapeutic lumbar transforaminal epidural steroid injections. Pain Physician 2009; 12:233–251.
21. Rho ME, Tang CT. The efficacy of lumbar epidural steroid injections: Transforaminal, interlaminar, and caudal approaches. Phys Med Rehabil Clin N Am 2011; 22:139–148.
22. Botwin KP, Gruber RD, Bouchlas CG, *et al*. Complications of fluoroscopically guided transforaminal lumbar epidural injections. Arch Phys Med Rehabil 2000; 81:1045–1050.

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