

General

Caudal Epidural Steroid Injections: A Retrospective Pilot Study of Safety and Patient-Reported Outcomes

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Keywords: Caudal epidural steroid injection, epidural steroid injection, chronic low back pain, lumbar radiculopathy, interventional pain management, dural puncture, neurological complications

<https://doi.org/10.52965/001c.134102>

Orthopedic Reviews

Vol. 17, 2025

Background

Caudal epidural steroid injections (ESIs) are commonly used to manage lumbosacral radicular pain and axial low back pain. While they are generally considered safe, real-world data on complication rates and patient-reported outcomes remain limited. This study aimed to evaluate the safety profile and short-term effectiveness of caudal ESIs by reviewing a series of randomly selected cases performed over a six-month period.

Methods

A retrospective chart review was conducted on 40 randomly selected caudal ESI procedures performed between July 1, 2024, and December 31, 2024. All procedures were performed under fluoroscopic guidance using a corticosteroid mixed with local anesthetic and preservative-free normal saline. Charts were reviewed for procedural complications, including dural puncture, neurological injury, and infection. Outcome data, including starting and post-injection pain scores and patient-reported percent relief, were analyzed in patients with complete follow-up at two weeks or by post-procedure phone call.

Results

There were no documented dural puncture, infection, or permanent neurological injury among the 40 cases. Of the 27 patients with complete follow-up data, the average pain score decreased from 8.6 to 2.9 on the numerical rating scale. The average patient-reported percent relief was 67.4%. A total of 24 patients (88.9%) reported at least 50% relief, 3 patients (11.1%) reported complete (100%) relief, and only 1 patient reported no relief (0%).

Conclusion

Caudal ESIs demonstrated a favorable safety profile and were associated with meaningful short-term pain relief in most patients. These findings support the continued use of caudal ESIs as a safe and effective interventional option for appropriately selected patients with lumbosacral pain.

INTRODUCTION

Caudal epidural steroid injections (ESIs) are a widely accepted interventional procedure for the management of chronic lumbosacral pain, particularly in patients with radiculopathy secondary to lumbar disc herniation, spinal stenosis, or post-laminectomy syndrome.¹ Administered via the sacral hiatus, caudal ESIs offer a route to deliver corticosteroids and local anesthetics to the epidural space to reduce inflammation, improve function, and decrease pain-related disability.²⁻⁴

Compared to interlaminar and transforaminal approaches, caudal ESIs are often considered technically less

complex. They may carry a lower risk of complications, particularly in patients with altered spinal anatomy or those who have undergone prior spinal surgeries.^{5,6} However, as with all epidural procedures, there remains concern for some potential adverse events, including dural puncture, post-dural puncture headache, infection, bleeding, and the rare but serious risk of permanent neurological injury.⁷⁻¹⁰

Despite their frequent use in clinical practice, there remains limited recent data precisely characterizing the safety profile of caudal ESIs in routine outpatient settings. The purpose of this retrospective review is to evaluate the incidence of documented complications, including dural puncture and permanent neurological injury, in a random

sample of patients who underwent caudal ESIs over six months.

This study aims to contribute to the growing body of literature supporting the safety and utility of this commonly performed procedure.

METHODS

A retrospective chart review was conducted to evaluate the safety profile and clinical outcomes of caudal ESIs performed at a single outpatient pain management clinic. The review included 40 randomly selected cases performed over six months from July 1, 2024, to December 31, 2024.

Inclusion criteria consisted of adult patients (age ≥ 18 years) who received a caudal ESI for treating lumbosacral pain or radiculopathy. Patients who received alternative epidural approaches (e.g., interlaminar or transforaminal) were excluded. Only patients with complete follow-up data—either from two-week clinic follow-up visits or post-procedure phone calls—were included in the outcome analysis. Patients with incomplete follow-up were excluded from pain score and outcome assessments.

Board-certified pain medicine physicians performed all procedures under sterile technique and fluoroscopic guidance. The injectate used in all cases included a corticosteroid (commonly triamcinolone acetonide or dexamethasone), a local anesthetic (typically 1–2% lidocaine or 0.25% bupivacaine), and preservative-free normal saline. Proper epidural spread was confirmed via fluoroscopy in all cases.

Electronic medical records were reviewed for documentation of procedural complications, including dural puncture, post-dural puncture headache, infection, neurological deficits, or other adverse events. Pain scores before and after the injection and patient-reported percent relief were extracted when available. Data collection and analysis were descriptive in nature, with the primary outcome being the incidence of documented dural puncture or permanent neurological injury following caudal ESI.

RESULTS

A total of 40 patient charts were reviewed over a six-month period, each corresponding to a caudal ESI performed for lumbosacral pain or radiculopathy. There were no documented cases of dural puncture, post-dural puncture headache, infection, or permanent neurological injury among the reviewed cases.

Of the 40 charts, 27 contained complete data regarding pre- and post-procedure pain scores on a numerical rating scale (NRS) as well as patient-reported percent pain relief. The average starting pain score across these patients was 8.6 (range: 6–10), which decreased to an average post-injection pain score of 2.9 (range: 0–8). The average patient-reported percent relief was 67.4%.

A total of 24 patients (88.9%) reported at least 50% relief in symptoms following the procedure. Three patients (11.1%) reported complete (100%) relief, while only one patient reported no relief (0%). A summary of individual

Table 1

Patient #	Starting Pain Score	Post-Injection Pain Score	Patient-Reported Percent Relief (%)
1	9	2	80
2	8	3	60
3	8	2	50
4	9	0	100
5	8	5	60
6	10	6	50
7	9	0	100
8	6	3	50
9	8	8	0
10	8	2	80
11	10	2	80
12	7	4	80
13	10	1	90
14	10	4	50
15	9	5	50
16	9	2	60
17	8	7	10
18	8	2	80
19	10	2	80
20	10	5	80
21	8	2	80
22	7	2	80
23	8	0	100
24	7	5	20
25	10	2	80
26	9	0	90
27	9	2	80

patient pain scores and relief percentages is presented in [Table 1](#).

A visual representation of the individual patient-reported percent relief following caudal ESI is provided in [Figure 1](#).

[Figure 2](#) presents the patient-reported NRS pain scores before and after caudal ESI. This side-by-side comparison highlights the reduction in pain scores experienced by most patients following the procedure.

These findings support the safety and potential effectiveness of caudal ESIs in providing meaningful short-term symptom relief in patients with lumbosacral pain.

DISCUSSION

This retrospective review of randomly selected caudal ESIs performed over six months demonstrated a favorable safety profile, with no documented cases of dural puncture or permanent neurological injury. These findings suggest that the

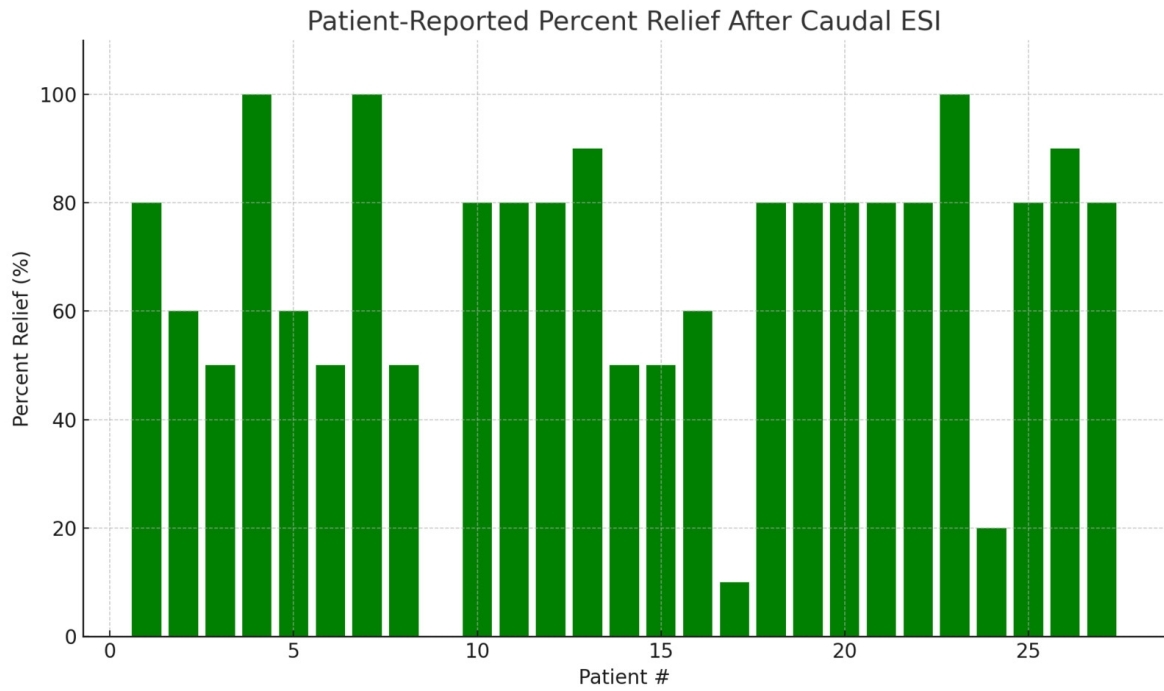


Figure 1

This bar graph illustrates the percentage of pain relief reported by each patient following caudal ESI. This bar graph represents the variability in patient response, highlighting that while the majority experienced significant improvement, the degree of pain relief ranged from 0% to 100%. **Green bars:** Represent each individual patient's self-reported percent improvement in pain following the procedure.

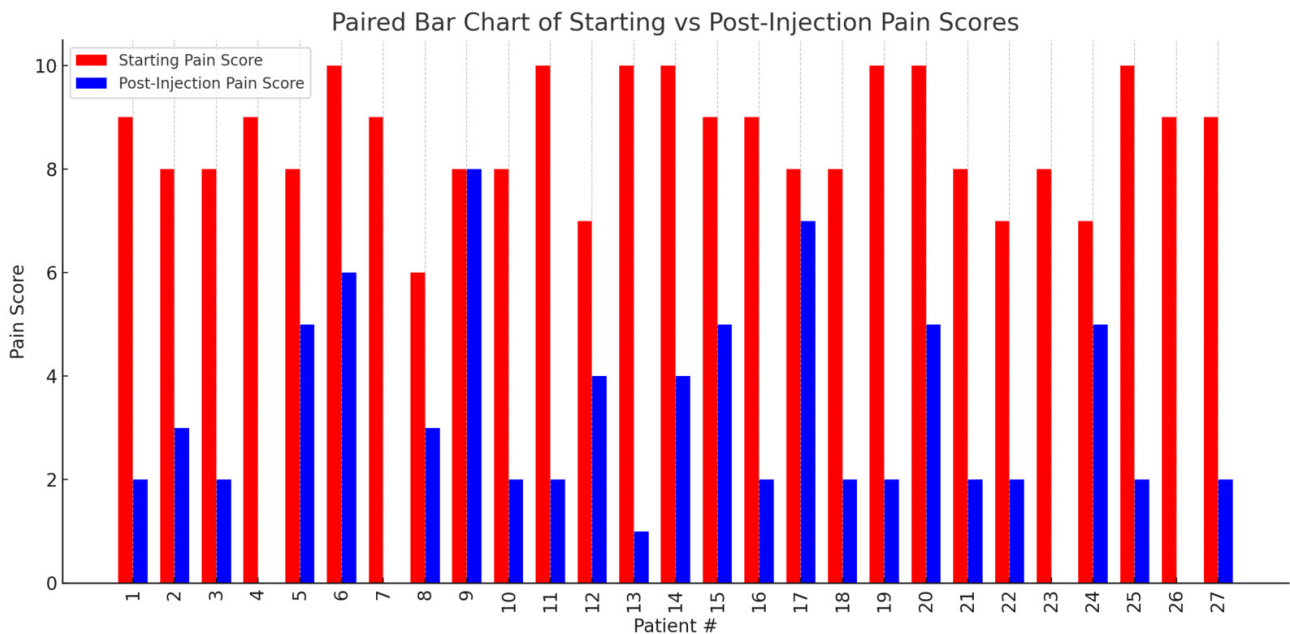


Figure 2

This chart presents individual patient-reported pain scores before and after caudal epidural steroid injections (ESIs). **Red bars:** Represent each patient's **starting pain score** (on a 0–10 scale) prior to the injection. **Blue bars:** Represent each patient's **post-injection pain score**. Each pair of bars corresponds to one patient, clearly comparing pre- and post-procedural pain levels.

caudal approach is among the safest routes for epidural steroid administration, particularly in patients with altered lumbar anatomy or a history of prior spinal surgery.^{5,11,12}

Among the 27 patients with complete outcome data, caudal ESI was associated with meaningful short-term pain

relief. The average reported pain score decreased from 8.6 to 2.9, and the average patient-reported percent relief was 67.4%. Notably, 88.9% of patients reported at least 50% improvement in symptoms, and 11.1% (3 patients) reported complete (100%) pain relief. Only one patient reported no

relief following the procedure. These findings highlight the potential clinical benefit of caudal ESI for appropriately selected patients suffering from lumbosacral radicular pain or axial low back pain.

The absence of complications in this series highlights the relative safety and technical ease of the caudal approach when performed in patients with typical anatomy. This technique is generally straightforward. However, anatomical variations such as abnormal sacral curvature or obesity can make needle placement more challenging, particularly when image guidance is not used. Fluoroscopy, especially when paired with contrast, is critical in confirming proper needle placement and ensuring appropriate epidural spread of injectate. Additionally, reviewing pre-procedure imaging can assist in procedural planning and may help identify anatomic challenges that could affect outcomes.¹³

The lack of significant complications in this case series likely reflects the consistent use of fluoroscopic guidance, adherence to sterile technique, and standardized injection protocols. These findings are consistent with the existing literature. For example, a survey conducted by Brown et al. reported that among 86 interventional pain physicians, none reported significant neurological injuries related to caudal ESIs, reinforcing the safety of this commonly performed procedure.⁵

Together, these results reinforce the safety and short-term effectiveness of caudal epidural steroid injections when performed under image guidance by experienced practitioners. The consistency of these findings with previously published literature further supports the role of caudal ESI as a reliable and low-risk interventional option for managing lumbosacral pain. While the outcomes observed in this series are encouraging, they must be interpreted within the context of the study's design and scope.

LIMITATIONS

This study has several limitations that should be considered when interpreting the findings. The sample size was primarily relatively small, with only 40 cases randomly re-

viewed and 27 patients included in the outcome analysis due to incomplete follow-up data. This limits the generalizability of the findings. However, this limited sample size is expected for a pilot study and serves as a preliminary step toward larger, more comprehensive investigations. Additionally, the follow-up data were collected at varying intervals through either clinic visits or post-procedure phone calls, which may introduce inconsistency in how and when patient outcomes were assessed. Outcomes were limited to short-term pain relief without assessment of long-term effectiveness, functional improvement, or quality-of-life measures.

Despite these limitations, our findings reinforce the safety and short-term efficacy of caudal ESIs in the outpatient setting. Future studies with standardized follow-up intervals, larger patient cohorts, and long-term outcome tracking are warranted to validate these results further and guide clinical practice.

CONCLUSION

Caudal ESIs appear to be a safe and effective interventional option for the management of lumbosacral pain and radiculopathy in the outpatient setting. This retrospective review of 40 cases identified no significant complications such as dural puncture or permanent neurological injury. Among the patients with complete follow-up data, the majority experienced meaningful pain relief, with an average reduction in pain scores and a high percentage of patients reporting at least 50% symptom improvement.

These findings support using caudal ESIs as part of a multimodal pain management strategy. Further prospective studies with larger patient populations and long-term follow-up are needed to confirm these results and better define the duration and predictors of therapeutic benefit.

Submitted: March 29, 2025 EST. Accepted: April 02, 2025 EST.

Published: April 22, 2025 EST.

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