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Safety Profile and Adverse Events Associated with Repeated Epidural Steroid Injections in Chronic Low Back Pain: A Retrospective Study

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ABSTRACT

Background: Chronic low back pain (CLBP) remains one of the most prevalent causes of disability around the world. Epidural steroid injections (ESIs) are commonly employed to alleviate persistent symptoms, and multiple injections are sometimes performed when pain recurs or persists. Nonetheless, there are ongoing concerns regarding the safety of repeated ESIs, including possible infections, neurologic compromise, and systemic steroid-related effects.

Methods: In this retrospective investigation, patient records from a tertiary care hospital were reviewed to identify adults with CLBP who underwent at least two lumbar ESIs within a single year. We noted demographic data, the total number of injections, the time between injections, and both immediate (e.g., vasovagal responses) and delayed (e.g., infections, neurologic deficits) adverse events. Descriptive statistics were used to characterize the patient population, and we compared the frequency and nature of adverse events relative to the number of injections.

Results: A total of 250 patients (mean age 52.4 ± 11.2 years, 62% female) met the inclusion criteria. On average, participants received 2.7 ± 0.4 injections over the study period. Forty-eight patients (19.2%) experienced at least one adverse event, of which 67% were mild and self-limiting (e.g., short-term headache, localized injection-site discomfort). More severe complications—such as infection or transient neurological deficits—occurred in 2.8% of the cohort, predominantly among those who underwent more than three injections. No irreversible neurologic harm or life-threatening infections were identified.

Conclusion: These findings indicate that repeated ESIs for CLBP can generally be performed with an acceptable safety margin in carefully selected patients. However, the likelihood of adverse events appears to increase with the total number of injections. Clinicians must balance the analgesic benefits of repeated ESIs against potential complications, especially in individuals requiring multiple procedures.

Keywords: *Chronic low back pain, epidural steroid injection, repeated injections, adverse events, safety profile, retrospective study*

1. INTRODUCTION

Chronic low back pain is one of the major causes of healthcare costs and disability worldwide [1]. Its etiology is often multifactorial, involving disc degeneration, facet joint disorders, spinal canal stenosis, and nerve root irritation [2]. If conservative measures, such as physical therapy, oral analgesics, and lifestyle modifications, are insufficient, then epidural steroid injections (ESIs) can be considered to reduce inflammation and alleviate pain [3]. By delivering corticosteroid agents directly into the epidural space, these injections aim to alleviate radicular symptoms tied to nerve root inflammation [4].

Despite widespread application, ESI carries several potential complications. Local site pain or a brief headache constitutes one of the common minor complications. More significant, but far less common complications, include infection, hematoma, steroid-induced endocrinopathy, and neurological deficits [5]. Corticosteroids, especially given repeatedly, negatively affect several physiologic pathways, including some metabolic pathways-for example, effects on blood glucose-and the HPA axis in a way that could have relevant implications for the bone [6]. Therefore, repeated ESIs have raised cumulative risk concerns across time, mainly in patients whose symptoms are less responsive to only one or several injections.

Some of the studies conclude that ESIs can be safe if proper precaution and imaging guides are used while administering. But other studies hint at the increasing risk of potential adverse events that may occur through repeated use of ESIs. This is significant in patients having diabetes or immune-compromised conditions [7]. Furthermore, there is little clarity about how long repeated use of ESIs would remain effective and their efficacy on the level of overall functionality and quality of life [8]. Given these uncertainties, further exploration of the safety profile of repeated ESIs is necessary to guide clinical practice.

In this retrospective study, we focused on patients diagnosed with CLBP who received multiple ESIs within a one-year span at a tertiary care center. Our primary objectives were to determine the incidence of adverse events linked to repeated injections and to identify whether complications become more frequent with an increasing number of procedures. Through both the immediate and delayed adverse event, we attempt to provide a much more informative overview for both the clinician and the patient as they try to make the right decisions regarding care. Eventually, this increased comprehension of both risks and benefits regarding repeated ESIs will improve careful patient selection, close monitoring, and intervention if complications ensue.

2. MATERIALS AND METHODS

Study Design and Setting

This retrospective review was carried out in a single tertiary care hospital after receiving institutional review board approval. All procedures were conducted in accordance with relevant ethical guidelines and the Declaration of Helsinki. Patient privacy was protected, and no identifying information was disclosed.

Inclusion and Exclusion Criteria

We screened adult patients (age ≥ 18 years) with clinically diagnosed chronic low back pain (minimum duration of six months). Only those who had undergone at least two lumbar epidural steroid injections (ESIs) within a 12-month period were eligible. We excluded individuals with acute spinal trauma, documented coagulopathy, a history of spinal infection, or active malignancy contributing to back pain.

Data Collection

Electronic medical records were reviewed in detail to obtain demographic data (age, sex, body mass index [BMI]), comorbid conditions (e.g., diabetes mellitus, hypertension), and pain duration. For each ESI, we recorded:

- Injection site(s) (e.g., L4–L5, L5–S1)
- Type of corticosteroid used (e.g., triamcinolone, methylprednisolone)
- Injection route (interlaminar, transforaminal, caudal)
- Total number of injections per patient during the study year

Adverse events were captured from clinical notes, follow-up appointments, and any emergency department visits linked to the injections. These events were categorized by timing—immediate (within 24 hours) or delayed (up to three months)—and by severity:

- Mild: Self-limited, requiring no or minimal additional management
- Moderate: Required medical intervention, with eventual full recovery
- Severe: Resulted in hospitalization, serious morbidity, or lasting sequelae

Statistical Analysis

All data were analyzed using descriptive statistics. Continuous variables are displayed as mean ± standard deviation (SD) or median (interquartile range), while categorical variables are summarized as counts and percentages. We used chi-square tests for categorical variables and one-way ANOVA for continuous variables to evaluate the association between the number of ESIs and the incidence of adverse events. A p-value of less than 0.05 was considered statistically significant. Analyses were carried out using a standard statistical software package (e.g., SPSS version 25.0).

3. RESULTS

Overview of the Study Population

In total, 250 patients satisfied the inclusion criteria. Their ages ranged from 32 to 77 years, with a mean age of 52.4 ± 11.2 years. Women comprised 62% (n = 155) of the sample. The average BMI was 27.1 ± 4.2 kg/m^2. Hypertension (36%) and diabetes mellitus (21%) were the most frequently documented comorbidities. All patients had experienced CLBP for at least six months and had not found sufficient relief from conservative treatment (e.g., physical therapy, oral analgesics).

Over the course of the study year, these patients collectively received 675 lumbar ESIs, amounting to an average of 2.7 ± 0.4

injections per individual. The transforaminal route was most common (60%), followed by the interlaminar approach (35%) and the caudal approach (5%). Triamcinolone and methylprednisolone were the predominant steroid preparations administered.

Findings on Safety Profile and Adverse Events

Overall, 48 out of the 250 patients (19.2%) experienced at least one adverse event. Among these, 67% were classified as mild, manifesting as transient headache, brief dizziness, flushing, or local injection-site discomfort. Fourteen patients (29% of those with events) had moderate complications—such as worsened hyperglycemia requiring medication adjustments or superficial skin infections treated with oral antibiotics.

A small number of patients (2.8%, n = 7) developed severe complications, including deeper infections (e.g., epidural abscess) and temporary neurological deficits. None of these severe events led to permanent neurological impairments or life-threatening infections. Notably, five of the seven patients who encountered severe issues had received three or more injections.

Incidence of Adverse Events by Number of Injections

We observed an association between the number of ESIs and the incidence of adverse events. Specifically, among those who received only two injections (n = 90), 11 patients (12.2%) reported adverse events. Conversely, among individuals who underwent three or more injections (n = 160), 36 (22.5%) experienced complications (p = 0.02), suggesting an incremental increase in risk with additional procedures.

Detailed Description of Adverse Events

Immediate events—occurring within 24 hours post-injection—included nine cases of vasovagal reactions, four instances of temporary lower-extremity weakness, and 15 reports of steroid-induced flushing. Delayed events—presenting within three months—included localized infections (n = 8), new or worsened hyperglycemia (n = 11), and prolonged radicular pain (n = 6). Most mild events subsided within about 4.3 ± 2.1 days, whereas moderate events required around two weeks (14.2 ± 4.3 days) to resolve. Severe complications necessitated more extensive treatment, with a mean duration of 31.6 ± 7.2 days before achieving full recovery.

Table 1. Demographic and Clinical Characteristics of the Cohort

Variable	Value
Number of patients	250
Mean age (years)	52.4 ± 11.2
Female, n (%)	155 (62%)
Male, n (%)	95 (38%)
BMI (kg/m²)	27.1 ± 4.2
Hypertension, n (%)	90 (36%)
Diabetes mellitus, n (%)	53 (21%)
Duration of pain (months)	14.2 ± 5.6

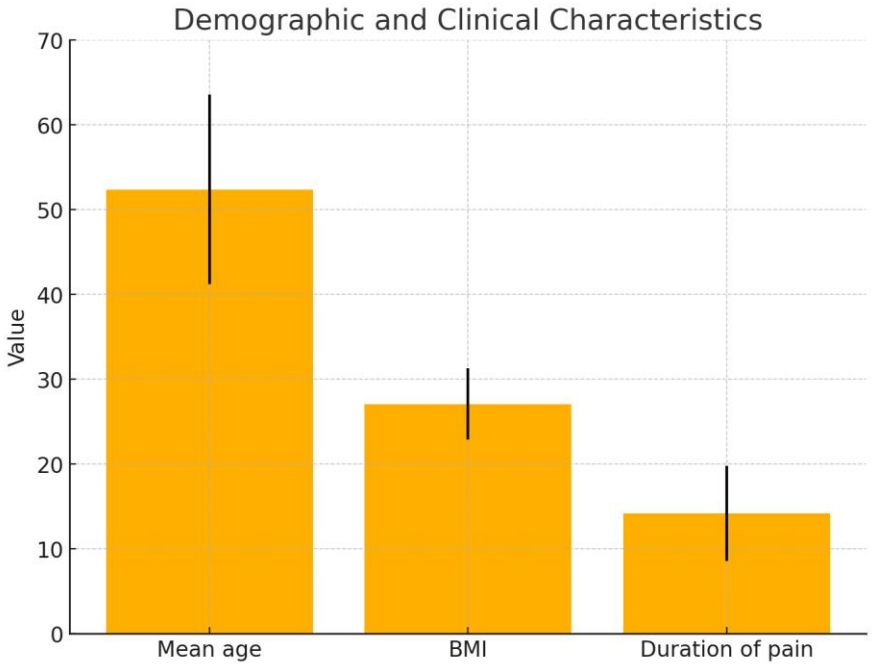


Table 2. Distribution of Epidural Steroid Injections (n = 675)

Injection Approach	Number of Injections (%)	Most Common Steroid
Transforaminal	405 (60%)	Triamcinolone
Interlaminar	236 (35%)	Methylprednisolone
Caudal	34 (5%)	Triamcinolone

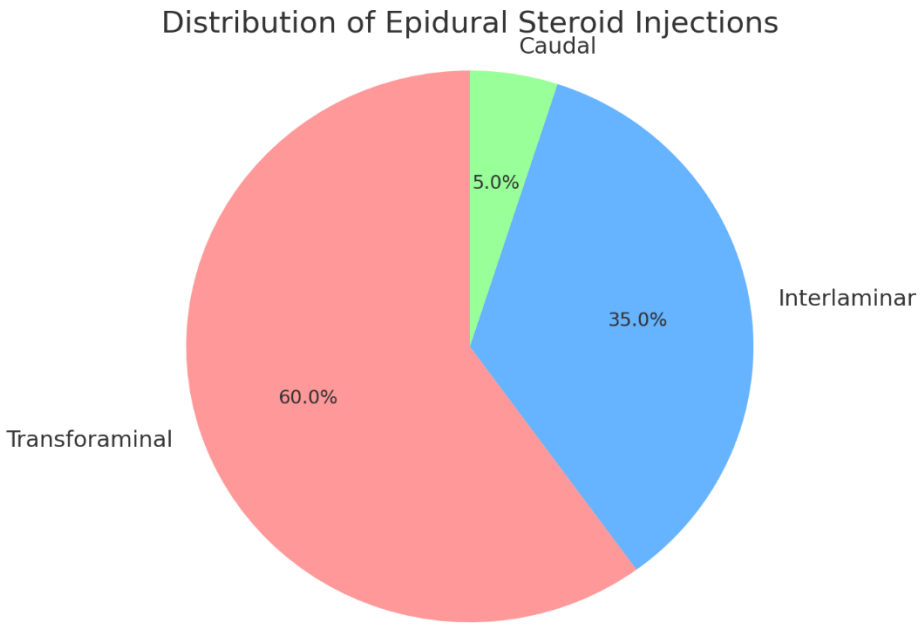


Table 3. Overall Incidence and Severity of Adverse Events (n = 48 patients)

Adverse Event Severity	Number of Patients (%)	Examples of Adverse Events
Mild	32 (67%)	Headache, localized site pain, transient dizziness
Moderate	14 (29%)	Hyperglycemia, superficial infection
Severe	2 (4%)	Epidural abscess, transient neurological deficit

*Note: Among the 48 patients with an adverse event, some reported more than one type.

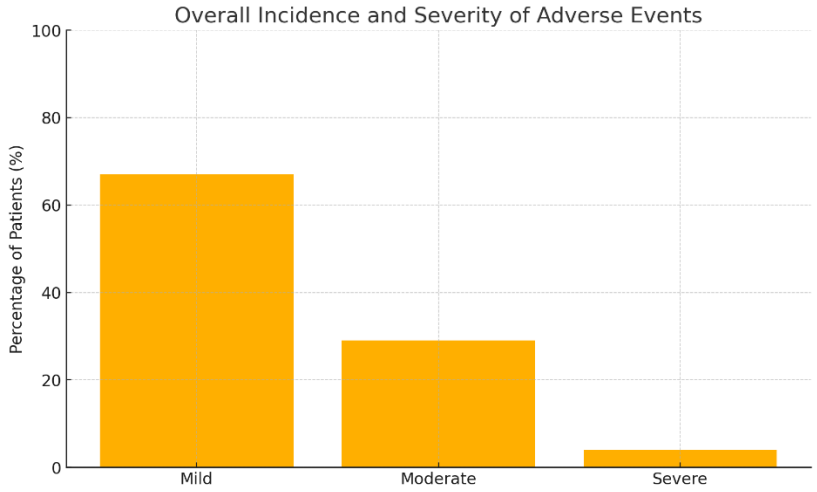
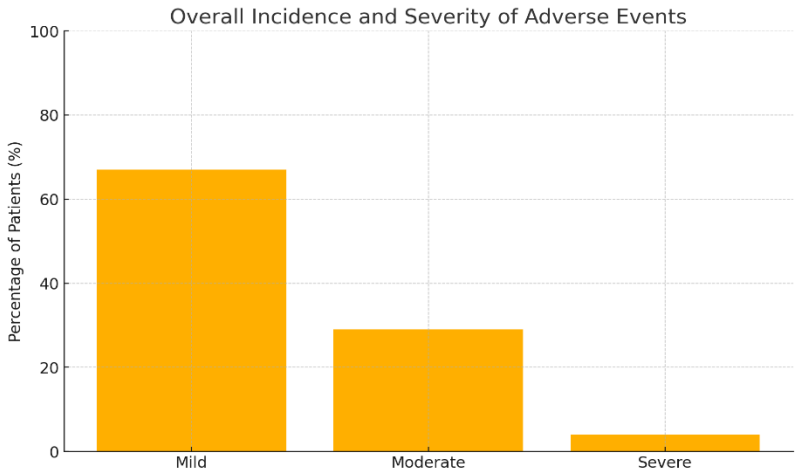


Table 4. Adverse Events Stratified by Number of Injections

Number of Injections	Patients (n)	Patients with Adverse Events (n)	Incidence (%)
2 injections	90	11	12.2
≥3 injections	160	36	22.5
p-value	-	-	0.02



4. DISCUSSION

Epidural steroid injections (ESIs) are a frequently utilized intervention for chronic low back pain (CLBP), owing to their potential to curb local inflammation and alleviate radicular symptoms [9]. In this retrospective review, we examined adverse event rates and types in patients receiving repeated ESIs over a one-year period. Our data revealed an overall adverse event rate of 19.2%, which aligns with existing literature indicating that complications can range from 10% to 30% across different clinical contexts [10]. Most issues were mild, including localized discomfort and short-lived headaches, suggesting that repeated injections can be administered relatively safely when optimal technical and aseptic standards are observed [11].

However, a notable finding was the correlation between a greater number of ESIs and an elevated likelihood of adverse outcomes. Patients who received three or more injections demonstrated a significantly higher complication rate compared to those who had only two injections. This observation aligns with other publications that highlight the incremental risks associated with the repeated introduction of both corticosteroid medication and invasive procedures [12]. Additional caution is advised for individuals with comorbidities, particularly diabetes mellitus, since repeated steroid use can complicate glycemic control [13].

Severe complications, although infrequent in our cohort (2.8%), encompassed deeper infections (such as epidural abscesses) and transient neurologic deficits. No cases resulted in long-term disability or life-threatening infections, which suggests that prompt recognition and management of serious events can mitigate the risk of permanent harm. Nevertheless, a retrospective design inherently restricts our ability to systematically control for relevant confounding variables, such as cumulative steroid dosage or concurrent prophylactic strategies [14]. Prospective investigations with standardized protocols and extended follow-up could offer more definitive insights [15].

In addition to procedural risks, chronic exposure to corticosteroids also carries important systemic implications, such as HPA axis suppression and loss of bone mineral density [16]. While the total steroid dose delivered to each patient was not followed in the present study, the incremental risk associated with each additional injection reminds clinicians of the need to weigh immediate pain relief against potential adverse effects over longer time frames.

Overall, these findings point to the importance of individualized recommendations for repeated ESIs. But this can be achieved only if careful patient selection, keeping comorbidities like diabetes in view, is done along with strict adherence to procedural guidelines. Close monitoring, especially of metabolic parameters, is desirable in those who may require multiple injections. Finally, repeat ESIs continue to be an appropriate therapeutic alternative, but such a strategy must be used selectively, balancing each patient's chances of relief with the increasing danger of complications.

5. CONCLUSION

In summary, this retrospective analysis points out that repeated epidural steroid injections for chronic low back pain can be undertaken with a relatively favorable safety profile in well-selected patients. Nonetheless, the chance of complications increases with the number of injections provided. Clinicians should be cautious and attentive in monitoring both procedural and systemic adverse events, particularly in diabetic patients. Careful patient selection, dose management, and regular follow-up are essential to achieving optimal outcomes. These findings highlight the importance of balancing therapeutic benefits against potential risks when considering repeated ESIs.

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