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Original Article

EVALUATION OF CAUDAL EPIDURAL STEROID INJECTION FOR MANAGING LOW BACK PAIN AND LUMBAR RADICULOPATHY IN A TERTIARY CARE CENTER: A RETROSPECTIVE STUDY.

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Abstract

Background

Epidural steroid injections (ESIs) have been a prevalent therapeutic intervention for managing pain due to lumbar disc injuries since the 1950s, particularly in patients with lumbosacral radiculopathies. This study evaluates the efficacy of caudal ESIs in alleviating pain and improving functional outcomes in affected patients.

Methods

This retrospective study was conducted at the Indira Gandhi Institute of Medical Sciences (IGIMS) in Patna over one year, involving 50 patients with low back pain and radiculopathy. Participants underwent comprehensive assessments based on predefined inclusion and exclusion criteria, followed by caudal epidural steroid injections.

Results

Follow-up evaluations showed that 80% of patients reported complete pain relief by the third day, increasing to 92% by the first month, with all patients (100%) pain-free by the third month. The study also indicated the effectiveness of the intervention when complemented with physiotherapy and postural corrections.

Conclusion

Caudal epidural steroid injections are effective and safe for managing low back pain associated with radiculopathy, significantly improving patient outcomes. These findings support the use of this technique as a reliable option for pain management in this patient population.

Recommendation

The authors advocate for additional research to focus on methodological aspects, including proper allocation concealment and blinding of care providers, to reduce the risk of biased treatment and adverse effect estimates.

Keywords: *Epidural Steroid Injections, Caudal Route, Low Back Pain, Radiculopathy, Pain Relief, Physiotherapy.*
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Introduction

Epidural steroid injections (ESIs) have been used since the 1950s to treat pain caused by lumbar disc injuries [1-3]. Such pain is frequently linked to nerve root compression caused by a herniated intervertebral disc, which irritates. This irritation usually causes neuropathic pain that radiates along the sensory distribution of one or more spinal roots. While ruptured discs are a prevalent cause, additional disorders like spondylosis, spondylolisthesis, and ligamentum flavum hypertrophy can all contribute to spinal nerve root compression.

Lumbosacral radiculopathies, a frequent consequence of nerve root compression, significantly impact the quality of life for many patients. More than half of those affected report persistent pain that interferes with their daily activities, even after adhering to oral medication regimens [4–7]. This emphasizes the necessity of effective alternative interventions to address this chronic and debilitating condition.

Among the various techniques available for delivering ESIs, the caudal epidural route is a commonly employed approach. This technique requires inserting a needle into the sacral hiatus, a bony plug that forms when the fifth (and, less frequently, the fourth) sacral vertebrae do not fuse completely. Gently pressing on the midline, near the base of the birth cleft, will reveal the sacral hiatus. Entering the sacral canal through the anterior aspect of the hiatus are the following structures: the filum terminale, lower nerve roots, extradural fat, and venous plexuses. Sacral cornua, which are landmarks in anatomy, are bilateral articular structures. According to references [8–10], the sacrococcygeal ligament, subcutaneous fat, and the skin that lies on top make up the posterior boundary.

Despite its utility, the caudal epidural approach carries certain risks, including local infection, neurovascular

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injury, and hematoma formation. Nevertheless, it remains a vital option in the management of lumbosacral radiculopathies, particularly when other conservative measures fail to provide relief. This study seeks to examine the efficacy of caudal epidural steroid injections in alleviating pain and improving functional outcomes in patients with lumbosacral radiculopathies.

Methods

Study Design

The study followed a retrospective, cross-sectional design. It included both male and female patients presenting with low back pain associated with radiculopathy. All patients underwent a comprehensive assessment to ensure eligibility based on predefined inclusion and exclusion criteria.

Study Setting

This study was carried out at Indira Gandhi Institute of Medical Sciences (IGIMS), Patna, a tertiary care center known for its specialized medical services and research capabilities.

Study Duration and sample size

The study spanned one year from September 2023 to August 2024, during which data were collected and analyzed from 50 patients.

Inclusion Criteria

Patients with low back pain associated with radiculopathy were included in this study. Eligibility was further supported by imaging findings, such as radiographs or MRI scans, showing early spondylitis or disc lesions in the lumbosacral spine. Individuals with intervertebral disc herniation were also considered eligible, as were elderly patients diagnosed with spinal canal stenosis. Additionally, participants with ligamentum flavum thickening, a condition often associated with nerve root compression, were included in the study population.

Exclusion Criteria

Patients below 18 years of age, had uncontrolled diabetes or were pregnant were excluded from the study. Those with a known history of cardiovascular diseases or a diagnosis of spondylolysis were also ineligible. Furthermore, patients using anticoagulant medications, which increase the risk of bleeding, were excluded to ensure safety during the procedure.

Study Procedure

Preparation of the Injectable Cocktail

The injectable solution used for caudal epidural administration was prepared fresh for each patient to ensure sterility and efficacy. The 10 mL cocktail consisted of:

- **1 mL of 2% Xylocaine**: A local anesthetic to provide immediate pain relief.
- **1 mL of Kenacort or Depo-Medrol**: A corticosteroid to reduce inflammation and nerve root irritation.
- **8 mL of distilled water**: Used as a diluent to achieve the required volume and ensure even distribution.

The components were mixed under aseptic conditions in a sterile syringe before being administered.

Procedure for Caudal Epidural Injection

The injection was performed via the caudal epidural route, a widely used technique for delivering steroids to the epidural space. Patients were positioned prone on the procedure table with a pillow placed under the abdomen to facilitate access to the sacral hiatus.

Localization of the Sacral Hiatus

The sacral hiatus, an anatomical landmark that is made by the non-fusion of the fifth (or occasionally the fourth) sacral vertebra, was palpated at the base of the natal cleft in the midline. The area was cleaned thoroughly using an antiseptic solution, and sterile drapes were placed around the site.

Needle Insertion and Drug Administration

Under strict aseptic precautions, a 22-gauge needle was carefully inserted through the sacral hiatus into the caudal epidural space. Correct needle placement was confirmed by the absence of cerebrospinal fluid or blood return. Once confirmed, the prepared injectable cocktail was slowly administered into the epidural space.

Post-Procedure Monitoring

Following the injection, patients were closely monitored for 30–60 minutes for any immediate adverse reactions, such as localized pain, dizziness, or allergic reactions. Patients were advised to refrain from engaging in strenuous activities for the next 24 hours and to recover.

Safety Measures and Follow-Up

To minimize complications, all procedures were performed by an experienced clinician under strict aseptic conditions. Patients were provided with instructions regarding potential side effects and advised to report any unusual symptoms promptly. Follow-up appointments were scheduled to assess pain relief, functional improvement, and any delayed complications.

Statistical Analysis

Data were analyzed using descriptive and inferential statistics with categorical variables being shown as percentages.

Results

The study included 50 patients categorized into three groups: Group I (18-40 years), Group II (41–60 years), and Group III (61-75 years). Table 1 presents the age distribution (Table 1).

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Table 1: Distribution According to Age

Age Group	Number of Patients	Percentage
18-40 yrs	12	24%
41–60 yrs	15	30%
61-75 yrs	23	46%
Mean ± Std. dev.	56.54 ± 14.83	

The gender distribution of the participants revealed that of the 50 patients a greater proportion of males in this study with 31 males (62%) and 19 females (38%) (Table 2).

Table 2: Distribution According to Gender

Gender	Number of Patients	Percentage
Male	31	62%
Female	19	38%

Patients were assessed for radiculopathy, low back pain, sciatic point tenderness, and straight leg raise test during follow-up visits on the 3rd day, 1st month, 3rd month, 6th month, and at the end of the study. After three days, 40 patients (80%) reported complete relief from low back pain and radiating pain, while 10 patients (20%) experienced partial or persistent complaints. These 10 patients received a second epidural steroid injection after one month, distributed as follows: 2 from Group I, 3 from Group II, and 5 from Group III. By the first month, 46 patients (92%) reported significant improvement in symptoms, while 4 patients (8%) experienced mild residual back pain. These patients showed further improvement after 2–3 months of regular physiotherapy and postural correction exercises (Table 3).

Table 3: Clinical Outcomes During Follow-Up

Follow-Up Time	Pain-Free Patients	Patients with Partial Relief	Second Injection Required
3rd Day	40 (80%)	10 (20%)	0
1st Month	46 (92%)	4 (8%)	10
3rd Month	50 (100%)	0	0

By the third month, all 50 patients (100%) were pain-free, demonstrating the effectiveness of the intervention when combined with physiotherapy and postural corrections.

Discussion

The transforaminal, interlaminar, and caudal routes are among the methods by which steroids can be administered. The caudal route was implemented in this investigation, which entails the insertion of a catheter through the sacral hiatus to administer medication to the epidural space. Earlier research has demonstrated that the caudal epidural block, which is administered using a landmark-based, blind technique, has a success rate of over 96% in pediatric populations [11,12]. In contrast, the success rate of the blind technique in adults, as observed in previous studies [13-15], ranges from 68% to 75%, even among experienced practitioners. Nevertheless, the accuracy and success rates of caudal epidural blocks in adults have been substantially improved by the integration of imaging technologies, including fluoroscopy and ultrasonography. This study achieved a 100% success rate in identifying the epidural canal.

The caudal epidural block is extensively recognized for the management of a variety of chronic pain conditions in adults, in addition to its use for surgical anesthesia and analgesia in pediatric patients [16]. The clinician's experience and skill level frequently dictate the technique selected, which can have an impact on patient outcomes. According to research, 70% to 90% of patients experience significant pain relief that persists for years [17]. Additional injections may be administered within 12 months for individuals who exhibit a favorable response to the initial injection as the effects of the first injection diminish. It is important to note that epidural injections administered at spinal levels L4 or lower generally have a lower risk of complications than injections administered at higher spinal levels, which is consistent with the results of the current study [18,19]. The treatment area is typically numbered with a local anesthetic, ensuring a benign experience, and patients remain conscious during the procedure. To facilitate access to the gluteal area, patients were positioned prone in this study, thereby exposing the lower two-thirds of the back to the upper third of the thigh. The area was meticulously cleaned, painted, and draped in aseptic techniques. The sacral cornua and apex of the sacral hiatus were marked to ensure accurate needle positioning.

A 10 ml injectable cocktail was prepared by combining 1 milliliter of 2% Xylocaine, 1 ml of Kenacort/Depomedrol, and 8 ml of distilled water. The needle was implanted at a

45-degree angle just distal to the apex of the sacral hiatus using an 18/20-gauge needle. The needle was further advanced after the angle was adjusted to 30 degrees upon contact with the bone. The medication was administered gradually after aspiration was conducted to verify its proper placement in the epidural canal and to detect any blood. Patients were advised to report any sensations they experienced during the injection procedure, including warmth in the lower limbs or back. Immediately following the injection, patients were instructed to remain in the same position for 15 minutes, and then to lie supine for two hours. Additionally, they were advised to commence physiotherapy the following day and were furnished with a lumbar support harness to ensure their comfort during travel.

This study did not encounter any complications, including local infections, neurovascular injuries, or hematomas. This result is especially noteworthy when contrasted with other epidural injection routes, which, despite providing direct delivery to the afflicted site, have a higher incidence of complications. The results demonstrate the safety and efficacy of the caudal route for steroid injections in the treatment of low back pain associated with radiculopathy, emphasizing its potential as a preferred method in clinical practice.

Conclusion

This study demonstrates that caudal ESI is a safe and effective treatment modality for managing low back pain associated with radiculopathy. With a 100% success rate in identifying the epidural canal and a significant proportion of patients experiencing substantial pain relief, the caudal route proves to be a reliable approach for this patient population. Additionally, the absence of complications such as infections, neurovascular injuries, or hematomas further reinforces the safety of this technique. These findings highlight the importance of using the caudal route in clinical practice, as it not only provides effective pain management but also minimizes the risks associated with alternative injection routes.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

Recommendation

The authors advocate for additional research to focus on methodological aspects, including proper allocation concealment and blinding of care providers, to reduce the risk of biased treatment and adverse effect estimates.

Acknowledgment

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Data Availability

Data is available upon request.

Author contributions

All authors contributed to the design of the research. KR and AA collected and analyzed the data. NKA wrote the manuscript. SK and AA edited the paper. All authors read and approved the paper.

List of abbreviations

ESI- Epidural steroid injections
MRI- Magnetic Resonance Imaging

Source of funding

No funding was received.

Conflict of interest

The authors have no conflicting interests to declare.

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