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General

Safety of Catheter-Based Cervical Epidural Steroid Injections: A Retrospective Review

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Background

Cervical epidural steroid injections (CESIs) are frequently utilized for the treatment of cervical radiculopathy and axial neck pain. Given the anatomical complexity of the cervical spine, techniques that enhance precision while maintaining safety are essential. This case series evaluates the safety of a catheter-based approach for CESI, allowing targeted medication delivery to the affected spinal level.

Methods

A retrospective review was conducted of 9 patients who underwent cervical ESIs using a catheter-based technique. Under fluoroscopic guidance, the epidural space was accessed with a touhy needle, and a flexible catheter was advanced to the level of pathology for medication administration. All patients were monitored during and after the procedure for any complications.

Results

All 9 procedures were successfully completed without any reported complications. There were no cases of dural puncture, neurological injury, or other adverse events associated with the procedure.

Conclusion

This case series supports the safety and feasibility of catheter-based cervical epidural steroid injections. The technique allowed for accurate targeting of pathology without any observed complications. These preliminary findings warrant further investigation in larger, controlled studies to confirm safety and efficacy.

INTRODUCTION

Cervical spine radiculopathy (CSR) is a frequently encountered condition characterized by irritation or compression of cervical nerve roots, resulting in neck pain, radiating upper extremity pain, and sensory or motor disturbances such as numbness, tingling, or weakness. The most common causes include cervical disc herniation and foraminal stenosis.[1] Epidemiological studies estimate an incidence of 0.83–1.79 per 1,000 persons and a prevalence ranging from 1.21 to 5.8 per 1,000 individuals.[2]

First-line management of CSR typically involves conservative treatments, including physical therapy, pharmacologic agents, and activity modification. When symptoms persist, cervical epidural steroid injections (ESIs) are a commonly employed interventional option aimed at reducing inflammation and alleviating nerve root irritation.

There are two primary techniques for administering cervical ESIs: cervical transforaminal epidural steroid injections (CTFESIs) and cervical interlaminar epidural steroid injections (CILESIs). CTFESIs involve delivering corticosteroids directly through the intervertebral foramen, enabling precise targeting of the affected nerve root. This approach offers both therapeutic and diagnostic advantages due to its specificity.[3,4] In contrast, CILESIs involve injection of steroids into the epidural space between the vertebral laminae, allowing broader medication spread to multiple nerve roots.[1,5,6] This approach allows for treatment of multilevel pathology and avoids the complications associated with CTFESIs at the expense of diagnostic precision.

While both techniques have clinical utility, each comes with its own limitations. CTFESIs, though anatomically tar-

geted, carry a higher risk of serious complications due to the proximity of critical vascular structures, while CILESIs may be limited by anatomical constraints—particularly at higher cervical levels where the epidural space narrows and there may be discontinuity of the ligamentum flavum.[7] To overcome these challenges, catheter-based cervical interlaminar epidural steroid injections have been explored as a method to enhance precision and safety by allowing directed delivery of medication to upper cervical levels. In this study, we present a retrospective review of cases utilizing this catheter-based technique to evaluate its safety profile and feasibility in routine clinical practice.

METHODS

A retrospective chart review was conducted to evaluate the safety of cervical ESIs performed using a catheter-based technique. Medical records were reviewed for all patients who underwent cervical epidural injections with interlaminar approach with catheter advancement to the targeted cervical pathology.

Data collection focused on identifying any immediate or delayed complications related to the procedure, including but not limited to dural puncture, neurological injury, infection, bleeding, or other adverse events. Only patients who underwent catheter-based CESIs were included in this review. All procedures were performed under fluoroscopic guidance by experienced interventional pain physicians. No identifiable patient information was included in the analysis.

RESULTS

A total of 9 cervical ESI procedures were performed using a catheter-based technique. All procedures were conducted via interlaminar approach using an 18-gauge Tuohy needle to access the epidural space at the C7/T1 level. Following epidural access, a 21-gauge flexible catheter was carefully advanced under fluoroscopic guidance to the cervical level of pathology corresponding to the patient's clinical and imaging findings.

Once the catheter was positioned at the desired level, contrast dye was injected through the catheter to confirm appropriate spread within the epidural space and to verify that there was no intrathecal or intravascular uptake. Both particulate and nonparticulate corticosteroids were used during the injections, depending on clinical judgment and patient-specific considerations. Steroids were injected slowly through the catheter following confirmation of correct positioning. No intra- or post-procedural complications were reported.

DISCUSSION

This case series demonstrates the safety and technical feasibility of performing cervical epidural steroid injections (CESIs) using a flexible catheter advanced through an interlaminar approach to target specific cervical pathology. In all 9 cases, the catheter was successfully advanced to the desired cervical level without complication, and no adverse events such as dural puncture, neurological injury, infection, or vascular compromise were observed. These findings support the potential utility of catheter-based CESIs as a safe alternative for patients with pathology at higher cervical levels that are traditionally more difficult to reach via standard interlaminar techniques.

Conventional interlaminar CESIs are generally limited in their ability to precisely target upper cervical levels due to the narrowing of the epidural space and anatomical constraints as the spinal cord occupies a larger proportion of the canal.[7] While CTFESIs offer more precise targeting of a specific nerve root, they carry well-documented risks related to inadvertent arterial injection or embolization of particulate steroids, which may lead to catastrophic outcomes such as spinal cord infarction, stroke, or paralysis.[4, 8-10] Many physicians are uncomfortable performing CTFESIs for this reason. Additionally, since the epidural space becomes narrower at higher levels – many physicians only perform cervical ESIs at the C7/T1 interspace for safety concerns.

The catheter-based interlaminar approach described in this series provides a compromise between these two techniques—offering more precise targeting than standard CILESIs while minimizing the vascular risks associated with CTFESIs injections. Previous studies have described the use of cervical epidural catheters, but published data remain limited.[11,12] Our series adds to the growing body of evidence suggesting that this method may be a valuable option for interventional pain physicians, particularly when treating multilevel or high cervical radicular pathology.

This study is not without limitations. The sample size is small, which limits the generalizability of the findings. Despite this constraint, the absence of procedural complications in this series supports the safety of catheter-based cervical epidural steroid injections when performed by experienced interventional pain physicians. This study provides preliminary evidence that the technique is feasible and well-tolerated in appropriately selected patients. However, larger prospective studies with standardized outcome measures are needed to further evaluate both the safety and clinical efficacy of this approach and to better define its role within the broader context of cervical spine interventional pain management.

CONCLUSION

Catheter-based cervical epidural steroid injections appear to be a safe and technically feasible approach for delivering targeted therapy to cervical spinal pathology, particularly in cases where traditional interlaminar access is limited or where transforaminal injections pose increased risk. In this small case series, no procedural complications were observed, supporting the potential utility of this technique in appropriately selected patients.

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