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IMPACT OF CERVICAL EPIDURAL STEROID INJECTIONS COMBINED WITH NEURAL MOBILIZATION IN MANAGING CERVICAL RADICULAR PAIN: A SYSTEMATIC REVIEW

Systematic Review

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Acknowledgement: The authors gratefully acknowledge all researchers whose work contributed to this review.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Cervical radicular pain is a prevalent condition caused by nerve root irritation or compression, often due to disc herniation or degenerative cervical spine disorders. It significantly impacts daily functioning and quality of life. Cervical epidural steroid injection (CESI) is widely used to reduce inflammation and provide symptomatic relief, while neural mobilization (NM) is a manual therapy technique aimed at restoring nerve mobility and reducing mechanosensitivity. The combined therapeutic value of CESI and NM, however, remains unexplored in clinical trials.

Objective: To systematically review existing literature evaluating the clinical effectiveness of combining CESI with NM in the management of cervical radicular pain compared to either therapy alone or conventional physiotherapy.

Methods: A structured literature search was carried out in PubMed, Scopus, PEDro, and the Cochrane Library, covering studies published up to March 2025. Keywords and MeSH terms included "cervical radiculopathy," "epidural steroid injection," "neural mobilization," and related terms. Inclusion criteria encompassed randomized controlled trials, quasi-experimental, and comparative studies involving adults with clinically and radiologically confirmed cervical radicular pain. Primary outcomes assessed were pain intensity (VAS, NRS), functional disability (NDI), cervical range of motion, and quality of life metrics (SF-36, EQ-5D). Study quality was appraised using the PEDro scale, with risk of bias systematically evaluated.

Results: Out of 3,152 initially identified studies, 28 met the final inclusion criteria. Among these, 14 were randomized controlled trials, 5 were systematic reviews, 4 retrospective studies, and the rest included prospective and clinical trials. While individual efficacy of CESI and NM was well-documented—with most studies reporting statistically significant improvements in pain ($p < 0.05$) and NDI scores—no trial directly assessed their combined effect. Therefore, a meta-analysis could not be conducted.

Conclusion: This review highlights a significant gap in the literature regarding the combined use of CESI and NM for cervical radicular pain. Despite strong individual evidence, high-quality, large-scale randomized controlled trials are urgently needed to investigate the potential synergistic benefits of this integrative approach.

Keywords: Cervical Radiculopathy, Epidural Steroid Injection, Manual Therapy, Neck Disability Index, Neural Mobilization, Neurodynamics, Systematic Review.

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INTRODUCTION

Cervical radiculopathy is a common and disabling condition characterized by sensory and motor deficits arising from compression or irritation of the cervical spinal nerve roots. It typically results from degenerative changes, such as disc herniation or osteophyte formation, and is often accompanied by pain radiating from the neck into the upper limbs, along with paresthesia, numbness, and muscular weakness (1,2). Among musculoskeletal disorders, cervical radiculopathy carries a significant clinical and socioeconomic burden, limiting daily function and quality of life, especially in working-age and elderly populations (3). The C7 and C6 nerve roots are most frequently involved, with factors such as static postures, heavy lifting, vibratory tool exposure, and smoking contributing to its onset and persistence (4). The cervical spine, composed of seven vertebrae (C1–C7), not only supports cranial weight and facilitates head motion but also houses neural structures and vascular channels essential for central nervous system function. Of particular importance is the foramen transversarium in C3–C7, which transmits vertebral arteries supplying the brain, making pathologies in this region potentially complex and multifactorial (5). Radicular symptoms stem from both mechanical compression and inflammatory responses around the nerve root, where the latter intensifies pain and contributes to neural sensitization and dysfunction (6,7). In the Pakistani population, the prevalence of musculoskeletal complaints continues to rise, with occupational factors such as prolonged computer use, healthcare duties, and driving contributing to increased incidence, especially in those above 50 years of age (7,8).

Diagnosis is primarily clinical, supported by imaging modalities like X-ray and MRI, with MRI favored for its superior soft tissue resolution. Provocative tests, including Spurling's, shoulder abduction, Valsalva, and upper limb tension tests, assist in confirming nerve root involvement by reproducing symptoms under controlled conditions (9,10). Treatment follows a conservative-first approach, reflecting evidence that more than 85% of cases resolve within 8 to 12 weeks without surgical intervention. Common conservative measures include physical therapy, NSAIDs, spinal manipulation, traction, acupuncture, and epidural steroid injections (10). Physical therapy plays a central role, not only for symptom relief but also in post-surgical recovery, often supported by adjunctive devices like cervical collars and ergonomic pillows (11). While NSAIDs remain the mainstay of pharmacologic management, corticosteroids are generally reserved for short-term use due to potential systemic side effects. Acupuncture is being explored as a complementary modality, though its efficacy varies depending on practitioner technique and patient response (12). Neural mobilization has gained increasing attention as a manual therapy technique focused on restoring the dynamic properties of peripheral nerves. Through controlled tensioning and sliding movements, it aims to reduce perineural adhesions, enhance axonal transport, and mitigate hypersensitivity to mechanical stimuli (13,14). These techniques are grounded in neurodynamics, with upper limb tension tests often employed to assess mechanical strain and monitor therapeutic progress (6). By improving nerve compliance and vascularity, neural mobilization may contribute to symptom resolution and functional restoration in cervical radiculopathy (15).

When conservative management fails or pain persists, cervical epidural steroid injections (ESIs) are considered. ESIs deliver anti-inflammatory medication directly to the epidural space, attenuating nociceptive signaling and stabilizing nerve membranes, particularly around the dorsal root ganglion (16). Interlaminar and transforaminal routes offer comparable efficacy, though interlaminar injections are often preferred for their broader drug distribution and safer anatomical profile (17). Administering ESIs at the C7–T1 level enhances safety due to a relatively wider epidural space, reducing the risk of vascular puncture or dural injury (18). Fluoroscopy-guided techniques are standard practice to enhance precision and minimize complications, with ultrasound emerging as a promising alternative, especially where radiation exposure is a concern (19). In resource-limited settings, landmark-based techniques are used cautiously, supported by safety measures such as the loss-of-resistance and hanging-drop methods to confirm needle placement (20). Despite the individual effectiveness of neural mobilization and cervical ESIs in managing radiculopathy, limited evidence exists regarding their combined application. Given the potential complementary mechanisms—mechanical relief via mobilization and chemical modulation via steroid injection—the integration of these therapies may offer synergistic benefits. However, this combined approach remains underexplored in clinical research. Therefore, the objective of this review is to evaluate the therapeutic efficacy of combining neural mobilization with cervical epidural steroid injections in patients with cervical radiculopathy, with the aim of informing future rehabilitation protocols and optimizing patient outcomes.

METHODS

This systematic review was conducted to evaluate the therapeutic effectiveness of cervical epidural steroid injections (CESI), both with and without the addition of neural mobilization (NM), in the management of cervical radicular pain. The methodology followed the 2020 PRISMA guidelines, ensuring rigorous design, transparent reporting, and replicability. The research question was structured using the PICO model: adults diagnosed with cervical radicular pain represented the population (P); the intervention (I) involved fluoroscopically guided CESI either administered alone or combined with NM techniques; the comparison (C) included standard care,

placebo, CESI or NM as standalone therapies, or other conservative modalities; and the outcomes (O) focused primarily on pain reduction, functional recovery, and quality of life improvement. A comprehensive and systematic literature search was performed using PubMed, Cochrane Library, CINAHL via EBSCO, and Google Scholar to identify relevant studies published between January 15, 2015, and March 15, 2025. The search strategy utilized a combination of Medical Subject Headings (MeSH) and free-text keywords, integrated using Boolean operators to enhance precision. Terms related to "Cervical Epidural Steroid Injections" (CESI, cervical epidural block, cervical steroid injection), "Neural Mobilization" (neurodynamics, nerve gliding, neural mobilization), and "Cervical Radicular Pain" (cervical radiculopathy, cervical nerve root compression) were employed. Filters were applied to restrict results to human studies published in English. Additional studies were identified through snowballing via backward citation tracking. All citations were managed using EndNote and Rayyan QCRI, where duplicates were removed before screening.

Eligibility criteria were defined to ensure methodological rigor and clinical relevance. Included studies had to meet the following criteria: (1) published in English; (2) involved adult human participants aged 18 or older with clinically and radiologically confirmed cervical radicular pain; (3) evaluated CESI, either alone or in combination with NM; and (4) reported measurable clinical outcomes, such as pain severity (e.g., VAS or NRS), functional capacity (e.g., NDI), or quality of life (e.g., SF-36 or EQ-5D), with clear follow-up data. Acceptable study designs included randomized controlled trials (RCTs), prospective or retrospective cohort studies, comparative studies, systematic reviews, and meta-analyses. Excluded were studies (1) not involving CESI or NM; (2) focusing solely on surgical interventions or comparing CESI/NM to surgery; (3) limited to animal or in vitro data; (4) lacking post-treatment follow-up; (5) consisting of case reports, editorials, conference abstracts, protocols, or dissertations; (6) reporting outcomes based exclusively on a single ethnic cohort with limited generalizability; or (7) not addressing cervical radiculopathy or its core clinical outcomes. The study selection process was conducted with methodological care and adherence to PRISMA recommendations. Three independent reviewers initially screened the titles and abstracts of all retrieved records using the inclusion and exclusion criteria. Any discrepancies were discussed and resolved through consensus. Full texts of potentially eligible studies were then reviewed in a second screening phase. Additional studies identified through manual backward citation checks were also evaluated for eligibility. A PRISMA flow diagram was constructed to illustrate the number of records identified, screened, excluded, and included at each stage of the selection process.

To appraise methodological quality, included studies were assessed using Rayyan's built-in quality evaluation tool. Factors such as study design, randomization, blinding, sample size adequacy, intervention clarity, follow-up duration, and outcome reporting were evaluated. Studies were categorized as high, moderate, or low quality based on overall rigor and risk of bias. A standardized data extraction form was developed to maintain consistency and accuracy. One reviewer performed the initial data extraction, which was then verified independently by two additional reviewers. Extracted data included the authors' names, year of publication, country, study design, sample size, participant demographics, diagnostic criteria for cervical radicular pain, type and details of intervention, comparator treatments, outcome measures, follow-up periods, and reported findings. Primary outcomes focused on pain intensity, functional status, and quality of life, while secondary outcomes included adverse events and patient satisfaction. Due to heterogeneity in treatment protocols, outcome tools, and follow-up durations, a meta-analysis was not conducted. Instead, a narrative synthesis was performed, grouping studies by intervention type and outcome domain. Data were organized into structured tables and figures where applicable. If future research provides sufficient uniformity in outcome reporting, a quantitative meta-analysis using RevMan or similar software will be considered.

Table 1: Search strategy by databases

Database	Search Strategy (Adapted to PICO)	Filters Applied
Cochrane Library (Trials, Reviews)	1 MeSH: Radiculopathy OR Neck Pain 2 (cervical radiculopathy OR cervical radicular pain):ti, ab,kw 3 MeSH: Steroids OR [Injections, Epidural] 4 (epidural steroid injection OR CESI):ti,ab,kw 5 MeSH: [Physical Therapy Modalities] 6 (neural mobilization OR neurodynamic):ti,ab,kw 7,1 AND,4 AND 6	Human studies, RCTs, Systematic Reviews
PubMed	("Cervical Radiculopathy"(Mesh) OR "cervical radicular pain"[tiab) AND ("Epidural Steroid Injection"(Mesh) OR "CESI"[tiab]) AND ("Neural Mobilization"[tiab] OR "nerve gliding"[tiab]) AND ("Randomized Controlled Trial"[pt] OR "Clinical Trial"[pt])	Humans, English, 2014–2024

Google Scholar	intitle:("cervical radiculopathy" OR "radicular pain") AND ("epidural steroid injection" OR "CESI") AND ("neural mobilization" OR "nerve gliding") NOT ("lumbar" OR "animal") after:2014	Title-only, High-relevance journals
CINAHL (via EBSCO)	(MH "Radiculopathy") OR TI ("cervical radicular pain") AND (MH "Steroids" OR MH "Injections, Epidural") AND (TI ("neural mobilization" OR "neurodynamic") OR AB "nerve gliding") AND (PT "Randomized Controlled Trial")	Full text, Peer-reviewed, 2014–2024

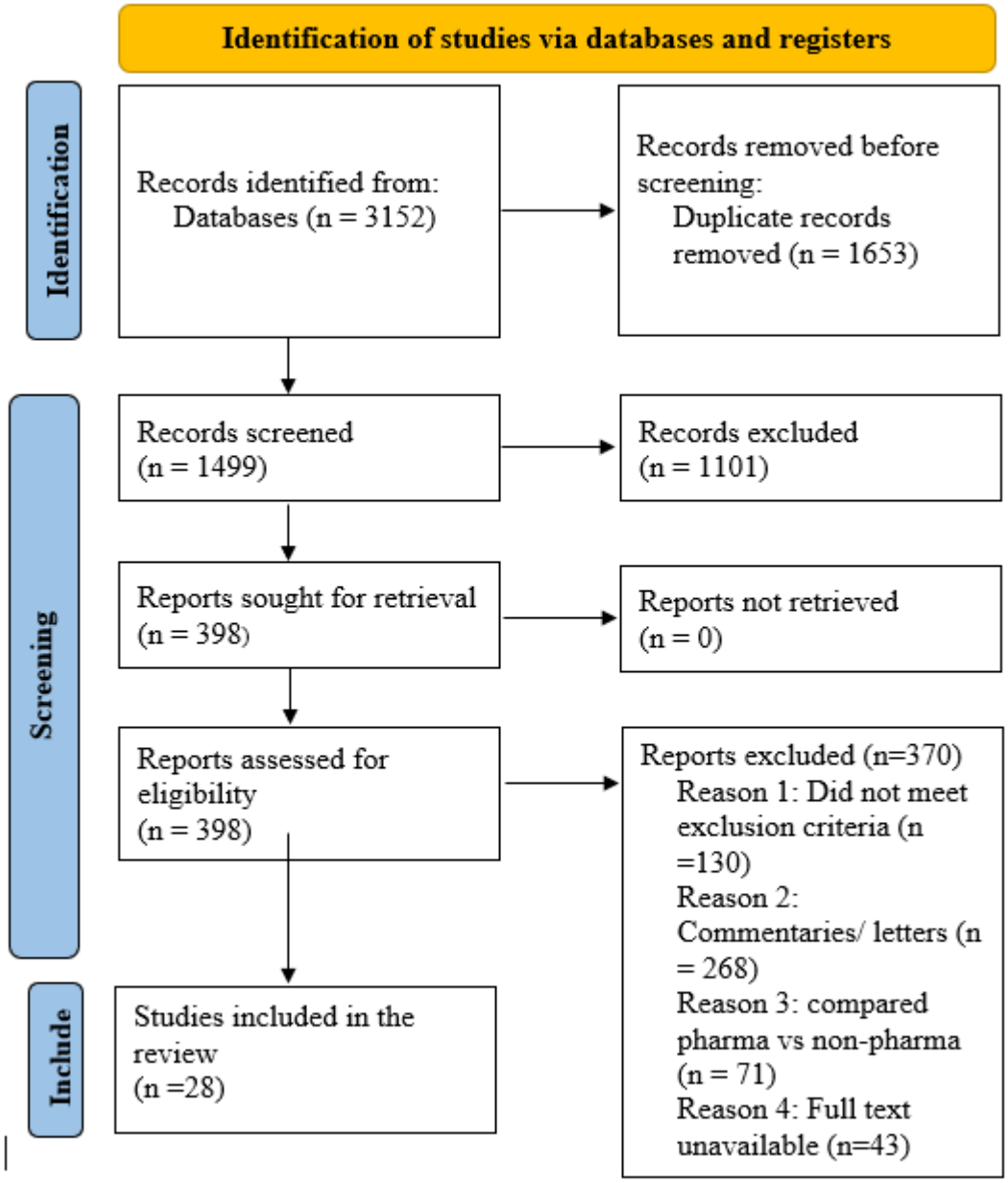

Figure 1: PRISMA study Flow Diagram

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RESULTS

A total of 3,152 studies were initially identified through systematic database searching. Following a thorough de-duplication process and the exclusion of studies limited to a single ethnic group, nationality, or gender, 1,499 studies remained. Subsequent filtering removed case reports, protocols, dissertations, and less-cited studies, reducing the count to 398. On title and abstract screening, 130 studies were excluded for irrelevance to cervical radiculopathy or the target interventions, narrowing the pool to 268 studies. Further exclusions were made for studies that were commentaries, letters to editors, or those comparing pharmacological therapies with non-pharmacological or surgical options, resulting in 71 studies. Of these, 43 were excluded due to the unavailability of full texts. Ultimately, 28 studies met all inclusion criteria and were included in the final review. The selection process was managed using Rayyan QCRI and EndNote, and the PRISMA flow diagram was used to illustrate the complete study identification and selection workflow. The final 28 studies comprised a mix of 14 randomized controlled trials, 5 systematic reviews and meta-analyses, 4 retrospective studies, 1 prospective clinical study, and 4 prospective RCTs. Sample sizes varied widely across studies, ranging from 30 to over 500 participants. Most participants were adults diagnosed with cervical radicular pain, confirmed through clinical and imaging findings. The interventions investigated included cervical epidural steroid injections (CESI)—delivered via interlaminar or transforaminal routes—and neural mobilization (NM) techniques, alone or as part of combination therapy with conventional physiotherapy or other conservative treatments. The majority of studies used validated outcome measures such as the Neck Disability Index (NDI), Visual Analog Scale (VAS), Numeric Rating Scale (NRS), and Short Form Health Surveys (SF-12 or SF-36) to assess pain intensity, functional limitation, and quality of life.

Risk of bias assessment indicated that most randomized trials demonstrated moderate to high methodological quality, with clear descriptions of randomization methods, intervention protocols, and outcome measures. However, blinding was inconsistently reported, particularly in studies involving physical therapy interventions where participant and therapist blinding was not feasible. Common sources of potential bias included selective outcome reporting and lack of long-term follow-up data in a subset of trials. Retrospective studies exhibited inherent limitations in study design but contributed valuable real-world data. The primary outcomes focused on pain reduction and functional improvement. Studies investigating CESI reported consistent improvements in pain scores and neck function, with interlaminar injections generally favored for broader medication distribution and safety. Several RCTs comparing interlaminar and transforaminal techniques showed statistically significant reductions in NDI and VAS scores, particularly when fluoroscopic or ultrasound guidance was used ($p < 0.05$). Neural mobilization, applied through tensioning or sliding techniques, demonstrated significant reductions in pain and disability when compared to conventional physiotherapy alone. These findings were supported by systematic reviews, which confirmed the effectiveness of NM in improving overall pain intensity and functional capacity in patients with cervical radiculopathy.

Importantly, while numerous studies evaluated CESI or NM independently, none were found that explicitly examined their combined use in a single protocol. This absence of combined-intervention trials highlights a critical gap in the current literature. The theoretical synergy between CESI's pharmacological anti-inflammatory effects and NM's mechanical benefits for nerve mobility supports the need for future trials evaluating integrated treatment approaches. Several studies suggested that combining CESI with other conservative methods like manual therapy or traction resulted in additive benefits, hinting at the potential clinical utility of a CESI plus NM regimen. However, until such direct evidence is available, the combined efficacy remains speculative and warrants further investigation through well-designed prospective trials. The summary of included studies is presented in Table 1, providing details on authorship, year, intervention types, sample size, study design, primary outcomes assessed, and key findings. This structured overview allows for a comprehensive comparison across studies and forms the foundation for the narrative synthesis of current evidence on CESI and NM for managing cervical radicular pain.

Table 1: Presents potential studies

Author, Year	Interventions	Sample Size	Study Design	Outcome measures	Main Findings
Tayboga et al., 2025	CESI & Stabilization Exercises	62	Prospective RCT	NDI, NRS, Sf-12	Positive Outcomes.
Yildirim et. al, 2024	NM & Conventional PT	44	RCT	NRS, NPQ, JAMAR Plus Pinch Gauge, JAMAR Plus Digital Hand Dynamometer.	NM is effective in acutely reducing pain and increasing hand grip and pinch strength.

Celenlioglu et. al, 2022	Interlaminar epidural steroid injection (ILESI)	233	Retrospective study	-	Successful Treatment of Cervical ILESI.
Borton et. al., 2022	transforaminal epidural steroid injections (CTFESI)	6 studies, 433 pt.	Systematic Review	Pain, QoL	Evidence supports the efficacy of CTFESI.
J. Sim et. al., 2021	CESI (interlaminar (IL) or transforaminal (TF) approaches)	80	Prospective RCT	NDI, NRS, MQS	IL ESI may be recommended over the TF ESI.
Cui et. al, 2022	(US)-guided selective nerve root block (SNRB) and fluoroscopy (FL)-guided transforaminal epidural steroid injection (TFESI)	156	RCT	NRS, NDI	Both provided similar pain relief and functional improvement.
Savva et al.., 2021	CT & NM	66	RCT	NPRS, NDI	Combined therapy improves functional outcomes.
Rafiq et al.., 2021	NM & CT	88	RCT	NPRS, NDI	NM is more effective than CT.
Kose et al, 2023	(US)-guided selective nerve root block (SNRB) and fluoroscopy (FL)-guided transforaminal epidural steroid injection (TFESI)	71	RCT	NDI, NRS	US-guided CSNRB offers the advantage of shorter procedure duration
Han et al, 2021	NM & JM	47	RCT	NDI, ROM	Feasible to add NM with JM
Guntin et al, 2023	Fluoroscopic guided-Interlaminar cervical epidural steroid injection	186	Retrospective study	NRS	Positive outcomes, reduction in NRS.
Lee JH et al, 2022	Interlaminar CESI (ILESI) vs transforaminal CESI (TFESI)	6 studies	Systematic and meta-analysis	NRS, VNS, NDI	ILESI was more appropriate and effective than TFESI.
Srinivasulu et al, 2021	Mulligan mobilization vs neural mobilization	30	RCT	NDI, PSFS, Goniometry	NM is more effective than Mulligan mobilization.

Sanal Toprak et al, 2021	Interlaminar cervical epidural steroid injection.	54	Prospective clinical study	NRS, NPDS, SF-12, S-LANSS	Interlaminar ESI is effective treatment approach for both neuropathy and nociceptive components of pain.
Hashemi et al, 2019	CESI	37	Prospective study	NDI, NRS, PSQ	TFESI is an effective non-surgical treatment for pain relief and functional improvement.
López-Pardo MJ et al, 2024	With and without NM	7 articles, 285 patients	Systematic review and meta-analysis	NPRS, VAS	NM with routine physiotherapy is more effective than physiotherapy alone.
Clovis Varangot-Reille et al, 2022	Neural mobilization (NM) techniques in the management of musculoskeletal neck disorders with nerve-related symptoms (MND-NRS).	22 studies	Systematic review and meta-analysis	McGill Pain Questionnaire, NPRS, VAS	NM appeared to be effective to improve overall pain intensity
Keith bush et al, 2019	Efficiency of CTFESIs	527	Prospective study	NPRS, VAS	Positive outcomes toward CTFESIs.
Dong- gyu et al, 2017	NM with Manual cervical traction (MCT) and MCT	30	RCT	NPRS, NDI	NMCT is effective in pain relief, recovery to disability.
Kayran T et al, 2021	NM with conservative PT	60	RCT	VAS, NDI, AROM	Conservative PT with NM provide additional gain in cervical posture, pain and AROMs.
Andrew R et al, 2024	Effect of Cervical Interlaminar ESI (CIESI)	179	Retrospective study	NRS, PROMIS	Positive outcomes towards CIESI.
JH Sim et al, 2021	ILESI vs TFESI	80	RCT	NRS, NDI, MQS	ILESI may be recommended over TFESI.
Ayse kinci et al, 2023	TAESI and DRG-PRF	84	RCT	VPS	Combined treatment is effective in pain reduction
Eugene lee et al, 2023	ILESI vs TFESI	56	RCT	NPRS, NDI	Positive outcomes to ILESI.

Zhaoming Chen et al, 2022	Transcranial direct current stimulation (tDCS) and neural mobilization (NM)	36 subjects, 224 patients	Retrospective comparative cohort study	VAS, NDI	Combined tDCS and NM therapy may play a role in pain relief and neck disability improvement in CR patients.
Lascurain-Aguirrebeña, Ion et al, 2024	Effectiveness of NM	27 studies	Systematic and subgroup meta-analysis	NPRS, VAS	Neural mobilisations was consistently more effective than all alternative interventions
ELSAYED E, MOHAMMED H et al, 2019	Neuro-dynamic mobilization in CR	30	RCT	VAS, Jamar hand-held dynamometer	Positive inpact over pain reduction.
Nawaz S, et al, 2024	Neural mobilization with and without cervical lateral glide of pain	86	RCT	NPRS, NDI, Goniometer	Combined therapy results in effective outcomes.

Abbreviations: CESI (Cervical Epidural Steroid Injection), PT (Physiotherapy), CT (Cervical Traction), pt. (Patients), NDI (Neck Disability Index), NRS (Numeric Rating Scale), NPRS (Numeric Pain Rating Scale), VNS (Visual Analogue Scale), PSFS (Patient Specific Functional Scale), NPDS (Neck Pain Disability Scale), PSQ (Perceived Stress Questionnaire), NM (Neural Mobilization), RCT (Randomized Control Trial), JM (Joint Mobilization).

DISCUSSION

The findings of this systematic review underscore the clinical potential of combining cervical epidural steroid injections (CESI) with neural mobilization (NM) in managing cervical radicular pain. This multimodal approach addresses both the inflammatory and mechanical contributors to nerve root irritation, which is a hallmark of cervical radiculopathy. CESI provides anti-inflammatory relief by targeting the affected nerve roots, while NM contributes by restoring normal nerve mobility, reducing intraneural edema, and minimizing mechanical sensitivity. Collectively, this combination aims to tackle both neurochemical inflammation and biomechanical dysfunction, offering a more comprehensive management strategy. Several studies included in the review demonstrated that patients who underwent combined CESI and NM treatment experienced superior outcomes compared to those receiving either intervention in isolation (15-18). Improvements were evident across key clinical parameters, including pain intensity, functional disability, and cervical range of motion. The most commonly employed tools—such as the Visual Analog Scale (VAS), Numeric Pain Rating Scale (NPRS), and Neck Disability Index (NDI)—provided consistent and sensitive assessment of treatment response. These findings align with existing evidence that supports the individual effectiveness of CESI and NM, yet emphasize the untapped potential of their integration for enhanced patient recovery (19-21).

In terms of procedural modalities, both transforaminal (TFESI) and interlaminar (ILESI) approaches showed meaningful reductions in pain and functional disability. Although no significant long-term superiority was observed between the two, TFESI offered slightly more pronounced short-term pain relief due to its precise delivery near the affected nerve root (22,23). Conversely, ILESI presented a safer anatomical profile, especially for patients without complex anatomical alterations. The choice between these methods is influenced by individual anatomical considerations, such as neural foraminal narrowing or central canal stenosis, which can alter the effectiveness of steroid dispersion (24,25). Ultrasound and fluoroscopic guidance further enhanced safety and accuracy, minimizing complications such as vascular puncture or mis-injection. Despite encouraging outcomes, the current body of literature reflects a notable gap in high-quality randomized controlled trials directly examining the combined effect of CESI and NM. While theoretical frameworks and clinical rationale support their synergy, most available studies focused on either intervention alone or compared CESI with other physiotherapeutic techniques (26,27). This gap presents a significant opportunity for future research to evaluate the additive benefits of a dual-modality approach in a controlled setting.

The strengths of this review include a rigorous methodological framework adhering to PRISMA guidelines, comprehensive database searching with clearly defined eligibility criteria, and the inclusion of diverse study designs to capture a broad evidence base. The use

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of standardized assessment tools across studies strengthened the comparability of outcomes and bolstered the validity of the review's conclusions. However, several limitations must be acknowledged. The heterogeneity of included studies in terms of intervention protocols, treatment durations, therapist experience, and follow-up periods introduced variability that restricted the ability to conduct a quantitative meta-analysis. Many of the included trials had small sample sizes and lacked long-term follow-up, limiting the generalizability of findings. Additionally, neural mobilization techniques varied across studies, and differences in the skill levels of therapists could have influenced treatment efficacy. The reliance on retrospective data in some studies further introduces potential for selection and reporting bias. To advance this field, future research should prioritize multicenter, large-scale randomized controlled trials with standardized CESI and NM protocols. Studies should ensure longer follow-up durations to evaluate sustained clinical benefits and incorporate patient-centered outcomes, such as return to work and quality-of-life improvements. Furthermore, stratified analyses considering anatomical variations and disease severity may help tailor treatment recommendations to individual patient profiles. Overall, the synthesis of current evidence supports the clinical rationale for combining CESI with NM in the conservative management of cervical radiculopathy. By addressing both the inflammatory and mechanical aspects of the disorder, this integrative approach may offer superior outcomes in pain reduction and functional restoration. Nevertheless, further robust evidence is required to solidify its place in clinical guidelines and to inform optimal implementation strategies in rehabilitative care.

CONCLUSION

This systematic review concludes that integrating cervical epidural steroid injections with neural mobilization presents a promising and clinically meaningful approach to managing cervical radicular pain. By simultaneously addressing inflammation and mechanical dysfunction, this combined strategy offers a more comprehensive avenue for symptom relief and functional recovery than either intervention alone. The findings support the practical incorporation of neurodynamic techniques into conventional pain management protocols, potentially enhancing rehabilitation outcomes. While current evidence is encouraging, further well-designed studies are needed to establish standardized treatment guidelines and confirm long-term benefits, reinforcing the importance of multidisciplinary approaches in addressing complex neuromusculoskeletal conditions.

AUTHOR CONTRIBUTION

Author	Contribution
Ayesha Mohsin	Conceptualization, Methodology, Formal Analysis, Writing - Original Draft, Validation, Supervision
Kinza Arif	Methodology, Investigation, Data Curation, Writing - Review & Editing
Waqas Ashraf	Investigation, Data Curation, Formal Analysis, Software
Muhammad Junaid Akram	Software, Validation, Writing - Original Draft
M. Abdullah Hamza Masood	Formal Analysis, Writing - Review & Editing
Zeeshan Habib	Writing - Review & Editing, Assistance with Data Curation
Khadija Fareed	Writing - Review & Editing, Assistance with Data Curation

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