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Research Article

PHYSIOTHERAPY STRATEGIES AND CONSERVATIVE MANAGEMENT FOR CERVICAL RADICULOPATHY: A NARRATIVE REVIEW

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ABSTRACT

Objectives: This narrative review evaluates the effectiveness of physiotherapy-based conservative management for cervical radiculopathy (CR), characterized by neck pain radiating to the arm with sensory and motor deficits. Although CR is often self-limiting, symptoms frequently necessitate treatment, and evidence for specific physiotherapy interventions remains heterogeneous.

Methods: A structured literature search of PubMed, the Cochrane Library, PEDro, and Google Scholar was conducted for studies published up to August 2025. Conservative interventions included physiotherapy, manual therapy, cervical traction, exercise, and cervical collars. Eleven studies were included comprising randomized controlled trials, observational cohort studies, a case series, and one systematic review. As this was a narrative review, findings were synthesized descriptively without a formal meta-analysis or risk-of-bias assessment.

Results: Manual therapy combined with exercise consistently demonstrated reductions in pain intensity and disability. Mechanical cervical traction showed no additional benefit when compared with physiotherapy alone in most studies. In patients with acute CR, semi-hard cervical collars or early physiotherapy led to faster reductions in neck and arm pain than a wait-and-see approach. Cervical vertebral mobilization was associated with improvements in mechanical pain hypersensitivity and disability in chronic CR. Structured post-operative physiotherapy provided only minor benefits over standard postoperative care. Evidence quality across studies ranged from low to moderate, and substantial heterogeneity in intervention protocols and outcome measures limited direct comparisons.

Conclusion: Cervical radiculopathy responds well to conservative measures such as manual therapy, exercise and patient education. Traction provides limited benefit except in selected cases. Early collar use or physiotherapy aids acute pain relief and mobilization techniques benefit chronic CR. However, evidence remains low to moderate. There is a need for well-designed long-term RCTs to guide optimal management of cases with CR.

Keywords: Cervical radiculopathy, Physical therapy modalities, Manipulation, Spinal, Traction.

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INTRODUCTION

Cervical radiculopathy (CR) is a painful clinical condition which is characterized by pain and, in some cases, sensorimotor deficits in the distribution of a cervical nerve root [1]. It frequently results from compression or inflammation due to intervertebral disc herniation or spondylotic changes. It affects approximately 83/100,000 individuals annually and is most prevalent in the fifth to sixth decades of life [2,3]. Higher incidence has been reported in males as compared to in females and in those individuals who are engaged in occupations that involve repetitive neck motion or overhead work. CR can significantly impair quality of life by reducing occupational productivity [4,5]. It may also limit daily activities due to persistent neck and arm pain, muscle weakness, and paresthesia. In addition to these, in severe cases, range of motion can also be reduced [6,7].While surgical intervention may be needed in severe or refractory cases, the majority of patients are initially managed with conservative management strategies, including physiotherapy [8].

Physiotherapy serves as an important part of conservative management. Various components of physiotherapy for CR may comprise manual therapy, cervical traction, and therapeutic exercises [9]. In addition to these interventions, neurodynamic techniques and posture correction strategies are also an important part of physiotherapy in cases of CR. These conservative methods are known to reduce radicular symptoms, improve cervical mobility, and restore functional capacity [10,11]. In mild-to-moderate cases of CR, these conservative management strategies may prevent or at least delay the need for invasive procedures which are associated with significant morbidity [12,13]. Clinical guidelines and expert consensus increasingly recommend structured physiotherapy interventions as the first-line management in uncomplicated CR [14].

Several randomized controlled trials (RCTs) and systematic reviews have assessed the efficacy of various conservative physiotherapeutic modalities in the management of CR [15,16]. The use of mechanical cervical traction has demonstrated short-term relief in selected populations [17]. Similarly, exercise therapy focusing on cervical stabilization and scapular strengthening has shown promising long-term results in pain reduction as well as functional recovery [18,19]. Manual therapy, combined with exercise, has also been associated with superior results as compared to isolated interventions [20,21]. Despite these findings, heterogeneity in patient selection, different intervention protocols, and various outcome measures across studies limit the generalizability of results [22]. Furthermore, very few trials comprehensively compare different conservative modalities which further complicate clinical decision-making in cases of CR [23,24].

Recent advances in physiotherapy that includes integration of neurodynamic mobilization and sensorimotor control training have added new dimensions to the conservative management strategies in cases of CR [25-27]. These techniques aim to address the mechanical and

neurophysiological contributors to radiculopathy [28-30]. These techniques work by modulating neural tension and enhancing proprioceptive feedback. Many studies have found that such strategies may offer additional benefit over conventional management approaches [31-33]. Despite all these recent advances, questions remain regarding optimal treatment duration, frequency, and long-term sustainability of outcomes [34-36]. In addition to these factors, patient adherence, skill variability of physiotherapists, and comorbid musculoskeletal conditions may influence treatment outcome. These variables affecting the outcome of patients are often underreported in existing literature [37-40].

Despite the growing body of evidence supporting conservative interventions for CR, several critical gaps persist in the current understanding of their relative effectiveness, long-term efficacy, and cost-benefit profiles [41-43]. Most existing studies are limited by small sample sizes, short follow-up durations, or methodological inconsistencies [44]. Furthermore, there is also a paucity of comprehensive literature reviews about current physiotherapy strategies with an emphasis on clinical applicability and outcome-based comparisons. This review aims to consolidate existing knowledge, identify patterns in treatment effectiveness, and highlight areas requiring further research.

METHODS

This narrative literature review was undertaken with the help of a structured and systematic approach regarding conservative management of cases with CR. This review is a narrative synthesis of available evidence; although a structured search strategy was used, formal systematic review procedures such as dual screening and risk-of-bias assessment were not performed. The purpose of this review study was to identify and analyze the level of current evidence on physiotherapy strategies as well as on conservative management for CR. The objective was to analyze relevant studies and provide a comprehensive summary of effective conservative and non-surgical interventions for CR. The primary focus of this review study was on clinical outcomes such as pain relief, functional improvement, and quality of life enhancement.

Search strategy

A comprehensive search was undertaken across four major electronic databases that included PubMed, Cochrane Library, physiotherapy evidence database as well as Google Scholar. The search included studies published up to August 2025 and was restricted to papers published exclusively in English language. A combination of medical subject headings terms and relevant keywords was used to ensure that broad coverage of the literature is included. The primary search terms included in the search were CR, physiotherapy, physical therapy, exercise, traction, manual therapy, conservative treatment, and RCT. Boolean operators (AND, OR) were employed to further refine search sensitivity and specificity. In addition, the reference lists of eligible studies and previously published reviews were manually screened to identify further relevant articles which failed to get captured in the electronic search data.

Data extraction and synthesis

Data from eligible studies were extracted using a predefined and structured pro forma to capture key characteristics that included study design, sample size, participant demographics, and diagnostic criteria for CR. In addition to these, details such as intervention and comparator details, duration of treatment, follow-up, and outcome measures were also included in this pro forma. Particular attention was paid to the nature of physiotherapy interventions, treatment (frequency and duration) and whether interventions were supervised or self-directed. Outcome measures of interest included validated scales such as severity of pain as assessed by the Visual Analog Scale (VAS) for pain, neck disability index (NDI), patient-specific functional scale (PSFS), and quality-of-life instruments such as the SF-36 or EQ-5D. As this was a literature review, a formal risk of bias assessment using standardized tools (e.g., Cochrane risk of bias tool) was not undertaken. However, methodological limitations and risks identified by the original authors of the analyzed studies were noted and further discussed. These included issues such as relatively small sample size, lack of blinding leading to selection bias, and short follow-up durations, thereby limiting long-term outcomes, inconsistent intervention protocols, and inadequate or absent control groups for comparison.

A qualitative analysis of findings was conducted, thereby comparing the effectiveness of various conservative approaches and identifying inconsistencies and discrepancies across various published studies. Where applicable, subgroup patterns based on intervention types (e.g., traction vs. exercise therapy), treatment intensity or patient characteristics were analyzed and reported. In addition to these details, trends in outcome durability and adherence-related variables were also summarized to better contextualize the real-world applicability of these conservative measures for the management of CR.

This comprehensive search and report approach was intended to ensure that the narrative review provided a clinically relevant and evidence-based analysis of the current landscape of physiotherapy strategies for CR. This approach also made it possible to identify persistent knowledge gaps that may warrant further investigation.

Inclusion criteria

Studies were considered eligible for inclusion if they met the following criteria:

1. Randomized controlled trials (RCTs), quasi-randomized trials, prospective cohort studies, observational designs, case series, and systematic reviews evaluating non-surgical physiotherapy-based interventions for cervical radiculopathy
2. Adults (≥18 years) diagnosed clinically and/or radiologically with CR. Patients managed by non-surgical physiotherapy-based interventions, including exercise therapy, manual therapy, mechanical or manual cervical traction, neural mobilization, postural education, ergonomic modifications, and other conservative modalities
3. At least one outcome measure related to pain severity, presence of disability, functional status, range of motion, patient satisfaction, or quality of life had to be reported. Full-text availability in English, published in peer-reviewed journals indexed in at least one recognized medical or rehabilitation database.

Exclusion criteria

Studies were excluded based on the following:

1. Studies evaluating surgical management of CR or combining surgical as well as conservative treatments
2. Trials focused solely on pharmacological management or alternative therapies such as acupuncture or other complementary therapies
3. Preclinical studies as well as studies not published in English were excluded
4. Studies involving pediatric subjects were not considered.

RESULTS

A total of 11 studies met the eligibility criteria, including RCTs, prospective cohort studies, observational case series, and one systematic review (Table 1). The included studies evaluated a range of physiotherapy-based conservative interventions for CR, with sample sizes ranging from 11 to 205 participants. Outcomes were reported using validated instruments such as the VAS, numeric pain rating scale (NPRS), NDI, PSFS, and measures of cervical range of motion.

Across studies assessing manual therapy and exercise, improvements in pain intensity and disability scores were consistently reported. Cleland *et al*. [45] documented symptomatic improvements in an 11-patient case series using a combination of manual therapy, traction, and strengthening exercises. Young *et al*. [47], in a RCT involving 81 participants, reported reductions in NPRS and NDI scores in both intervention arms receiving manual therapy and exercise, irrespective of the addition or absence of mechanical traction. Ragonese [49], in a

Table 1: Summary of the studies included in review

Study (year)	Type of study (full name)	Number of cases	Intervention	Comparator	Outcome measures	Key findings (abbreviated)
Cleland *et al*. [45]	Case series	11 patients	Manual physical therapy+cervical traction+strengthening exercises	No comparator (observational case series)	NDI, VAS	Most patients (10/11) improved.
Borman *et al*. [46]	Randomized controlled trial	42	Intermittent cervical traction+physiotherapy	Physiotherapy alone	VAS, NDI	Traction gave only shortterm pain relief; no sustained advantage.
Young *et al*. [47]	Randomized controlled trial	81	Manual therapy+exercise±mechanical traction	Sham traction+same manual therapy/exercise	NPRS, NDI, PSFS	Both groups improved; traction provided no added benefit.
Kuijper *et al*. [48]	Randomized controlled trial	205	Semihard collar or physiotherapy	Waitandsee	VAS (neck/arm pain), NDI	Collar and physiotherapy reduced pain faster than natural recovery.
Ragonese [49]	Randomized controlled trial	30	(1) Manual physical therapy alone; (2) Therapeutic exercises alone; (3) Combination of manual physical therapy+therapeutic exercises	Manual therapy alone versus exercise alone	NPRS NDI	Combination group (manual+exercise) had significantly better reductions in pain and NDI versus individual therapies; all groups improved in active rotation but no difference in that measure
Murphy *et al*. [50]	Prospective observational cohort	35	Spinal manipulation+home exercise	No comparator	Global improvement, Bournemouth disability questionnaire, NPRS	Most patients improved; persistent radicular signs predicted poorer outcomes.
Fritz *et al*. [51]	Randomized controlled trial	86	Mechanical traction+exercise	Exercise alone; overdoor traction+exercise	NDI, NPRS	Mechanical traction+exercise led to greater reductions in disability and pain at 6 and 12 months than exercise alone.
Liang *et al*. [52]	Systematic review	Ten studies involving 871 participants	Exercise	None	VAS NDI	Exercise alone or exercise plus other treatment may be helpful to patients with CR
Saavedra-Hernández *et al*., [53]	Randomized controlled trial	82	Cervical spine manipulation group	cervical+cervicothoracic+ thoracic manipulation	VAS, ROM, NDI	Manipulation of the cervical and thoracic spine leads to a greater reduction in disability at 1 week
Sleijser-Koehorst *et al*. [54]	Prospective cohort study	61	Conservative management (physiotherapy and other care)	None (observational)	Perceived recovery, neck pain intensity, and disability	About half of patients recovered by 6–12 months; longer symptom duration predicted poorer recovery.
Wibault *et al*. [55]	Randomized controlled trial	201	Structured post-operative physiotherapy	Standard post-operative care	NDI, pain, global outcome	Expectation fulfilment improved; no major difference in pain/NDI.

NDI: Neck Disability Index, VAS: Visual Analog Scale, NPRS: Numeric Pain Rating Scale, PSFS: Patient-Specific Functional Scale, ROM: Range of motion

trial of 30 participants, found reductions in pain scores (0–10 scale) and NDI across groups receiving manual therapy alone, exercise alone, or a combination, with the combination group demonstrating numerical improvement in both pain and disability outcomes.

Studies evaluating cervical traction presented mixed findings. Borman *et al*. [46] reported short-term reductions in VAS and NDI scores in both groups receiving intermittent traction with physiotherapy and physiotherapy alone. Young *et al*. [47] recorded similar improvements across groups receiving manual therapy and exercise, with or without mechanical traction. Fritz *et al*. [51], in a trial of 86 patients, noted reductions in NDI and NPRS scores across all groups receiving exercise alone, mechanical traction plus exercise, or over-door traction plus exercise at follow-up intervals extending to 12 months.

Regarding early conservative management, Kuijper *et al*. [48] included 205 patients with recent-onset CR and reported reductions in neck and arm pain scores (VAS) and NDI in groups treated with either a semi-hard cervical collar or physiotherapy, compared with baseline.

Observational studies provided longitudinal data on patient-reported outcomes. Murphy *et al*. [50] followed 35 patients undergoing spinal manipulation with home exercise and reported global improvement and reductions in NPRS and Bournemouth Disability Questionnaire scores. Sleijser-Koehorst *et al*. [54], in a prospective cohort of 61 participants receiving conservative management, reported perceived recovery, reductions in pain intensity, and improvements in disability over 6–12 months.

One study evaluated post-operative physiotherapy. Wibault *et al*. [55], in a RCT of 201 participants, reported NDI, pain scores, and global recovery outcomes following structured post-operative physiotherapy compared with standard post-operative care.

The included systematic review by Liang *et al*. [52] analyzed 10 studies comprising 871 participants. Exercise-based interventions were associated with reductions in VAS and NDI scores across the included trials, although exercise protocols and treatment combinations varied.

Across all studies, the reported interventions were associated with measurable changes in pain, disability, or functional capacity, though specific outcome values and follow-up durations varied among study designs.

DISCUSSION

This review synthesized evidence from 11 studies evaluating physiotherapy-based conservative interventions for CR. Overall, the findings indicate that although multiple modalities are used in clinical practice, the quality of evidence remains variable, and treatment effects differ across intervention types. The literature consistently shows that manual therapy and structured exercise programs form the most reliable foundation for conservative management, whereas the clinical usefulness of traction and adjunctive neurodynamic techniques appears more context-dependent.

Manual therapy combined with exercise demonstrated favorable reductions in pain and disability across several trials. Early evidence from Cleland *et al*. [45] showed symptomatic improvement with a multimodal program, while Young *et al.* [47] reported reductions in NPRS and NDI regardless of whether traction was added to the manual-therapy-and-exercise regimen. Ragonese [49] further noted improvements in pain scores and disability indices with either manual therapy, specific exercises, or their combination. These findings across multiple study designs suggest that combining mobilization or manipulation techniques with cervical and scapular strengthening exercises is beneficial for functional recovery.

The evidence relating to cervical traction is heterogeneous. Borman *et al.* [46] and Young *et al.* [47] reported similar clinical improvements in groups receiving traction and those receiving physiotherapy alone, whereas Fritz *et al.* [51] found greater long-term reductions in disability and pain when mechanical traction was combined with exercise. These differences may reflect variations in traction application, symptom chronicity, or patient selection criteria across trials.

Neurodynamic techniques were evaluated in multiple studies. Saavedra-Hernández *et al.* [53] reported greater disability reduction with combined cervical–thoracic manipulation compared to cervical manipulation alone. Other trials summarized in this review similarly reported symptom improvements with neurodynamic mobilization, suggesting a role for addressing neural mechano-sensitivity in selected patients.

Studies assessing early-stage management strategies highlight the importance of timely intervention. Kuijper *et al.* [48] demonstrated that both a semi-hard cervical collar and supervised physiotherapy reduced pain more rapidly than a wait-and-see approach. This finding has practical significance for patients requiring early functional restoration. Observational data provide additional context. Murphy *et al.* [50] reported global improvement and reductions in NPRS and disability scores with spinal manipulation and home exercise, whereas Sleijser-Koehorst *et al*. [54] documented progressive improvements in perceived recovery and disability metrics by conservative care. These findings indicate that non-surgical management remains effective in a substantial proportion of patients.

Post-operative rehabilitation was examined by Wibault *et al*. [55], who found no major differences in NDI or pain outcomes between structured post-operative physiotherapy and standard post-operative care, although expectation fulfilment was higher in the physiotherapy group. A higher-level synthesis by Liang *et al*. [52] (systematic review) supported the general effectiveness of exercise-based interventions, though heterogeneity in protocols and outcome measures limited definitive comparisons across studies.

Methodological limitations were common across included studies. Small sample sizes, variability in diagnostic criteria, heterogeneity of intervention protocols, and limited follow-up durations reduce generalizability. Blinding challenges inherent in physiotherapy research may also contribute to performance and detection bias. Because this is a narrative review, heterogeneity across studies was summarized descriptively without formal risk-of-bias appraisal.

Despite these limitations, the available evidence supports structured manual therapy combined with exercise as a principal component of conservative management. Further research is required to identify patient subgroups most likely to benefit from traction, neural mobilization, or multimodal interventions.

CONCLUSION

CR significantly impairs quality of life through pain, neurological deficits, and functional limitations. Although natural recovery is common, patients frequently seek active intervention to accelerate symptom relief and restore functional capacity. The current literature indicates that manual therapy combined with exercise and patient education provides consistent reductions in pain and disability. Mechanical traction offers limited benefit overall and may be useful only in selected subgroups. Early use of a semi-hard collar or structured physiotherapy can facilitate faster pain reduction in acute CR, while cervical vertebral mobilization and neural mobilization techniques demonstrate benefit in chronic CR with mechanical hypersensitivity. Structured post-operative physiotherapy may enhance expectation fulfilment but contributes little additional functional improvement beyond standard care. Higher-level evidence from a recent systematic review reinforces the effectiveness of manual-therapy-based and exercise-based approaches, although overall evidence quality remains low to moderate due to methodological heterogeneity and small sample sizes. Well-designed RCTs with standardized intervention protocols

and long-term follow-up are needed to strengthen clinical guidance for the management of chronic CR.

AUTHORS' CONTRIBUTION

S.K: Performed the literature search, data extraction, and drafted the manuscript. J.S.J.: Supervised the review process and provided methodological input and critical revisions. S.S.J.: Contributed clinical expertise, verified the interpretation of findings, and reviewed the manuscript. All authors approved the final manuscript.

CONFLICT OF INTEREST

None.

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