RJNMSR
Review Journal of Neurological & Medical Sciences Review

Volume 3, Issue 5, 2025

ROLE OF NERVE MOBILIZATIONS IN DECREASING PAIN AND DISABILITY AMONG PATIENTS WITH CERVICAL RADICULOPATHY

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DOI: https://doi.org/10.5281/zenodo.17163882

Received	Accepted	Published
21 June 2025	06 September 2025	20 September 2025

ABSTRACT

Background: *Cervical radiculopathy is an emerging health problem in this modern era of computers and online education which can be a cause of disablement for individuals. Researches must be done on the treatment protocols to overcome the loss caused by cervical radiculopathy.*

Objective: *To study the effects of conventional physical therapy with and without nerve mobilizations in patients with cervical radiculopathy.*

Methods: *This was a prospectively registered, two-arm parallel design, randomized controlled trial with concealed allocation, a blinded assessor and intention to treat analysis. Seventy-six patients of any gender suffering with pain in cervical region for more than 4 months, having age between 20 and 45 years were recruited consecutively. All the participants must have positive upper limb neurodynamic test and positive spurling test. In group A, patients received nerve mobilizations along with conventional physical therapy while group B received only conventional physical therapy. Treatment was provided for 45 minutes up to 4 weeks with 4 sittings per week. Outcome measure used for pain intensity was Numeric Pain Rating. Upper extremity functional index and neck disability Index scale were used to assess upper extremity functional level and disability due to neck pain.*

Results: *Mean between-group difference for the Numeric pain rating scale after 4 weeks of intervention was -1.03 (95% CI -1.51 to -0.56), which is not significant. The results of physical function and functional mobility showed significant between-group differences that were 16.78 (95% CI 14.59 to 18.97) and -14.09 (95% CI -18.51 to -9.68), respectively.*

Conclusion: *Nerve mobilization is more effective in improving physical function and mobility among patients with cervical radiculopathy as compared to conventional physical therapy alone. However, for improving pain, nerve mobilizations are as effective as conventional physical therapy. Trial registration: NCT04896749*

Keywords: *Nerve mobilizations, cervical radiculopathy, Numeric Pain Rating Scale, Neck Disability Index, Upper Extremity Functional Index*

INTRODUCTION

Cervical radiculopathy is one of the common causes of concern in health domain. It is a neurological dysfunction which is due to compression of nerve roots. (1)Causes of compression include muscular spasm, cervical disc herniation, bony spur and osteophytes. Tumor and infection are the less common causes of cervical radiculopathy.(2) The average occurrence rate of cervical radiculopathy in general population of Pakistan is 83 per 100000 annually, reaching the peak level in the fifth decade of individual's life.(3) According to a study conducted in Rochester (New York State), incidence rate of cervical radiculopathy in man was 107.3 per 100,000 and in women it was found to be 63.5 per 100,000 individuals.(4) In United States, the incidence of cervical radiculopathy in military was found to be 1.79 per thousand persons.(5) Risk factor of cervical radiculopathy includes white race, prior vertebral injury, trauma, smoking, frequent diving, playing golf and driving.(6)Sixth and seventh cervical nerve roots are most frequently affected due to disc herniation or spondylosis at C5-C6 and C6-C7 vertebral level. Half of the population experiences pain in upper extremity and cervical region at some time in their life.(7)

Symptoms occurring from cervical radiculopathy cause the individual to have difficulty in performing daily life activities. Occupational activities and social life are also badly affected. Depending on patient's condition, different surgical and non surgical treatments are used to cure the underlying cause of cervical radiculopathy.(8)The pattern of symptom present and location depends on the affected nerve root level, with the complaints of tingling, numbness and weakness in one or both arms along with neck pain. Symptoms can include both motor and sensory dysfunctions. (3)

A number of physical therapy interventions like cervical traction, neck isometrics and strengthening exercises have been effective in the management of cervical radiculopathy. (9)Muscle energy techniques, manipulations, spinal mobilization, soft tissue mobilization, and neural mobilizations are some of the manual physical therapy techniques used for treatment of cervical radiculopathy.(10)

Increased cases of cervical radiculopathy are causing individuals to lose their independence, professional status and social activities. To reduce disabilities, a proper physical therapy rehabilitation approach is required. Nerve mobilization is an effective neurorehabilitation approach that can be incorporated into the conventional physical therapy to gain beneficial effects in patients in cervical radiculopathy. This study helped to determine the effects of conventional physical therapy with and without nerve mobilizations in treating pain and disablement among patients with cervical radiculopathy.

A randomized controlled trial was conducted to find out the effectiveness of neural mobilizations along with cervical traction on patients with cervical radiculopathy. Results clearly showed the importance of nerve mobilizations over conventional physical therapy alone.(11)

Another study showed the effectiveness of nerve mobilization based on Kaltenborn-Evjenth concept combined with intermittent cervical segment traction on Neck Disability Index (NDI) scores, range of motion (ROM), endurance and pain in patients with cervical radiculopathy. Results showed significant importance of nerve mobilizations in patients with cervical radiculopathy. (12)

The research questions for this randomized controlled trial were:

Is there any clinically significant difference in the effects of conventional physical therapy with and without nerve mobilizations in patients with cervical radiculopathy?

Is nerve mobilization combined with conventional physical therapy is more effective than conventional physical therapy alone in patients with cervical radiculopathy?

METHODS

Design:

This was a prospectively registered, two-arm parallel design, randomized controlled trial with concealed allocation, a blinded assessor and intention to treat analysis. Participants were recruited from University Physical

Therapy and Rehabilitation clinic, University of Lahore, Pakistan. Patients who met eligibility criteria were informed about the study aims. All eligible people who agreed to participate in the study signed a consent form. Eligibility was assessed by two physiotherapists from research team before randomization. Eligible patients were randomly assigned (in a 1:1 ratio) into 2 groups (Group A and Group B) after baseline assessment. Randomization was done by one of the research team members using fish bowl method. Randomization assignments were kept in opaque sealed envelopes and were unsealed by researcher after baseline testing. Outcome assessors were masked to group allocation and patients were instructed not to talk about the content of their exercise program during post intervention visit and could consult therapist in case of any problem during trial registration.

Participants:

Seventy six patients, either male or female, suffering with pain in cervical region for more than 4 months, having age between 20 and 45 years were recruited consecutively. All the participants must have positive spurling test and positive upper limb neurodynamic test. Patients with any kind of trauma to cervical spine and upper limb were excluded from the study. Patients suffering with dizziness, circulatory disturbances and malignancy were also excluded.

Interventions:

In group A, patients received nerve mobilizations along with conventional physical therapy. Hot pack all over cervical spine was applied for ten minutes. Transcutaneous Electrical Nerve Stimulation (TENS) was applied for 10 minutes at the frequency of 60 Hz, using 2 electrodes.(12) Cervical traction was applied for 10 minutes with 7 sec hold and 5 sec rest time. Isometric exercises of cervical region were performed with a 7 sec hold and 30 repetitions in each direction two times daily. Radial, ulnar and medial nerve mobilization were given in three sets of 10 repetition, with a hold of 3 sec at final stretched position.(7)

Radial Nerve: Glenohumeral joint depression, extension of elbow, internal rotation of arm and wrist flexion

Ulnar Nerve: Wrist extension, forearm pronation, elbow flexion, glenohumeral lateral rotation and depression and abduction of shoulder.

Median Nerve: abduction of glenohumeral joint, supination, wrist extension, glenohumeral lateral rotation, elbow extension, neck lateral bending to opposite side.

In group B, patients had received conventional physical therapy as described below:

Hot pack was applied all over cervical spine for ten minutes. TENS was applied for 10 minutes at the frequency of 60 Hz, using 2 electrodes.(12) Cervical traction was applied for 10 minutes using hold time of 7 sec and 5 sec rest time. Cervical isometric exercises were performed with a 7 sec hold and 30 repetitions in each direction two times daily. (7)

Patients of both groups were also given home exercise plan for cervical isometric exercises. The total duration of the treatment program was 4 weeks (four sessions per week).

Outcome measures:

Outcome measure used for pain intensity was Numeric Pain Rating. Other outcome measuring tools were Upper extremity functional index and neck disability Index scale, that were used to assess upper extremity functional level and disability due to neck pain respectively. All participants were assessed at baseline and at 4 weeks after treatment. The instruments used to measure outcomes variables are described in table 1.

Data analysis:

Sample size was calculated as 76 participants (38 per group), allowing statistical power of 80%, an alpha level of 5% and 20% attrition rate, having mean difference of 1.1 and standard deviation of 1.48 and 1.63.the estimates used in the sample size calculation were based on results from previously published clinical trials on cervical radiculopathy.(7) Participant characteristics were reported using descriptive statistical tests.

The statistical analysis was conducted on an intention-to-treat basis. For the missing data, results obtained in the last available assessment of each participant were repeated. The effects of treatment (ie, mean between-group differences) and 95% confidence intervals were calculated via mixed linear models using 'time versus group' interaction terms. These interaction terms are equivalent to the between-group differences. An estimation approach was used to interpret the findings rather than using statistical significance. All analyses were conducted using commercial software[a] and a level of significance of $p<0.05$ was adopted for all tests.

RESULTS

Flow of participants through the trial:

Participants for this study were recruited between 1st June 2021 and 30th July 2021. The baseline characteristics of the participants of both the groups are shown in table 2. Mean age of participants was 33 years, 63% women were affected and 38% men suffered with cervical radiculopathy. Mean BMI of participants was 27. Mean duration of time from which patients were experiencing pain was 6 months. Most common level of cervical spine affected was C4-C5. Demographic data and clinical characteristics were similar at baseline in both experimental and control group. Among seventy three patients assessed for eligibility, nine patients were excluded because 3 of them did not meet the inclusion criteria and 6 declined to participate in trial. Detailed flow chart is presented in figure 1.

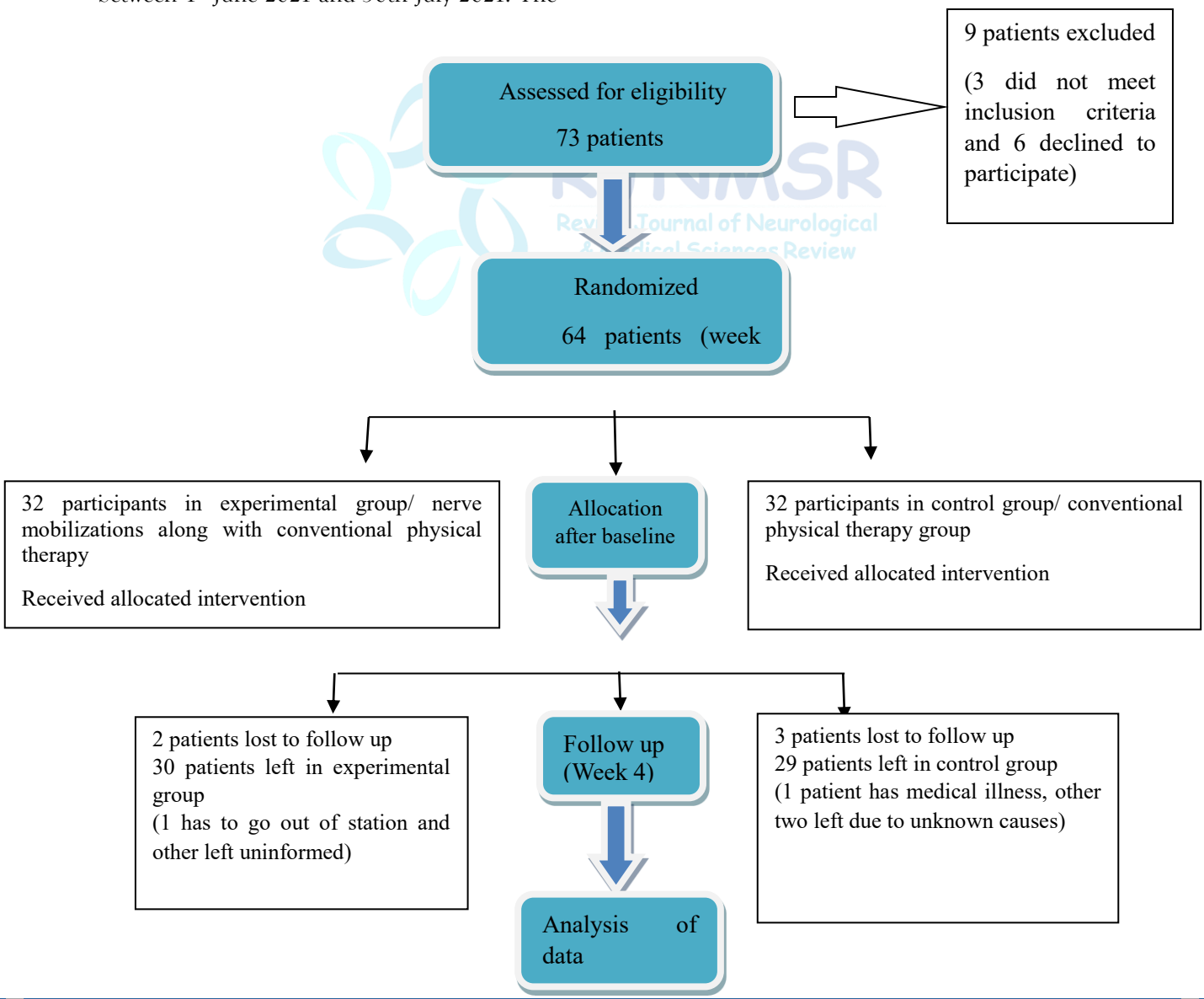

Figure 1: Flow of participants through clinical trial.

Table:1: Detailed description of instruments used in outcome measurement.

Instruments	Description
Upper extremity functional index	It is an outcome measure to assess the functional disability in patients with upper limb dysfunction, and is patient reported. Total score is eighty. Higher the score, better will be the state of patient. This outcome was measured at 0 and 4th week of therapy.(17)
Numeric pain rating scale	It is used for measuring pain level among individuals. It is scored from 0 to 10. Ten being the worst pain level and zero being the lowest. Corresponding to the pain experienced in the previous 24 hours, patient is asked to state 3 pain ratings. The average of these three readings was used to represent level of pain among patients.(18)
Neck disability index scale	This scale is used to assess the ability of neck pain to affect the ability of individuals to do everyday life activities. Each section of scale is scored on 0 to 5 rating scale. Five means worst pain and zero means no pain. Total ten questions' points are summed to a total score. Greater the scores, greater the disability.(19)

Table 2: Baseline characteristics of study participants.

Characteristics	Experimental group (n 32)	Control group (n 32)
Age (years), mean (SD)	33.7(7.4)	33.4 (8.7)
Gender, n (%)	Male 12(37.5) Female 20(62.5)	Male 12(37.5) Female 20 (62.5)
Height (ft), mean (SD)	5.3 (0.6)	5.4 (0.5)
Weight(kg), mean (SD)	71.9(11.5)	69.2 (13.6)
BMI, mean (SD)	28.2 (7.5)	25.5 (5.6)
Time duration of pain(months), mean (SD)	5.8 (1.3)	6.3 (1.4)
Occupation, n (%)	Student 9 (28.1) Teacher 8 (25) Banker 6 (18.8) Laborer 6(18.8) Housewife (3 9.4)	Student 12 (37.5) Teacher 6 (18.8) Banker 6 (18.8) Laborer 3 (9.4) Housewife 2 (6.3) Dentist 3 (9.4)
Level of cervical spine effected, n (%)	C2- c3 3 (9.4%) C3 -c4 14 (43.8%) C4- c5 15 (46.9%)	C2- c3 6 (18.8) C3 -c4 9 (28.1) C4- c5 11 (34.4) C5-c6 6 (18.8)
Type of pain, n (%)	Unilateral pain 12 (37.5%) Bilateral pain 20 (62.5%)	Unilateral pain 18 (56.3) Bilateral pain 14 (43.8)

Experimental group: nerve mobilizations and conventional physical therapy, Control group: conventional physical therapy, BMI: Body Mass Index.

Adherence to trial protocol:
In experimental group, out of 32 patients, two patients were not followed up at 4th week. In control group, three patients out of 32 were dropped out from study as they did not come for follow up at 4th week.

Effect of intervention: Both groups showed a decrease in pain intensity (table 3). The mean between-group differences for the pain

intensity after 4 weeks of intervention were -1.03 (95% CI -1.51 to -0.56). The results of physical function and functional mobility are presented in Table 3. For these outcome measures, significant between-group differences were detected. The between-group differences were 16.78 (95% CI 14.59 to 18.97) and -14.09 (95% CI -18.51 to -9.68), respectively.

Table 3: Mean (SD) for outcomes for each group, mean (SD) difference within groups, and mean (95% CI) difference between groups

Outcome	Groups				Difference within groups		Difference between groups
	Week 0		Week 4		Week 4 minus Week 0		Week 4 minus Week 0
	Exp (n = 32)	Con (n = 32)	Exp (n = 32)	Con (n = 32)	Exp	Con	Exp minus Con
NPRS	6.56 (0.80)	6.94 (0.67)	2.97 (0.74)	4.38 (0.79)	-3.59 (1.16)	-2.56 (0.67)	-1.03 (-1.51 to -0.56)
UEFI	28.03 (3.40)	28.03 (3.17)	69.59 (2.28)	52.81 (4.19)	41.56 (3.72)	24.78 (4.95)	16.78 (14.59 to 18.97)
NDI	63.59 (9.07)	64.34 (9.76)	30.00 (3.81)	44.84 (4.24)	-33.59 (8.63)	-19.50 (9.04)	-14.09 (-18.51 to -9.68)

Exp = experimental group, Con = control group, NPRS = numeric pain rating scale, UEFI = upper extremity functional index, NDI = neck disability index

DISSCUSION:

This trial showed the effectiveness of routine physical therapy with and without nerve mobilizations on pain, physical function and functional disability in patients with cervical radiculopathy. Total ten sessions of nerve mobilizations were applied to estimate their effectiveness in comparison with conventional physical therapy alone. Clinically important differences were observed for the outcomes of Pain intensity, neck disability index and upper extremity functional index between both groups.

Participants in both groups experienced reduction in pain intensity after interventions (table 3), Minimal clinically important difference (MCID) of Numerical pain rating scale is greater in experimental group (3.6) as compared to control group (2.5), however the difference between both the groups (1.03) was not enough to be declared as significant as the value is less than the threshold of MCID mentioned in literature.(13, 14)

Neck disability index and upper extremity functional index score showed significant between-group differences (table 3). NDI showed a mean difference of -14.09 which is considered as significant as this value is greater than the threshold for minimal clinically important difference for NDI in literature.(13, 15, 16) UEFI showed mean difference of 16.78 between groups, and this difference was supported by literature to be called as minimum important difference.(15)

Strength of this study is that the interventions applied to both the groups were in line with the clinical practice of cervical radiculopathy.(7, 12) Participants of both the groups followed proper treatment protocol, no placebo was given. Risk of biasness was removed with proper randomization, concealment of allocation, blinding of outcome assessor and similarity of baseline measurements in both groups. Patient's safety was kept in mind and ethical considerations were strictly followed. Physiotherapist and patients were not blinded due to nature of treatment given.

This study has an important impact on the clinical practice of patients with cervical radiculopathy. Significant clinical improvements in pain and functionality of patients undergoing nerve mobilizations in their routine treatment protocol put emphasis on the inclusion of nerve mobilizations in routine intervention program of radiculopathy patients.

Clinical relevance:

- Nerve mobilization is more effective in improving physical function and mobility

among patients with cervical radiculopathy as compared to conventional physical therapy alone.

- For improving pain, nerve mobilizations are as effective as conventional physical therapy.
- Treatment protocol used was supported by literature and the study was conducted in pure clinical settings in Lahore City of Pakistan.

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