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Research Article

Effectiveness of Adding Cognitive Behavioral Approach to Physical Therapy for Chronic Cervical Radiculopathy

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Abstract

Background and Objective: Cervical radiculopathy (CR) is a nerve root pathology that causes chronic physical and psychological disabilities. The aim of this study was to investigate the effectiveness of adding cognitive behavioral therapy (CBT) to standard physical therapy program to study the short and medium term effects in patients with chronic CR. **Materials and Methods:** Sixty patients from both gender between 45 and 65 years who were diagnosed with chronic spondylotic CR were assigned randomly into two groups: Group A (control group): 30 patients received a physical therapy program of manual therapy (MT) and therapeutic exercise (TE) for 18 sessions over 6 weeks period (3 sessions/week). Group B (study group): 30 patients received the same program as in Group A plus CBT. Arabic neck disability index (ANDI), Arabic pain anxiety symptoms scale (APASS) and right/left side-bending (Lt/Rt SB) range of motion (ROM) were measured at baseline, post intervention and at 6 months for follow up. **Results:** Mixed MANOVA for effect of treatment on mean values of NDI, PASS and Rt/Lt SB for Groups A and B exposed that there was a significant difference for post-treatment and 6 months follow up as compared with pre-treatment. Multiple pair wise comparisons determined the difference between both groups, for pre-treatment, there was no significant difference, but for post-treatment and follow up there was a significant improvement in study Group B than control Group A as p-value was 0.0001. **Conclusion:** A multimodal approach of CBT combined with physical therapy program of manual therapy and therapeutic exercise yielded greater improvement among pain anxiety, neck disability and cervical ROM in the short and medium term effects in comparison with physical therapy alone.

Key words: Cervical radiculopathy, cognitive behavioral therapy, physical therapy, arabic neck disability, side-bending range of motion

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Cervical Radiculopathy (CR) is a neuropathic condition caused by nerve root compression in the cervical spine. Patients with CR usually suffer from neck and upper limb pain, numbness, tingling and muscle weakness¹. Furthermore, functional impairment occurs due to chronicity of symptoms as well. Chronic neuropathic pain results in negative neuroplastic changes and central sensitization (CS) of the central nervous system (CNS). The CS is an important feature mediated by collateral sprouting of non-nociceptive A-beta fibers with nociceptive neurons in the dorsal horn and damage to inhibitory inter-neurons leading to hypersensitive nociceptors, abnormal pain response to non-noxious stimuli and alterations to the descending pain modulatory pathways accompanied by pain anxiety and depression that influence treatment outcomes and result in physical and psychological disabilities². Psychological barriers such as fear-avoidance beliefs, catastrophizing and negative pain cognitions have been considered as an important factor in chronic pain suffering³. Consequently, bio psychological approach combined with physical therapy appears to be an effective method to overcome dangerous physical and psychological barriers⁴⁻⁷.

Chronic CR was included only in three studies of CBT in addition to physical therapy, they showed low quality evidence about benefits of adding CBT. Outcomes were downgraded to low quality due to serious bias regarding study design, heterogeneous psychological approach, unexplained sample heterogeneity and sample size⁵. Thus, there is lack of evidence of psychological approach role concerning chronic CR.

Consequently, this study was carried out taken in consideration previous studies bias to identify a more conclusive knowledge on the impact of psychological factors on the treatment outcomes and importance of adherence to physical therapy programs and to provide a base for planning an effective rehabilitation program for patients with chronic CR.

MATERIALS AND METHODS

This study was conducted at the Outpatient Clinic at Faculty of Physical Therapy, Cairo University, during the period from February, 2017-December, 2018 to investigate the effectiveness of adding CBT to standard physical therapy program in the short and medium term effects for physical

and psychological disabilities in patients with chronic CR. This study was registered at Pan African Clinical Trial Registry with registry ID 201701001972227.

Design of the study: It is randomized controlled study.

Sample size: It was determined using G*Power (version 3.1.9.2) (Franz Faul, Uni Kiel, Germany). This calculation was based on t- test. The type I error was 5%, alpha-level was 0.05 and type II error was 95%. The effect size (1.118) was calculated on the main outcome (NDI) from a pilot study on three patients at each group. Considering a 20% drop out rate, the appropriate minimum sample size for this study was 44 patients.

Selection of patients: After assessment for eligibility by neurologist, 60 patients from both gender (36 male and 24 female) aged between 45 and 65 years were assembled from the Out-Patient Clinic of Faculty of Physical Therapy at Cairo University. The control group consisted of 30 patients (19 male and 11 female) and the study group consisted of 30 patients (17 male and 13 female). They received verbal and written explanation for this research and signed the agreement form which accepted by Research Ethics Committee of Faculty of Physical Therapy, Cairo University with NO: P. T. REC/012/001515.

Inclusion criteria: Patients with unilateral CR symptoms for more than 3 months due to spondylotic causes at C5-6 or C6-7 levels, confirmed by magnetic resonance image and at least three positive tests from the clinical prediction rules were included in this study^{8,9}.

Exclusion criteria: Patients with current or previous history of fracture or surgery at the cervical and thoracic spine, spinal tumor and infection, drug abuse, osteoporosis, rheumatoid arthritis, upper motor neuron disease, vestibulobasilar insufficiency, amyotrophic lateral sclerosis, myelopathy, bilateral radicular symptoms and diagnosed psychiatric disorder or cognitive impairment were excluded from this study^{10,11}.

Randomization: It was performed in blocks of 8 according to a computer generated randomization list. The sequence of allocation was concealed and kept in numbered.

Outcome measures: All measurements were performed at baseline, post-intervention and after 6 months for follow up.

Pain related anxiety: Four components including physiological anxiety, cognitive anxiety, fear of avoidance and fearful appraisals of pain were assessed by a valid and reliable tool (APASS). Items are rated on a 6-point likert scale based at 0 (never) and 5 (always) giving scores for the 4 dimensions. Total scores range from 0 indicating no pain anxiety to 100 indicating severe pain anxiety¹².

Neck disability: It was assessed by a valid and reliable tool (ANDI)^{13,14}. It contains 10 levels with 6 answers (0-5). Total scores determined the disability level. Four levels of disability were provided: 'no' (scores 0-4), 'mild' (scores 5-14), 'moderate' (scores 15-24) and 'severe' (scores 25-34) as well as complete disability' (scores above 35)¹⁵.

Side bending motion: Left and right side bending ROM were assessed by CROM (deluxe version-Performance Attainment Associates, Roseville, MN, USA). This device has a good to excellent inter-rater reliability (ICC 0.73-0.89)¹⁶. Patients were sitting in an erect position in a straight back chair, CROM was strapped around the head. Patients were requested to tilt their head to the right/left side until possible ROM is obtained and recorded from the frontal plane meter¹⁷.

Treatment procedures: Group A: received physical therapy program of manual therapy (MT) and therapeutic exercise (TE) for 18 sessions over 6 weeks period (3 sessions/week). Group B received the same program as in Group "A" plus CBT.

Manual therapy: It consisted of several mobilization techniques in the facet cervical joint aimed to restore neck function and reduce pain. Techniques included cervical postero-anterior central mobilization, cervical retraction mobilization, cervical rotation mobilization and cervical lateral glides. All mobilization techniques were repeated rhythmically with a progressive increase of force to grade IV for 30 sec. or 15–20 repetitions at each desired level¹⁸.

Therapeutic exercise: It consisted of specific exercises aimed to strength neck core muscles, which included deep neck flexor strengthening, lower and middle trapezius strengthening and serratus anterior strengthening¹⁹. All exercises were performed three sets per session, each set consisted of 10 repetitions and subjects were instructed to perform all exercises at home twice daily^{19,20}.

Cognitive behavioral therapy: It aimed to modify any erroneous beliefs about pain and disability and promote coping strategies and self-efficacy through graded activity⁶. It

consisted of two stages, the first six sessions: the cognitive part was explained with the support of a power point presentation. Cervical engine behavior, neurophysiologic basis of pain, importance of the participant's involvement in the treatment (e.g., coping) and good ergonomics were discussed to modify the physiologic response to pain system.

The second 12 sessions (respondent and operant section): in which the physiotherapist explained self-treatment techniques such as; diaphragmatic breathing and relaxation techniques, provided the patients with coping strategies, reduced their attention to pain and learned them self-stretching and neck active ROM¹⁹. Duration of each session was approximately⁶ 30 min.

Statistical analysis: The distribution of all measures data was assessed using the Shapiro-Wilk test ($p > 0.05$). The data showed a normal distribution so parametric test was used (SPSS version 23) (IBM Corp, New York, United States).

RESULTS

Characteristics of subjects: Analysis of variance (ANOVA) was used to compare the general characteristics between both groups in mean age, weight, height and BMI ($p < 0.05$) (Table 1). There was no significant difference between both groups.

Outcome results: Mixed multilevel analysis of variance (MANOVA) was performed out to investigate the effect of treatment and time. There was a significant effect for both treatment and time ($p = 0.0001$) (Table 2).

Table 1: Demographic data of the participants

Parameters	$\bar{X} \pm SD$			
	Control group	Study group	f-value	p-value
Age (Years)	57.1 ± 5.4	55.1 ± 6.03	1.18	0.18
Weight (kg)	81.2 ± 5.8	79.06 ± 6.2	2.007	0.16
Height (cm)	176.3 ± 5.4	175.96 ± 4.6	0.065	0.8
BMI (kg m ⁻²)	26.16 ± 1.79	25.56 ± 1.91	1.58	0.214

\bar{X} : Mean, S.D: Standard deviation, P: Probability value, F: ANOVA test

Table 2: Mixed MANOVA for effect of treatment and time on PASS, NDI, Lt SB and Rt SB

Mixed MANOVA	p-value
Interaction effect (treatment * time)	
F = 86.542	p = 0.0001
Effect of treatment (group effect)	
F = 42.265	p = 0.0001
Effect of time	
F = 1040.59	p = 0.0001

P: Probability value, F: MANOVA test

Table 3: Mixed MANOVA for effect of treatment on mean values of NDI, PASS, SB-Lt and SB-Rt

Outcomes	Groups	$\bar{X} \pm SD$			MD		p-value
		Pre-treatment	Post-treatment	Follow up	Pre vs. post	Pre vs. follow up	
NDI	Group "A"	83.70±4.67	61.30±4.28	71.03±5.91	22.40	12.6	0.0001*
	Group "B"	83.96±4.15	48.46±4.97	56.76±6.19	35.50	27.2	0.0001*
PASS	Group "A"	83.40±3.70	62.40±4.84	70.13±5.64	21.00	13.2	0.0001*
	Group "B"	84.03±3.48	40.86±5.03	47.20±5.14	43.10	63.8	0.0001*
SB-Lt	Group "A"	32.97±1.25	40.67±1.29	34.81±1.11	7.69	1.83	0.0001*
	Group "B"	33.03±1.58	42.57±2.57	38.30±1.84	9.53	5.26	0.0001*
SB-Rt	Group "A"	32.92±1.45	39.60±1.45	34.86±1.30	6.67	11.9	0.0001*
	Group "B"	33.49±1.66	43.00±1.91	38.03±1.78	9.51	4.54	0.0001*

\bar{X} : Mean, S.D: Standard deviation, MD: Mean difference, p-value: Probability value, *Significant

Results of measurement outcomes: Mixed MANOVA test for effect of treatment on mean values of NDI, PASS, SB-Lt and SB-Rt within Groups A and B exposed that there was a significant difference in the mean values of NDI, PASS, SB-Lt and SB-Rt for post-treatment and 6 months follow up compared with pre-treatment in both groups as p-value was (0.0001) (Table 3).

DISCUSSION

The study findings revealed that both control and study groups improved among pain anxiety, neck disability and Lt/Rt SBRoM in the short-term effect (post-intervention) and medium term effect (after 6 months). However, combination of CPT with physical therapy program of MT and TE in the study Group "B" showed a significant improvement in all variables compared with conventional program alone in control group. In this study, the NDI scores and side bending ROM in control group showed significant improvement in neck function and ROM for short-term effect and minimal changes for medium term effect. These improvement in neck function and ROM may be justified by application of treatment protocol that combine several mobilization techniques and therapeutic exercise^{21,22}, which are capable of directly or indirectly activating descending periaqueductal gray (PAG) mechanisms and make sympathetic response²³.

However, adding CPT to the physical therapy program in the study group showed greater influence among neck function and ROM, which was supported by Beltran-Alacreu *et al.*, who stated that combination of MT techniques, TE and patient education for neck have short and medium-term effects on chronic non-specific neck pain and disability. In addition, this is in agreement with previous literature that has shown a higher level of fear of movement is predictive of a higher risk of prolonged disability²⁴. Hence, this could be a justification for the integration of CBT with

physical therapy program resulting in reduction of fear of movement and enhance physical function. Moreover, a recent study stated that fear-avoidance beliefs and pain self-efficacy should be considered when implementing home-based physical exercise as treatment for chronic neck pain to promote self-efficacy within individuals, change an individual's perception of pain, develop confidence and encourage exercise²⁵.

In addition, another study among chronic low back pain found that multimodal treatment integrated with CBT showed an improvement in fear avoidance beliefs in the long term compared with an exercise alone²⁶. This was supported by Ris *et al.*²⁷ who stated that chronic neck pain patients receiving pain education, exercises and graded activities significantly improved their function, quality of life and psychological factors²⁷. Furthermore, this study agreed with Blanpied *et al.*²⁸ who revealed that clinicians should provide multimodal approach while treating chronic neck pain in form of MT, TE and patient education to reinforce any negative pre-existing beliefs and achieve great improvement in clinical outcomes²⁸.

Controversy, this research did not agree with Monticone *et al.*⁵ who reported that there was low quality evidence that CBT in addition to physical therapy intervention did not differ from physical therapy alone in terms of effect on pain and disability at short-term and medium term effects in chronic neck pain^{5,10}. The main limitation of the study was lack of a strictly recorded, dose-specific home exercise program maintained during the course of treatment.

CONCLUSION

According to the current study finding, chronic radicular pain was not limited to a pathoanatomical cause alone but also psychological factors which must be considered as well. A multimodal approach that addressed the biological and

psychological aspects of pain showed greater improvement among neck disability and pain related anxiety. Further studies should be conducted to identify which psychological factors have the strongest influence on pain experience.

SIGNIFICANCE STATEMENT

This study investigated the effectiveness of adding CBT to physical therapy program for patients with chronic CR that can be beneficial for relieving pain related psychological factors that play a role in the chronicity of symptoms and influence treatment outcomes, improving the rate of patients returning to work and reducing number of patients who will require surgery. This study may help the researchers to uncover the critical areas of impact of psychological factors on the clinical outcomes during CR treatment that many researchers were not able to explore. Thus, a new theory about integration of physical therapy with psychological approaches may be arrived at.

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