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Co-relation of neck pain with upper limb disability and psychological factors

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Abstract
Background: Neck problems account for a large proportion of occupational illness and disability. Symptoms referred in upper limb in patients with neck pain with or without the neurological deficit may affect functional activities of daily living, thus affecting quality of life. Also, psychosocial factors are known to highly influence neck pain, but are often inadequately considered in clinical practice. Thus the objective of the present research was to study the co-relation of neck pain and disability with upper limb disability and psychological factors (anxiety, depression and kinesiophobia).
Methods: 37 participants between age group of 19-45 years, both males and females with neck pain more than 3 months were selected for the study. Outcome measures recorded were Numerical Pain Rating Scale (NPRS), Neck Disability Index (NDI), Single Arm Military Press test (SAMP test), Hospital Anxiety and Depression Scale (HADS) and Tampa Scale for Kinesiophobia (TSK). Data collected was subjected to statistical analysis.
Results: A statistically significant negative co-relation was seen between neck pain and SAMP test of dominant and non-dominant hand (r = -0.60; -0.57). A statistically significant negative co-relation was seen between NDI and SAMP test of dominant and non-dominant hand (r = -0.75; -0.73). Positive co-relations were seen between Pain and Anxiety(r = 0.28); Pain and Depression (r = 0.17) and Pain and TSK(r = 0.27). Significant positive co-relation was seen between NDI and Anxiety (r = 0.47). Positive co-relations were also seen between NDI and Depression (r = 0.32); NDI and TSK (r = 0.31), but were not statistically significant.
Conclusion: Study concluded that higher the neck pain and disability, more is the upper limb disability and higher is the presence of psychological factors (anxiety, depression and kinesiophobia).

Keywords: neck pain, upper limb disability, psychological factors, kinesiophobia

1. Introduction

Neck pain is a common occurrence in the general population, with annual incidence of 14.6% [1]. It is the second most common cause of disability and absenteeism from work following back pain [2]. Studies have shown higher incidence of neck pain amongst office and computer workers. Studies have also shown higher prevalence of neck pain in women and in high income countries and urban areas [3].

The etiology of neck pain is multifactorial. Several risk factors contribute to its development. These include individual risk factors like age, gender, profession, domestic and recreational activities; physical factors like static postures, repetitive movements; psychosocial factors like high job demands, low job satisfaction, low social support; and work related risk factors like poor workplace design, poor design of tools and machinery [4].

Neck pain can lead to symptoms being referred into the upper limbs [5]. In approximately 80% of patients with neck pain, upper limb activities were found to aggravate the neck pain [6]. This may considerably affect one's functional activities of daily living [7].

Pain is thought to be a physical as well as a psychological stressor that can affect one's temperament and mood [8]. Various factors such as emotional, psychological, social and spiritual factors influence the experience of pain [9]. The way in which an individual reacts to the pain indicates the characteristics of the pain. It also reflects the person's thoughts and behaviour developed during the course of the illness. Uncertainty about ever being pain-free or the possibility of worsening pain is accompanied by feelings of anxiety, sadness, grief and anger. It may be difficult for some people to cope-up with this and may result in development of a mental disorder like anxiety, depression, pain catastrophizing, kinesiophobia, etc. [10]. Studies have suggested that cognitive or emotional processes play a major role in the development of neck-related disability [11]. Neck pain and disability thus can considerably affect overall health status of an individual [12].

Neck-related disability is a multi-dimensional construct, hence, it must be appreciated from different perspectives [11]. Hence, this study was undertaken to research the co-relation of neck pain with upper limb disability and psychological factors.

2. Materials and Method

The study was approved by institutional ethics committee prior to commencement. It was a cross-sectional, co-relational study carried out at tertiary health care center over a period of 12 months on 37 subjects. Sample size was calculated from the pilot study. Individuals in age group of 19-45 years, both males and females, having neck pain for more than 3 months were included in the study. Individuals with NPRS more than 7, having neck pain due to traumatic neck injury, inflammatory or infective conditions of spine (rheumatoid arthritis, pott's spine, etc.), any shoulder and upper limb pathologies, traumatic conditions of upper limb and known psychological disorders were excluded.

Procedure

Individuals satisfying the inclusion criteria and willing to participate in the study were selected. The purpose of study and the study procedure was explained to them in the language best understood. Following this, their written consent was obtained. Data record sheet including demographic details of participants, duration of neck pain and intensity of pain on Numerical Pain Rating Scale (NPRS) were recorded. Then the following outcome measures were recorded randomly (by chit method).

Interview based outcome measures included Neck Disability Index (NDI), Hospital Anxiety and Depression scale (HADS) and Tampa scale for Kinesiophobia (TSK) which were recorded in the language best understood (English/Hindi/Marathi). Face validity was done for the translated versions (Hindi/Marathi) of the above scales. Performance based outcome measure included Single Arm Military Press (SAMP) test.

Single Arm Military Press (SAMP) test

The test consists of the participant standing with a 3kg weight held in hand, just above the shoulder level, with elbow flexed (Fig.1). Then, they were asked to move the weight away from the shoulder by pushing it up overhead until the elbow is completely extended (SAMP technique) (Fig.2). Participants were asked to perform as many repetitions of this technique as possible within 30 seconds. All participants were instructed to do the test as fast as possible but can stop and start at any time during the 30 seconds, though the timing continues. The number of repetitions were recorded. Lower the score, more is the upper limb disability [13].

Fig 1: Starting position of SAMP test

Fig 2: End position of SAMP test

3. Results

The data was analysed using GraphPad InStat software version 3.0. Normality of data was assessed using the One – Sample Kolmogorov – Smirnov Test. Pearson's Co-relation Test was used for the data passing normality test, while Spearman's Co-relation Test was used for the data not passing normality test. P value less than 0.05 was considered statistically significant.

Study was conducted on 37 participants with neck pain between age group of 19 to 45 years (31.97 ± 9.47). 78% of the participants in the study were females while 22% were males. A statistically significant negative co-relation was seen between NPRS and SAMP test, indicating more the neck pain, more is the upper limb disability (Table no.1). A statistically significant negative co-relation was also seen between NDI and SAMP test, indicating more the neck disability, more is the upper limb disability (Table no.2). Positive co-relations were observed between NPRS and psychological factors (anxiety, depression and kinesiophobia); however, it was not statistically significant (Table no. 3). Positive co-relations were also observed between NDI and psychological factors (anxiety, depression and kinesiophobia); however, only the co-relation between NDI and anxiety was statistically significant (Table no. 4).

Table 1: Co-relation of neck pain with upper limb disability

	Co-relation co-efficient (r)	P value
NPRS and dominant hand SAMP test	-0.60	< 0.05
NPRS and non-dominant hand SAMP test	-0.57	< 0.05

Table 2: Co-relation of neck disability with upper limb disability

	Co-relation co-efficient (r)	P value
NDI and dominant hand SAMP test	-0.75	< 0.05
NDI and non-dominant hand SAMP test	-0.73	< 0.05

Table 3: Co-relation of neck pain with psychological factors (anxiety, depression and kinesiophobia)

	Co-relation co-efficient (r)	P value
NPRS and anxiety	0.28	>0.05
NPRS and depression	0.17	>0.05
NPRS and TSK	0.27	>0.05

Table 4: Co-relation of neck disability with psychological factors (anxiety, depression and kinesiophobia)

	Co-relation co-efficient (r)	P value
NDI and anxiety	0.47	<0.05
NDI and depression	0.32	>0.05
NDI and TSK	0.31	>0.05

4. Discussion

The present study was undertaken to determine the co-relation of neck pain with upper limb disability and psychological factors. It was observed that 54% individuals had non-specific neck pain, 38% had neck pain due to cervical spondylosis, 5% had cervical disc prolapse and 3% had thoracic outlet syndrome.

Neck pain and upper limb disability

Results of the present study shows statistically significant negative co-relations between NPRS and SAMP test; and NDI and SAMP test of both dominant and non-dominant hand. This indicates more the neck pain and disability, more is the upper limb disability.

Upper limb is mechanically connected to the neck and shoulder girdle via skeletal and muscular structures. Thus, mechanical loading of upper limb increases the mechanical loading of the articular and ligamentous structures of neck, causing protective spasm, and leading to a neck pain response. This may inhibit patients from using their upper limbs. Also, upper limb is mechanically attached to the neck through brachial plexus that extends from the neck into the upper limb. In individuals having neck pain, there may be presence of inflammation and increased mechanosensitivity in and around the connective tissue structures and cervical nerve roots. Upper limb function results in sliding or elongation of neural structures throughout the brachial plexus including neck. Elongation of inflamed and sensitive neural structures at the neck may cause a neck pain response. This may lead to decreased use of upper limbs in patients with neck pain. This can further cause decrease in strength and endurance of neck and upper limbs musculature, resulting in disability [13].

The findings of the present study are consistent with the study done by Osborn W, Jull G (2013) which showed a moderate to high co-relation ($\rho = 0.669$; $p < 0.001$) between DASH and NDI, indicating, higher the neck pain severity greater is the upper limb functional restrictions. This study concluded that upper limb function is often impaired in association with neck pain disorders [6].

Study done by D. B. Kinchuk, G. Soumya, D. Payal (2013) also reported similar results, where out of 72 subjects with neck pain, 93.1% had upper limb dysfunction as determined by the Single Arm Military Press (SAMP) test scores. They concluded that upper limb dysfunction is highly prevalent in patients with non-specific neck pain [14]. SM McLean, et.al (2011) also stated that the patients presenting with high levels of neck pain may also have high levels of upper limb disability [15].

Neck pain and psychological factors

Present study showed positive co-relations between NPRS and psychological factors (anxiety, depression and kinesiophobia); and NDI and psychological factors (anxiety, depression and kinesiophobia); however, only the co-relation between NDI and anxiety was statistically significant. These results suggest that more the neck pain and disability, more is the presence of psychological factors (anxiety, depression and kinesiophobia).

Depression and anxiety disorders share same pathophysiological pathways as pain and can have a reciprocal effect on each other. They facilitate central modulation of pain response in the periaqueductal area of gray matter, amygdala and hypothalamus. If deficits occur in these areas, it disturbs the modulation of signals from the body, leading to a more severe experience of pain.

Also, depression and anxiety are known to induce a stress response. This results in increased production of pro-inflammatory cytokines; which may increase pain [16].

Pain and Depression

A common link is thought to be present between the two neurotransmitters, Serotonin (5-HT) and Norepinephrine (NE), which plays a crucial role in pathophysiology of pain and depression. Any alterations in these neurotransmitters is thought to have an effect on well being, motivation and is responsible for various symptoms of depression. Serotonergic and norepinergic pathways from the brainstem ascend into the brain and bring about various emotional and physical functions. They also descend down the spinal cord where they inhibit nociceptive inputs. Hence, dysregulation of these neurotransmitters in the spinal cord may alter the ascending pain sensations from the cord, thus causing an increased pain response among depressed individuals [8].

Dysfunction of Hypothalamic Pituitary Adrenal (HPA) axis, that is known to occur in patients with depression, is also thought to be responsible for both chronic pain and depression. A physical or emotional stressor stimulates the HPA axis and results in a stress response. Thus, alteration in the central regulation of the HPA axis may cause pain [8].

Amygdala, a cluster of nuclei in the medial temporal lobe is also thought to be responsible for such associations between pain and depression. It is known to play a role in the reciprocal relationship between pain and negative affective states. It is also responsible for controlling emotional behaviour and memorial processes. In depression, there is abnormal functioning of this structure along with abnormally high activity within the amygdala. Since there is bidirectional regulation of pain through the amygdala, it is responsible for both, pain inhibition and enhancement. Negative affect is thought to be responsible for stimulating

pain-facilitating pathways, thus increasing pain [8].

Pain and Anxiety

Pain gives rise to the feeling of anxiety. Anxiety in turn, makes individual more sensitive to pain and its negative effects. Chronic pain increases the state of anxiety which leads to chronic muscle tension and anticipatory anxiety, further causing disability. Individuals generally tend to restrict their usual activities, resulting in reduced mobility, muscle atrophy and increased muscle tension; all of which increases the pain. This may result in social isolation, reduced self-efficacy, increased feeling of uselessness and subsequent increase in anxiety and depression [9]. Physiological symptoms of anxiety and lack of positive emotions may increase pain. Similarly, some aspects of pain experience (for eg: pain catastrophizing, avoidance behavior etc.) may increase the symptoms of anxiety [17].

Findings of the present study are consistent with the study done by Angst F, et.al (2008) which demonstrated a positive co-relation between pain and depression [18]. Also a study done by Bon Sung Koo, et.al (2015), demonstrated a moderate positive co-relation (r=0.475) between pain and anxiety [19].

Similar results were observed in a study done by Eva Blozik, et.al (2009) which concluded that depression and anxiety were significantly associated with increasing levels of neck pain. The study also stated that, higher the neck pain level, the more attention should be paid to psychosocial distress as a related burden [20]. A study done by Ali Asghari, Skyneh Julaeiha, Maryam Godarsi (2008) also showed positive co-relation between pain intensity and depression (r=0.24), and between pain intensity and physical disability (r=0.33) [21].

Similarly, a study done by Eric W. de Heer, et.al (2014) stated that the depressive and anxiety disorders have a similar and strong association with the musculoskeletal pain, pain-related disability and pain intensity, which is in accordance with the present study [16].

Pain and Kinesiophobia

An individual with chronic pain may form negative beliefs about their experience of pain and may believe that physical movement will worsen their pain [22]. Such cognitive responses to pain may lead to fear avoidance behavior, resulting in hypervigilance to bodily sensations, followed by disability, disuse and depression. This may eventually lead to a vicious circle of fear and avoidance in patients experiencing pain [22, 23].

Findings of the present study are consistent with the study done by Janice Cheung, Tara Kajaks and Joy C. MacDermid (2013) which concluded that the patients with neck pain reported higher neck disability and higher fear of movement [24]. Also, a study done by Cleland JA, Fritz JM, Childs JD (2007), demonstrated a weaker relationship between measures of fear and avoidance belief and pain as well as disability [25]. Similarly, Mari Lundberg (2006) in their study concluded that kinesiophobia is a commonly seen factor in patients with musculoskeletal pain and a high degree of kinesiophobia, depressed mood and pain may have a negative impact on psychological distress level of patients [26].

Thus the results of the present study conclude that there is an association of neck pain with upper limb disability and psychological factors. However, the present study had limitations since it was conducted in a limited geographical area. Also, results of this study cannot be generalized in a population over 45 years' age group.

5. Conclusion

The study concluded that higher the neck pain and disability, more is the upper limb disability. Also, higher the neck pain and disability, higher is the presence of psychological factors (anxiety, depression and kinesiophobia). Hence, the study is suggestive of assessment of upper limb disability and evaluation of psychological factors in patients with neck pain as it may influence the treatment outcome and prognosis.

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