RESEARCH PAPERS

Intensity of neck pain and its association with anthropometric measurements

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Abstract

Objective

This study was conducted to determine the association between intensity of pain (PI) and anthropometric measurements among patients with chronic neck pain.

Material and methods

This cross-sectional study was conducted among 321 patients with chronic neck pain aged 20-69 years. PI was measured by a visual analog scale (0 to 100). The following anthropometric measurements were taken; weight (Wt), standing height (StHt), sitting height (SiHt), neck circumference (NC) and absolute neck length (ANL). The body mass index (BMI) and relative neck length (RNL) were calculated. Independent sample t-test was used to compare the mean difference between groups ('mild or moderate' and 'severe or worst' pain). Pearson correlation was used to determine the correlation between PI and anthropometric measurements and $p<0.05$ was taken as statistically significant.

Results

A significant low positive correlation was obtained between PI and BMI of the patients with the majority being overweight or obese individuals experiencing 'severe or worst possible pain' ($r=0.14$, ($p=0.03$). Statistically significant low positive correlation between PI and SiHt was observed in females ($r=0.16$, $p=0.03$), but not in males ($p=0.79$). The means of NC, ANL and RNL were not significantly different between patients with 'mild or moderate' and 'severe or worst possible' pain among both male and female. There were no significant gender differences in PI.

Conclusion

Overweight and obese were more likely to have high intensity of neck pain. The SiHt of the females was significantly associated with intensity of neck pain.

Key words: Body mass index, Chronic neck pain, Neck circumference, Neck length, Sitting height

Introduction

Neck pain is a public health problem worldwide, common among the adult population, with one in two people suffering neck pain during their lives [1,2]. Chronic neck pain is significantly associated with their day-to-day life. It has an impact on their families, as well as on the communities and health-care systems of a country [3,4]. Economically, it is a burden to a country considering the cost of the health system, the reduced work efficiency, work absenteeism and insurance coverage [5]. It is a common issue for early retirement, sick leave, and disability [6]. The National Institute for occupational Safety and Health, estimated that the annual cost for work related Musculoskeletal Disorder was $ 13 billion a decade ago and very recently it was between $ 45-54 billion [7]. Neck pain is defined as "a pain originating from musculoskeletal tissue in the region from the occiput to the first thoracic vertebrae" [8]. It is a complex physiological, psychological, and behavioral phenomenon [8,9]. Improper posture, lower intensity stress and strain for longer periods are foremost causative factors for neck pain [10-12]. The cause of neck pain can vary from degeneration, trauma and mechanical causes and depends on factors such as age, gender, anthropometric measurements, physical activity, occupation, genetics, psychopathology (depression, anxiety, somatization), smoking and alcohol consumption, sleeping disorders, poor posture [13,14].

The presence of chronic neck pain may vary depending on the anatomy of the neck and anthropometric measurements of the individuals. The aim of this study was to determine the association between neck pain and the anthropometric measurements of the patients with chronic neck pain. This may provide a clearer understanding of the etiology of neck pain and a more effective management of this problem.

Running title*:* Intensity of neck pain and anthropometric measurements among chronic neck pain patients in Sri Lanka

Materials and Methods

The study was conducted at the Colombo South Teaching Hospital (CSTH) after obtaining ethical approval from the Ethics Review Committee (ERC) of the Faculty of Medical Sciences, University of Sri Jayewardenepura, and ERC of Colombo South Teaching Hospital. It was a cross sectional study among a convenient sample of 325 patients presented with neck pain to the rheumatology clinic at CSTH. Patients between the ages of 20 and 69 years, who had undergone radiological investigations (X-ray cervical spine- Anteroposterior and lateral) of the neck were included. Excluded from this study were, patients who had a past history of neck surgery or surgery of the cervical spine, cervical tumors or cervical ribs, patients diagnosed with metabolic bone disease (eg. osteoporosis, osteomalacia), neoplasia (eg. metastases, multiple myeloma), or bone infections (TB, osteomyelitis, abscess in the vertebral column) and pregnant females. Written informed consent was obtained from the patients. Neck pain was defined as "pain

originating from musculoskeletal tissue in the region from the occiput to the first thoracic vertebrae" [8]. Chronic neck pain was defined as neck pain that lasted for more than three months [13]. A pretested interviewer administered questionnaire was used to collect the socio-demographic data and intensity of pain. Anthropometric measurements (weight, standing height, sitting height, neck circumference, absolute neck length) were recorded by the principal investigator using standard calibrated scales. The visual analogue scale 101 (0 to 100) was used to measure the intensity of pain. Patients were asked to get the average of the intensity of pain suffered during the past 7 days and record the value out of 100 [15]. Pain intensity was categorized as mild (1-25), moderate (26-50), severe (51-75) and worst possible (76-100). For purposes of calculation, mild and moderate pain was considered together as 'mild or moderate' (<50), and severe and worst possible pain was considered as one category 'severe or worst possible' (≥ 50).

Weight (kg) and standing height (cm) of the patients were recorded with light clothing and without shoes to the nearest 0.1cm and 0.1kg, respectively, and BMI was calculated as weight in kilograms divided by the square of the height in meters (kg/m^2) [16]. It was categorized into four groups as underweight (<18.5 kg/m^2), normal weight (18.5-22.9 kg/m^2), overweight (23-24.9 kg/m^2) and obese (≥25 kg/m^2) according to the Asia-Pacific cutoff points [16]. For purposes of calculation, overweight and obese considered as one category 'overweight or obese' (≥23kg/m^2).

The sitting height of the patients was measured with light clothing, without shoes and hair accessories. The patient was asked to sit on a stool looking straight a head, feet hanging down and back in contact with an upright surface. The head was kept straight having the lower border of the orbital cavities in the same horizontal plane as the external auditory meatuses. Measurements were recorded to the nearest millimeter [17].

The non-stretchable plastic tape was used to measure the neck circumference. The measurement was taken, with the patient standing upright, looking straight ahead, with shoulders down but not hunched. The measurement was taken just below the level of laryngeal prominence (Adam's apple) midway between mid-cervical spine and mid anterior neck, to within 1 mm [18].

The absolute neck length was measured as the perpendicular distance between external occipital protuberance and seventh cervical vertebra spinous process (A-B) in the lateral cervical x-ray [19] (Figure 1). The relative neck length was calculated by dividing the absolute neck length with height of an individual and multiplying it by 100 [19].

Figure 1: Absolute neck length

The following formula was used to calculate the relative neck length.

$$\text{Relative neck length} = \frac{\text{Absolute neck length x 100}}{\text{Total height of individual}}$$

Statistical Analysis

Data entry and analysis was done by using the Statistical Package of Social Sciences (SPSS). Quantitative data were presented using frequency distribution and mean values. Qualitative data were presented using percentages.

Intensity of pain was defined as continuous dependent variable as well as categorical variable. Age, BMI, standing height, siting height, neck length, absolute neck length, relative neck length and neck circumference were considered as continuous variables.

Continuous variables were checked for normality, and all found to be normally distributed, therefore independent samples t-test was used to compare the mean difference between two groups. Pearson correlation was used to determine the correlation between pain intensity and anthropometric measurements. P value of < 0.05 was taken as statistically significant.

Results

Of the 325 patients who presented to the clinic with chronic neck pain, 321 patients were selected for this study according to eligibility criteria. The characteristics of the participants are summarized in Table 1 and the correlation between the anthropometric measurements and the intensity of the pain are tabulated in Table 2.

Table 1: Summary of sample characteristics

Characteristic		**Descriptive statistic**
Age (Years)	Mean ±SD	53.08 ±12.04
	20-29	16 (5%)
	30-39	29 (9%)
	40-49	70 (21.8%)
	50-59	86 (26.8%)
	60-69	120 (37.4%)
Gender	Female	254 (79.12%)
	Male	67 (20.88%)
Weight (Mean±SD)	Male	59.46±9.09
	Female	57.89±10.38
Standing height (cm) (Mean±SD)	Male	162.62±6.22
	Female	153.13 ±9.11
Intensity of pain (Mean ±SD)	Male	74.69±11.25
	Female	73.55±11.98
	Sample	73.81±11.86

Body mass index (kg/m2)	Underweight (<18.5 kg/m2)	29 (9.04%)
	Normal (18.5-22.9 kg/m2)	41 (12.77%)
	Overweight or obese (≥23kg/m2)	251 (78.19%)
	(Mean ±SD)	24.32±4.05
Sitting height (Mean ±SD)	Male	83.89±4.49
	Female	79.08±4.62
Neck circumference	Male	364.14±36.13
(Mean ±SD)	Female	339.08±29.37
Absolute neck length (Mean ±SD)	Male	99.28±12.37
	Female	92.02±10.93
Relative neck length (Mean ±SD)	Male	6.12 ±0.79
	Female	6.03±0.84

Table 2: Comparison of anthropometric measurements of patients having 'mild or moderate pain' and 'severe or worst possible pain'

Characteristic	**Mild or moderate pain**	**Severe or worst possible pain**	**P value**	**t value**
Body mass index	21.57± 3.49	24.46 ±3.98	0.00	t=3.34
Standing Height				
Male	167.67±0.58	162.95±6.45	0.21	t=1.25
Female	153.24±6.22	153.16±9.53	0.97	t=0.03
Sitting Height				
Male	80.33±2.52	83.79±4.91	0.23	t=1.19
Female	76.71±4.49	79.01±4.72	0.04	t=1.93
Neck circumference				
Male	347.33±14.18	357.60±33.47	0.60	t=0.52
Female	332.59±24.72	340.99±29.83	0.26	t=1.12
Absolute neck length				
Male	108.33±1.53	103.29±9.66	0.37	t=0.89
Female	93.71±4.93	92.37±11.04	0.35	t=0.93
Relative neck length				
Male	6.46±0.08	6.355±0.68	0.36	t=0.92
Female	6.10±1.64	6.06±0.86	0.85	t=0.17

The patients mean age ± SD was 53.08 ±12.04. Of the 321 patients studied, 254 (79.12%) were females. The mean weight was 59.46±9.09 kg in males and 57.89±10.38 kg in females. The mean standing height was 162.62±6.22cm and 153.13 ±9.11cm in males and females respectively. The mean intensity of pain was 73.81±11.86 in the sample. Mean

intensity of pain in males was 74.69±11.25 and in females 73.55±11.98. There was no significant difference between the mean intensity of pain in male and female (p=0.49, t=0.68).

Mean BMI±SD was 24.32±4.05 in this sample. The mean BMI of patients in the category of 'severe or worst possible pain' (≥ 50) (24.46±3.98) was significantly higher than the mean BMI of patients in the category of 'mild or moderate pain' (< 50) (21.57±3.49) (p=0.00, t=3.34) (Table 2). A significant low positive correlation (r=0.14, p=0.03), was seen between intensity of pain and BMI. Out of 321 patients with chronic neck pain, 251 (78.19%) belonged to overweight or obese group, of whom 225 (89.6%) had 'severe or worst possible pain'.

Mean standing height (cm) of patients with 'severe or worst possible pain' was not significantly higher than mean standing height (cm) of patients with 'mild or moderate pain' in both males (p=0.21, t=1.25) and females (p=0.97, t=0.03) (Table 2). There was no correlation between intensity of pain and standing height in both males (p=0.62) and females (p=0.94).

Mean sitting height of female patients with 'severe or worst possible pain' (79.01±4.72) was significantly higher than those with 'mild or moderate pain' (76.71±4.49) (p=0.04, t=1.93). This difference was not observed in male patients (p=0.23, t=1.19) (Table 2). Statistically significant (p=0.03), low positive correlation (r=0.16) was found in the intensity of pain and siting height in female but not in male (p=0.79). Out of the total females studied, 40% were sewing machine operators. In an analysis of the other 60% of female who were not sewing machine operators no significant correlation between the intensity of pain and sitting height was observed (p=0.64, r=0.46).

Mean neck circumference (male: p=0.60,t=0.523; female: p=0.26, t=1.12) , absolute neck length (male: p=0.37, t=0.89; female: p=0.35, t= 0.93), and relative neck length (male: p=0.36, t=0.92; female: p=0.85,t=0.17) of patients with 'mild or moderate pain' were not significantly different from patients with 'severe or worst possible pain' in both males and females (Table 2). A statistically significant association was not seen between the intensity of neck pain and neck circumference or absolute neck length or relative neck length in both males and females.

Discussions

The etiology of neck pain is still not clear. There are several factors that could be responsible for neck pain, its etiology, and its impact on individuals. The present study was to determine the association between intensity of pain in patients with chronic neck pain and their anthropometric measurements.

There was a statistically significant, positive correlation between BMI of the patients with chronic neck pain and intensity of the pain. The majority of the patients studied were overweight or obese (Table 1). Of these, almost 90% had 'severe or worst possible pain'. Previous studies have demonstrated an association between obesity and neck pain. A

relatively strong association between obesity and the prevalence of chronic pain in the neck, shoulders, and low back were demonstrated especially among women [20]. Another study has shown that the association of overweight and obesity with an increased risk of chronic pain in the neck/shoulders among both women and men was significant [21]. These findings could indicate that obesity may be a factor responsible for chronic neck pain.

No single cause could be attributed to justify the association of chronic neck pain with obesity; the link may be multifactorial. Addressing the known causes of obesity, such as a sedentary lifestyle, incorrect eating habits, mental depression, mental stress, could reduce the incidence and intensity of neck pain in individuals. Studies have recommended as preventive measures regular physical activity and healthy nutrition.

A statistically significant positive correlation between intensity of pain and sitting height was observed in females. Of the female patients studied, 40% were sewing machine operators. A subsequent analysis of the non sewing machine operators (who form 60% of females studied), did not show this positive correlation. The positive correlation between the intensity of pain and sitting height in this study, could be occupation related and be attributed to the working conditions of sewing machine operators, whose work involve long hours in a sitting position. The sewing machine operation is characterized by a static sitting posture with forward incline head and trunk [22]. Little work has been done to associate chronic neck pain with occupational factors (the posture, working conditions and the sitting height of individuals). A task analysis has shown that posture problems as a result of a poor workstation layout such as incorrect table, chair height, and non-adjustable equipment contributes to the high incidence of muscular skeletal disorders in sewing machine operators [23]. A Sri Lankan study has demonstrated an association between neck pain and chair height in sewing machine operators [24].

It is known that the height of the chair as well as the height of the sewing machine used by these workers are fixed and cannot be adjusted to suit the individual worker's needs. A better understanding of their association is required to appropriately manage this group. Future studies with larger sample size and different working setups may provide a basis for recommendations for height adjustable equipment in workplaces that would contribute to a lower incidence of neck pain.

Although there was no positive correlation between intensity of pain and sitting height in males a probable association cannot be excluded as in this sample, only about 20% of the patients are male. Further studies using larger samples are required.

The association of neck circumference, absolute neck length and relative neck length with the intensity of neck pain were not statistically significant in both male and female. Previous studies have shown, that, there is no significant relationship between neck length and cervical spondylosis [19].

A significant association between intensity of pain and gender was not observed in the present study. This observation is not

compatible with the existing evidence, that females are more prone to have greater intensity of pain [15,25].

Few limitations should be acknowledged. This is a cross sectional study conducted among a specific group of patients with chronic neck pain, at a single centre. We have not assessed other factors which may be responsible for chronic neck pain such as: depression, engaging physical activity, hours spend for reading and watching television, smoking and alcohol consumption. Future studies should be multicentered and other confounding factors should be analyzed with the intensity of pain and anthropometric measurements.

Conclusion

Overweight or obese were more likely to have high intensity of neck pain ('severe or worst possible pain'). The sitting height of the females was significantly associated with intensity of neck pain.

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