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Cervical Pain Severity and Symptoms Distribution in Association with Body Mass Index: A Retrospective Cross-Sectional Analysis

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Abstract

Objective: The objective of this study was to evaluate the association between body mass index (BMI) and the severity of neck pain, with or without radiculopathy, as an independent risk factor. BMI was analyzed as a continuous variable without categorization in patients with a confirmed diagnosis of cervical pathology.

Methods: This retrospective cross-sectional study included data from 272 patients who presented to three separate private clinics in the two major Iraqi cities of Babylon and Kerbala. Pain intensity was assessed using the Visual Analogue Scale (VAS). Associations were examined using simple linear regression, multivariate regression analysis, and Spearman correlation.

Results: The mean body mass index was 27.1 kg/m^2, and the median VAS score for neck pain was 6. A significant association was identified between BMI and neck pain severity, with each one-unit increase in BMI corresponding to a 0.094-point increase in VAS score ($\beta = 0.094$, $P = 0.006$). No significant association was observed between BMI and radicular arm pain ($r = 0.07$, $P > 0.05$). Multivariate regression analysis demonstrated that BMI remained a statistically significant independent predictor of cervical pain severity.

Conclusion: Higher BMI was significantly associated with greater severity of axial neck pain but not with radicular arm pain. These findings suggest that metabolic-inflammatory mechanisms may contribute to axial neck pain, whereas radiculopathy appears to be more strongly related to mechanical nerve root compression. BMI should therefore be considered a modifiable risk factor in the management of chronic cervical pain.

Keywords: Neck pain, neck, body mass index, visual analog scale, Iraq

Introduction

Cervical radiculopathy is a condition associated with cervical nerve compression by various causes, which might be cervical stenosis or cervical spondylotic changes. Radiculopathy differs from Neck pain, which occurs due to degenerative disc or bone changes that may be associated with inflammatory abnormalities.[1] Many studies discussed the association between high BMI and degenerative changes in the Lumbar spinal levels; obesity and the cervical spinal levels have been less discussed. However, cervical radiculopathy and Neck pain, like Lumbar radiculopathy, might be triggered by various psychological or physical factors, which could be neuropathic pain, nociceptive pain, or both.[2] Despite the various exact causes of neck pain, intervertebral degenerative changes of the disc remain the most common cause.[3] The prevalence of Cervical radiculopathy is estimated to be about 0.4%.[1] Approximately 203 million people in the world are reported to have cervical pain. The prevalence was estimated to be about 3% of the population. The Females have a higher prevalence than males, between 45 and 75 ages.[4]

Obesity, as a highly developed condition worldwide, is a result of inheritance and social factors. These metabolic disorders are considered a systemic inflammatory condition derived from adipokines, which has been proven to be correlated with degenerative intervertebral discs.[2,3,5] The spine pain is supposed to be related to the mechanical abnormalities resulting from the eight loads in addition to the degenerative changes.[2]

Most literature reports the high association between obesity and spine degenerative changes. However, the relationship between BMI and cervical radiculopathy remains incompletely clarified, as most of the literature studied the relation of BMI with postoperative cervical surgery outcome as an influencing factor / comorbid factor and the correlation with lower back pain.[5] Moreover, Mizoguchi et al., (2024)[6] found no relation between high BMI and preoperative cervical radiculopathy in their cross-sectional study. Gender revealed a relationship between BMI and Radiculopathy. Apaydin 2024 reported the high prevalence of cervical radiculopathy in females. Moreover, the prevalence of high BMI is higher among females.[7]

Our primary hypothesis is that high BMI, as a continuous variable, not a categorical variable, is associated independently with high-intensity axial neck pain. The secondary hypothesis, the radicular pain in the form of arm pain, is not associated with high BMI.

Our aims in this study are to evaluate the association between BMI and the severity of Neck pain and the severity of Radiculopathy as an independent risk factor using the BMI as a continuous variable without categorising it. Changing continuous variables to categorical variables might reduce the statistical power.[8]

Methods

This study is retrospective cross-sectional data from 272 patients. These patients presented at three separate private clinics in two major cities, Babylon and Kerbala, in Iraq between September 2023 and October 2025. The Visual Analogue Scale (VAS) is a known valid tool that has been used to measure the intensity of pain on the visual paper scale from (0) for no pain to (10), which represents high-intensity pain in the Neck or Arm.[9] The VAS scores have been recorded separately for each pain (Neck or Arm) at the time of the patient's visit to the Clinic.

The BMI and length of each patient were collected during the Data collection of the patient's history. We used an electronic weight scale and a tape measure. All patients have a confirmed MRI diagnosis of cervical spine disc pathology.

We included patients between 25 years and 75 years old, who either have only neck pain or Arm pain (radiculopathy) with or without paresthesia. Our exclusion criteria were the patients who underwent previous spine surgery or have motoric deficit in the form of muscle weakness.

Ethical Approval

The patient's consent to use data for research purposes has been obtained verbally. An ethical approval has been obtained from the medical research committee of Al Mustaqbal University (No. Med 7/2026 in January 2026).

Statistical Analyses

Microsoft Excel has been used to collect DATA and SPSS 24 for analysis. BMI, considered as a continuous variable, were reported as Numbers. Simple linear regression analysis was used to examine whether there was any relation between the VAS scores and BMI for both Arm pain and Cervical pain. The significant p-value was less than 0.05. The multivariate regression analysis was used to determine the relationship among BMI, Gender and Age and cervical pain and radiculopathy severity.

Using G power and post hoc tests to calculate the sample size needed for acceptable statistics, since we have 272 patients, the statistical power was more than 80%, which is sufficient to investigate a small to medium effect size ($r = 0.2$) at alpha = 0.05.

Results

The Number of cervical spine levels was distributed as follows: C4/5: 76 (28%), C5/6: 102 (37.5%), and C6/7: 92 (34%). In segment C3/4, there were only 2, so our analysis focused on the other three levels, Table 1.

The Mean BMI is about 27.1 kg/m² (Participants' BMI: 18.9–47.4). In this study, the statistical analysis of BMI was as continuous variables; we didn't change it to categorical variables as most researchers do because changing continuous variables to categorical variables will reduce the statistical power. The median radiculopathy reported by the patients was 8 out of 10, whereas the median cervical pain without radiation was on the score 6.

According to statistics using Pearson correlation, no significant association between Arm pain and BMI ($r = 0.07$, $P > 0.05$). By the statistical analysis using the linear regression analysis, there was a significant correlation between BMI and Cervical pain, $P = 0.006$. In Spearman correlation, by considering the non-normal distribution, there was still a significant association, $P = 0.005$. For each 1-unit increase in BMI is associated with a 0.094-point increase in cervical pain. However, there was a weak positive correlation ($r = 0.18$), Fig. 1.

In the multivariate regression analysis for BMI, Gender and Age. However, BMI still has a statistically significant relationship as an independent variable of cervical pain severity ($\beta = 0.082$, 95% CI: 0.018 to 0.146, $P = 0.012$). On the other hand, age and gender have no significant statistical relation $P > 0.05$. In contrast to cervical radiculopathy, BMI, Age and Gender demonstrate no significant correlation ($\beta = 0.021$, $P = 0.43$).

Discussion

Our findings show a strong link, but because the study was cross-sectional, we cannot tell whether one caused the other or which came first. To our knowledge, this study would be the first study to examine the association of high BMI and Neck pain in the Iraqi population. Most published articles were based on Western or Asian countries.[10-12]

The association between high BMI and Cervical spine disorders is not well established, as with lumbar spine disorders. Moreover, most research treated BMI as a categorical variable, not a continuous variable.[6,10,11] In this study, treating BMI as a continuous variable will provide greater power and a stronger response to non-linear correlation than using a categorical BMI variable. Moreover, a continuous BMI variable will avoid bias.[13] In Iraq, the community is facing rapid changes in dietary habits, physical activities, and urbanisation, especially in women.[14]

Table 1. **The patients characteristics**

Patients involved in the study ($N = 272$)	
Patients age	Minimum age: 25 years Maximum age: 75 years Mean: 43.18; SD: 14.87
Gender	
Male	135 (49.4%)
Female	137 (50.6%)
Median Neck Pain	6
Median Arm Pain	8
BMI	Minimum BMI: 18.9 Maximum BMI: 47.4 Mean: 27.1; SD: 2.68
Cervical spine level abnormalities	
C3/4	Only 2 patients
C4/5	76 (28%)
C5/6	102 (37.5%)
C6/7	92 (34%)

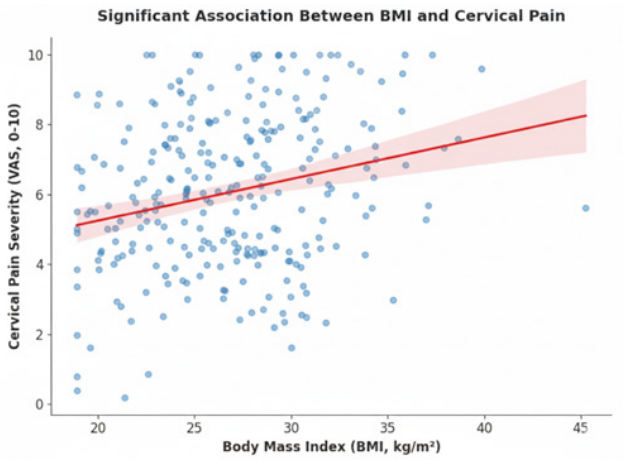

Fig. 1 **This figure demonstrated the relation between cervical pain intensity and BMI, with 95% CI; the shaded area around the regression line.**

In this context, our findings of high BMI association with neck pain might highlight new metabolic and mechanical abnormalities. This different association suggested different pathophysiologic mechanisms that might be independently associated with axial neck pain, compared to the radicular arm pain mechanism, which is related to mechanical nerve compression.

These systemic inflammatory suggestions are linked to high BMI, in which pro-inflammatory adipokines can sensitise peripheral nociceptors that are independently associated with degenerative disc pathology. In contrast, cervical radiculopathy is associated with neurological nerve compression, which might be associated with more distal symptoms such as Arm pain.[2,3]

Numerous studies support the correlation between BMI and cervical pain. The longitudinal study of 30000 participants by Nilsen et al. (2011) supported the relation between high BMI and Neck pain.[15] Moreover, Hozomi et al., (2016) in their cross-sectional study of 44 patients reported the strong relationship between obesity and Neuropathic pain.[2] Kang et al., (2023) in a retrospective study suggested that high BMI is an independent risk factor of chronic Neck pain.[3] Moreover, Wilson et al., (2017), in an analysis of two pooled prospective studies, reported that obese patients with DCM had significantly worse disability (NDI) scores 1 year postoperatively, despite similar neurological recovery.[16] The biological explanation of this association is that adipose tissue is not only an inert mass, but it acts as an endocrine tissue that secretes generic inflammatory adipokines such as Tumour Necrosis Factor that are independently associated with systemic inflammation, which, in the end, in reacting the nociceptor 2, 5, triggering the intervertebral disc and contribute in their degeneration. What supported this explanation, Snodgrass et al., in 2022, a radiological study conducted a cross-sectional study of 82 patients who had chronic cervical pain, and they found significant neck muscle fat infiltration. There was a statistically significant association between high BMI and patients who have high muscle volume, which is related to fat infiltration.[10]

In another Mendelian randomisation study by Gou and Zheng in 2023, in revealed that genetic high BMI is not only associated with Chronic Neck pain but also a highly related risk factor.[11]

In this study, there was no significant relation between high BMI and radiculopathy. This finding is clinically logical, because radiculopathy is associated with direct nerve compression in the form of intervertebral disc herniation or foramen stenosis by osteophytes. On the Other hand, Mizoguchi et al., (2024) conducted a cross-sectional study to evaluate the association between Age, Diabetes, and Obesity; however, no significant association was found. This might be because of the neurological compression that masks the metabolic influence.[6]

Fazaa et al., (2024) reported in their cross-sectional study of the paediatric population that approximately 23% of 88 children experienced neck pain. In their study, a significant association was found between high BMI and overall spine complaints. However, there was no direct significant relation with Neck pain.[17]

Godlewski et al., (2018) in a prospective study for the social factors that affect the surgical cervical outcome, reported no direct association between high BMI and postoperative cervical ACDF.[18] Khanum et al., in 2024 conducted an observational study to predict neck pain in individuals who use computers for a long time. The study revealed low relevance to BMI. However, professional-related Neck pain might be associated with other risk factors that overshadow BMI, such as Mechanical Posture and sitting abnormalities and psychological discomfort.[19] In contrast, our DATA depend on the outpatient clinic, not neck pain related to occupation. Aetiology of neck pain in the Iraqi context is independently related to BMI biomechanical influence more than in highly specialised occupational cohorts.

Zheng et al., (2022 in a cross-sectional study of 1921 healthcare students reported no significant correlation between BMI and Neck pain independently. However, it was associated with other Biomechanical postural and psychosocial factors.[20] Chen et al., 2023 in a prospective study reported the association between chronic Neck pain, OA and Mortality. Neck pain has a significant correlation with OA. Although BMI was a cofounder, there was no direct significant association.[21] These variations underestimated the importance of the demographic variation but raised the importance of BMI as a modifiable risk factor, especially in the Iraqi context where high BMI is prevalent.

Although we did not measure inflammatory markers or metabolic abnormalities, our finding that higher BMI is independently associated with greater axial neck pain, but not radicular arm pain, raises the possibility that systemic, metabolic, or low-grade inflammatory mechanisms may play a role in nociceptive non-compressive cervical pain. This hypothesis is consistent with prior Mendelian randomisation studies suggesting a causal link between obesity and cervicalgia,[11] as well as imaging evidence linking BMI to fatty infiltration in deep cervical extensors.[10] However, without direct assessment of cytokines, adipokines, or metabolic health indicators, this needs confirmation in future studies.

Limitations of this Study

We cannot rule out the association with some cofactors that might be associated with the findings, such as psychological factors, occupation and metabolic conditions, such as DM, which were limited in this population. Moreover, cross sectional study cannot determine causality. Radiculopathy was classified based on patient-reported arm pain with or without paraesthesia, supported by MRI evidence of single-level nerve root compression. However, we did not use electrophysiological testing to confirm radicular involvement. This may have led to misclassification of some patients. Pain severity was assessed using a single retrospective Visual Analogue Scale (VAS) score during clinical consultation.

Conclusion

A high BMI has a significant association with Neck pain, independent of other factors. However, radiculopathy has no direct association. This finding highlights the possibility of two pain mechanisms: one that is associated with metabolic factors such as obesity, and the other might be due to nerve root compression. Future prospective studies are needed to examine if BMI reduction might improve cervical pain and delay surgical referral and to confirm the association with metabolic comorbidities and inflammatory markers.

Acknowledgment

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Conflicts of Interest

None.

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