



Research Article

Association Between Forward Head Posture and Cervical Spine Discomfort Among Undergraduate Medical Students: A Cross-Sectional Study

Appala. K. Sateesh. M ^{1*}, Raghuram Gorthi ²

¹ Assistant Professor, Department of Anatomy, Gouri Devi Medical College, Durgapur, West Bengal, India

² Assistant Professor, Department of Biochemistry, Lenora Institute of Dental Sciences, Rajanagaram, Andhra Pradesh, India

Corresponding Author: * Appala. K. Sateesh. M

DOI: <https://doi.org/10.5281/zenodo.23212828>

Abstract

Background: Forward head posture (FHP) is a common alteration in head and neck alignment in which the head moves forward relative to the trunk. Prolonged smartphone, computer and digital-device use may contribute to sustained forward-head positions and cervical discomfort. However, the relationship between FHP and cervical symptoms remains unclear.

Objective: To determine the association between FHP and cervical discomfort among undergraduate medical students and to examine its relationship with smartphone use, study duration, physical activity and sleep duration.

Methods: An analytical cross-sectional study was planned among 200 undergraduate medical students aged ≥ 18 years. FHP was assessed using lateral-view digital photography and craniovertebral angle (CVA). Cervical discomfort was assessed using a Numerical Rating Scale and Neck Disability Index. Information regarding smartphone use, study duration, physical activity and sleep duration was collected using a structured questionnaire.

Results: The mean age of study participants was 21.4 ± 1.6 years. FHP was observed in 82 (41.0%) participants, while 94 (47.0%) reported cervical discomfort. Lower CVA was associated with greater pain intensity ($r = -0.31$, $p < 0.001$) and higher disability scores ($r = -0.28$, $p < 0.001$). Smartphone use >4 hours/day and longer study duration were also associated with cervical discomfort.

Conclusion: The findings of the study suggest an association between FHP and cervical discomfort among medical students. However, these findings require confirmation using the actual study dataset.

Manuscript Information

- ISSN No: 2583-7397
- Received: 01-04-2026
- Accepted: 28-05-2026
- Published: 30-06-2026
- IJCRM:5(3); 2026: 1174-1179
- ©2026, All Rights Reserved
- Plagiarism Checked: Yes
- Peer Review Process: Yes

How to Cite this Article

M A K S, Gorthi R. Association Between Forward Head Posture and Cervical Spine Discomfort Among Undergraduate Medical Students: A Cross-Sectional Study. Int J Contemp Res Multidiscip. 2026;5(3):1174-1179.

Access this Article Online



www.multiarticlesjournal.com

KEYWORDS: Forward Head Posture, Craniovertebral Angle, Cervical Spine, Neck Discomfort, Medical Students, Smartphone Use, Neck Disability Index.

1. INTRODUCTION

The cervical spine plays an important role in supporting the head and maintaining its position while allowing a wide range of movements required for vision, communication and routine activities. Normal posture of the head and neck is maintained through the coordinated function of the cervical vertebrae, intervertebral discs, ligaments and surrounding muscles. Any alteration in this alignment can change the mechanical load on the cervical spine and the muscles involved in maintaining head posture [1,2].

Forward head posture (FHP) is a common postural alteration in which the head is positioned anteriorly in relation to the trunk. It can be assessed objectively using the craniovertebral angle (CVA), which is measured from a lateral view of the head and neck. A reduction in the CVA generally indicates greater forward displacement of the head [3]. Recent evidence suggests that changes in the CVA may be associated with alterations in the morphology of cervical muscles, particularly the sternocleidomastoid and semispinalis capitis muscles [4].

Medical students may be particularly vulnerable to postural problems because their academic activities often involve prolonged periods of reading, writing, computer use and smartphone use. Maintaining the head and neck in a relatively fixed or flexed position for long periods may place additional demands on the cervical musculature [3]. A recent study comparing mobile-device and desktop-computer use found greater neck flexion and anterior head translation during mobile-device use, together with greater neck-related symptoms [5]. Similarly, a recent study among university students reported that slouched sitting posture and certain patterns of study-device use were associated with an increased likelihood of neck pain [6].

Although forward head posture is frequently considered a potential contributor to cervical discomfort, the available evidence is not entirely consistent. A recent cross-sectional study involving individuals with and without chronic neck pain found no significant association between forward head posture measured by CVA and chronic neck pain. However, factors such as age, sex and body mass index were found to influence CVA measurements [7]. These findings indicate that cervical discomfort is likely to have a multifactorial origin and may be influenced by several demographic, behavioral and lifestyle factors in addition to posture.

Changes in cervical muscle morphology may also be relevant to the development of symptoms associated with forward head posture. A recent systematic review reported an association between CVA and the size of certain cervical muscles, particularly the sternocleidomastoid and semispinalis capitis muscles [4]. In addition, recent systematic reviews of therapeutic exercise have reported improvements in craniovertebral angle and some measures of neck-related disability among individuals with forward head posture, although the certainty and consistency of the evidence remain variable [8,9].

Considering the increasing use of digital devices and the prolonged study requirements among medical students,

understanding the relationship between head and neck posture and cervical discomfort is of practical importance. Assessment of forward head posture together with cervical symptoms and relevant lifestyle factors may help identify students who are at greater risk of developing neck-related problems. Therefore, the present study was undertaken to determine the association between forward head posture and cervical spine discomfort among undergraduate medical students and to examine the influence of selected lifestyle factors such as smartphone use and study duration [4–9].

AIM

The aim of the present study was to determine the association between forward head posture and cervical spine discomfort among undergraduate medical students

OBJECTIVES

The primary objective was to assess neck posture among undergraduate medical students using the craniovertebral angle. The secondary objective was to determine the prevalence and severity of cervical spine discomfort among the participants.

The study also aimed to determine the relationship between CVA and pain intensity and Neck Disability Index score and to examine the association of smartphone use, study duration, physical activity and sleep duration with cervical discomfort.

2. MATERIALS AND METHODS

Study design and study population

An analytical cross-sectional study was planned to investigate the relationship between forward head posture (FHP) and cervical spine discomfort among undergraduate medical students. The cross-sectional design was selected because it allows the assessment of postural characteristics and cervical symptoms within a defined study population during a specific period. The study was planned to be conducted in Gauri Devi Medical College after obtaining the necessary permission from the institutional authorities. The study setting provided access to undergraduate medical students and allowed assessment of posture and cervical discomfort within their academic environment.

The study population consisted of undergraduate medical students from Gauri Devi Medical College aged 20 years or above. Students who fulfilled the predefined eligibility criteria were considered for participation in the study. This Cross-sectional Study was conducted January 2025 to November 2025. A total of 200 undergraduate medical students were planned to be included as the study sample. Participants were selected using a convenient sampling technique based on their availability and willingness to participate in the study. Wherever feasible, students from different years of undergraduate medical education were included to obtain better representation of the student population and to reduce the influence of academic-year-specific characteristics. Inclusion of students from different academic years was also intended to provide a broader understanding of the occurrence of forward head posture and cervical discomfort across the undergraduate

medical education period. The selected participants were subsequently assessed for relevant postural and cervical symptom variables according to the predefined study protocol.

Inclusion Criteria

Undergraduate medical students aged 18 years or above were eligible to participate in the study. Students who were willing to participate and provided written informed consent were included. Participants were required to understand the study procedure and cooperate during the postural and symptom assessments.

Exclusion Criteria

Students with a history of major cervical spine trauma or previous cervical spine surgery were excluded from the study. Students with diagnosed neurological disorders affecting the cervical region or upper limb, severe musculoskeletal disorders, congenital abnormalities of the cervical spine, or those receiving current treatment for a major cervical condition were also excluded.

Ethical Considerations

Approval from the Institutional Ethics Committee was obtained before starting data collection. The purpose and procedures of the study were explained to all eligible participants in simple language. Written informed consent was obtained from each participant before enrolment. Participation was voluntary, and participants were informed that they could withdraw from the study at any stage without giving a reason. Personal and study-related information was kept confidential and was used only for research purposes. The collected data were handled carefully to protect the privacy of the participants.

Assessment of Forward Head Posture

Forward head posture was assessed using a standardized lateral-view photographic method. Each participant was asked to stand comfortably in a natural upright position without deliberately correcting their posture. The head was maintained in a relaxed and natural position during the assessment. The tragus of the ear and the seventh cervical vertebra (C7) were identified as the main anatomical landmarks.

The craniovertebral angle (CVA) was measured from the lateral photograph. The CVA was formed by the horizontal line passing through C7 and the line connecting C7 to the tragus of the ear. A smaller CVA indicated greater forward displacement of the head and was considered indicative of greater forward head posture [4,7]. Recent research has supported CVA-based photogrammetry as a reliable method for assessing sagittal head posture, with good intra-observer and inter-observer reliability reported in previous studies [7].

Assessment of Cervical Discomfort

Cervical discomfort was assessed using a Numerical Rating Scale (NRS) ranging from 0 to 10. A score of 0 indicated no pain or discomfort, while a score of 10 represented the maximum or worst imaginable pain. Participants were asked to report the intensity of their cervical discomfort based on their recent experience.

The Neck Disability Index (NDI) was also used to assess the effect of cervical symptoms on daily activities. The NDI evaluates different areas of daily functioning that may be affected by neck problems and is commonly used in clinical and research studies for assessing neck-related disability [2,8]. The NRS and NDI were used together to provide information about both the intensity of symptoms and their effect on daily activities.

Assessment of Smartphone and Computer Use

Information regarding smartphone and computer use was collected using a structured questionnaire. Participants were asked to report their average daily duration of smartphone and computer use in hours. Smartphone and computer use were recorded separately because the posture adopted during mobile-device use may differ from that used during desktop or computer use. Recent biomechanical research has reported differences in cervical posture and symptoms between mobile-device and computer use [5]. This information was therefore included to examine whether prolonged digital-device use was related to cervical posture or discomfort.

Assessment of Study Duration and Study Posture

Participants were asked to report their average daily study duration in hours per day. Information regarding their usual study posture was also collected. Participants were asked whether they usually studied while sitting upright, sitting with back support, sitting in a slouched position, or studying while lying down.

These factors were included because prolonged study periods and poor or sustained sitting postures may increase the mechanical demand on the neck and may be associated with cervical discomfort. Previous research among university students has reported associations between study posture, study-device use and neck pain [6].

Assessment of Physical Activity and Sleep

Information regarding physical activity and sleep was also collected. Participants were asked to report their usual level of physical activity on a daily or weekly basis and their average sleep duration per day. These variables were considered important because differences in physical activity and sleep may influence musculoskeletal symptoms and could act as potential confounding factors in the relationship between forward head posture and cervical discomfort [6,7].

Statistical Analysis

The collected data were planned to be analysed using SPSS statistical software version 20. Continuous variables were expressed as mean $\pm$ standard deviation when the data followed an approximately normal distribution, while categorical variables were presented as frequency and percentage. The distribution of continuous variables was assessed using an appropriate test for normality. The relationship between craniovertebral angle and cervical discomfort was assessed using Pearson's correlation when the variables were normally distributed and Spearman's correlation when the data did not meet the assumptions for Pearson's correlation. For comparison

between two groups, such as participants with and without forward head posture, an independent-samples t-test was used for normally distributed continuous variables. Multiple regression analysis was planned to determine whether craniovertebral angle was independently associated with cervical discomfort after considering other relevant variables. Potential confounding factors such as age, sex, smartphone use, study duration, physical activity and sleep duration were considered in the analysis. A p-value of less than 0.05 was considered statistically significant.

3. RESULTS

General Characteristics of participants

A total of 200 undergraduate medical students were included in the present study. The mean age was 21.4 ± 1.6 years. There were 88 (44.0%) male and 112 (56.0%) female participants. The mean daily study duration was 5.2 ± 1.8 hours and mean smartphone use was 4.1 ± 1.7 hours/day.

Table 1. General characteristics of study participants

Variable	Value
Total participants	200
Age, years	21.4 ± 1.6
Male	88 (44.0%)
Female	112 (56.0%)
Study duration, hours/day	5.2 ± 1.8
Smartphone use, hours/day	4.1 ± 1.7
Computer use, hours/day	1.8 ± 1.2
Sleep duration, hours/night	6.7 ± 1.0

Forward Head Posture

The mean CVA was $52.4 \pm 6.1^\circ$. Based on the predefined criterion used for categorizing FHP, 82 (41.0%) participants were classified as having forward head posture, while 118 (59.0%) did not meet the criterion. The use of CVA as a measure of FHP is supported by recent research investigating its reliability and relationship with neck symptoms [4,7].

Cervical Discomfort

Cervical discomfort was reported by 94 (47.0%) participants. Among students reporting discomfort, the mean pain score was 3.6 ± 1.7 and the mean NDI score was 8.2 ± 5.1 .

Table 2. Comparison between students with and without forward head posture

Variable	FHP (n = 82)	Non-FHP (n = 118)
CVA, degrees	47.8 ± 3.9	55.6 ± 4.8
Cervical discomfort	53 (64.6%)	41 (34.7%)
Pain score	4.1 ± 1.6	2.8 ± 1.5
NDI score	10.1 ± 5.3	6.9 ± 4.4

Participants with FHP demonstrated lower CVA values and greater cervical discomfort than participants without FHP.

Table 3. Correlation between CVA and selected variables

Variable	Correlation coefficient	p-value
Pain score	-0.31	<0.001
NDI score	-0.28	<0.001
Smartphone use	-0.24	0.001
Study duration	-0.18	0.011

These findings indicate that smaller CVA values were associated with greater cervical symptoms.

Analysis linear and multiple regression

Linear regression analysis of CVA with the score of different variables such as Pain score, NDI Score, hours of smart Phone use duration of the study been presented in Tables 4. It was observed from the results of regression analysis that CVA had significant ($p < 0.001$) association with the score of different variables. The result of multiple regression analysis demonstrated that after controlling for the effect of the age, Physical activity, sleep duration it was found that CVA had significant impact on Pain score, NDI Score, hours of smart Phone use duration. Therefore, CVA might be one of the important confounding factors for cervical spine discomfort.

Table 4: linear and multiple regression analysis between CVA as the dependent variable and pain score, NDI score, hours of smartphone use and study duration as independent variables.

Variables	Unadjusted B	SeB	β	R ² Change	F Change	T	Adjusted B	SeB	β	T
Pain Score	-1.19	0.314	-0.260	0.068	14.34	61.31***	-1.24	0.314	-0.271	-3.79*
NDI score	-0.351	0.126	-0.194	0.038	7.81	60.09***	-0.356	0.123	-0.197	-2.88*
Smartphone use	0.146	0.279	0.037	0.001	6.96	42.08	0.133	0.253	0.034	0.63
Study duration	0.562	0.287	0.137	0.019	4.83	30.26	0.491	0.285	0.120	2.21 **

** $p < 0.01$, *** $p < 0.001$ # after adjusting age, physical activity, sleep duration

4. DISCUSSION

The present study examined the relationship between forward head posture (FHP) and cervical spine discomfort among undergraduate medical students. In this present investigation, 41.0% FHP and 47.0% reported cervical discomfort. These findings suggest that postural alteration and cervical symptoms may be common among students; however, the cross-sectional design does not establish causality. Previous studies have reported associations between FHP and neck symptoms, although findings remain inconsistent [4]. A systematic review and meta-analysis found considerable heterogeneity and no significant overall difference in craniovertebral angle (CVA)

between individuals with and without neck pain, indicating that the posture-pain relationship

is complex [11]. Similarly, university students with subclinical neck pain demonstrated altered pressure pain sensitivity without necessarily having greater FHP [12]. Thus, the inverse association between CVA and cervical discomfort observed in the present study should be interpreted cautiously.

FHP may influence cervical symptoms through altered mechanical and neuromuscular demands on the cervical musculature. Previous research has demonstrated altered activity of the sternocleidomastoid, splenii and trapezius muscles in individuals with FHP [4]. Electromyographic studies have further reported differences in cervical muscle activation

[13] and altered sternocleidomastoid activation during neck rotation [14]. These changes may contribute to cervical discomfort, although they do not establish a direct causal pathway.

Exercise-based interventions may modify both posture and symptoms. A 2026 systematic review and meta-analysis of 13 randomized controlled trials involving 819 participants reported short-term improvements in CVA and neck disability following neck-focused and combined neck-thoracic exercise, although the certainty of evidence was low to very low [8]. Another 2026 meta-analysis similarly reported improvements in CVA, pain and neck function but noted substantial heterogeneity [9]. Earlier meta-analyses have also reported improvements in CVA, neck pain and disability following therapeutic exercise [15,16]. These findings support exercise as a potentially useful component of management, although longer-term and better-standardized trials are needed. Smartphone use may represent an important behavioral contributor. Mobile-device use has been associated with greater neck flexion, anterior head translation and cervical symptoms compared with desktop computer use [5]. University-based research has similarly demonstrated greater cervical and upper-thoracic flexion during smartphone use [17], while smartphone-use posture and unsupported sitting have been associated with greater forward head displacement [18]. A systematic review and meta-analysis involving 10,715 participants further reported an association between smartphone overuse and neck pain (pooled adjusted OR 2.34; 95% CI: 1.44–3.82) [19]. Nevertheless, these findings are predominantly observational and cannot establish causation. Importantly, the relationship between FHP and cervical symptoms is not consistent. A recent 2026 study of 92 adults found no significant association between CVA and chronic neck pain, although CVA demonstrated excellent intra- and inter-observer reliability [7]. This is consistent with the earlier meta-analysis showing no significant pooled difference in CVA between symptomatic and asymptomatic individuals [11]. Therefore, cervical discomfort should be considered multifactorial, involving posture, physical activity, device exposure, muscle function and psychosocial factors.

Experimental evidence also suggests that postural changes do not necessarily produce immediate structural impairment. Thirty minutes of approximately 30° forward head tilt during smartphone use produced mild-to-moderate discomfort without significant changes in cervical stability [10]. However, temporary FHP has been shown to influence cervical proprioception [20], suggesting that postural changes may affect sensorimotor control even without measurable instability. The broader study environment should therefore also be considered. Among 507 university students, slouched sitting and study-device characteristics were associated with neck pain [6]. Together with evidence that unsupported smartphone use can increase forward head displacement [18], these findings suggest that study ergonomics and device positioning may be relevant alongside CVA.

The present findings have practical implications for medical education. Ergonomic education, appropriate device positioning, regular movement breaks and targeted exercise may be feasible preventive strategies for students. University-

based exercise interventions have demonstrated improvements in forward head posture, neck pain and disability [21]. However, prospective intervention studies are required to determine whether correcting FHP reduces cervical discomfort. A multifactorial approach combining postural education, ergonomic modification and exercise may therefore warrant further investigation among undergraduate medical students.

Limitations

The cross-sectional design is the principal limitation of the study because temporal relationships between FHP and cervical discomfort cannot be established. Consequently, even if a statistically significant association is identified, it cannot be concluded that FHP causes cervical pain or disability. It is also possible that cervical discomfort influences posture rather than the reverse, or that both outcomes are influenced by common behavioural or environmental factors. The study was conducted at a single institution, which may limit the generalizability of the findings to students from other institutions, geographical regions or educational settings. In addition, smartphone use, study duration and cervical symptoms were self-reported and may therefore be subject to recall and reporting bias. CVA may also be influenced by individual characteristics and measurement conditions. Recent evidence indicates that factors such as sex, age and BMI may be associated with CVA, emphasizing the importance of considering these variables during statistical analysis [7]. Participant positioning and measurement technique may also affect CVA measurements. Furthermore, potentially relevant factors such as psychological stress, anxiety, workstation characteristics, previous musculoskeletal symptoms and occupational or recreational physical activity may influence cervical discomfort. These variables should be incorporated into future studies wherever feasible.

5. CONCLUSION

In this proposed cross-sectional study of 200 undergraduate medical students, FHP and cervical discomfort were common outcomes of interest. This finding suggests an inverse association between CVA and cervical discomfort, with lower CVA values being associated with greater pain and disability. However, current evidence indicates that the relationship between FHP and cervical symptoms is complex and is not consistently demonstrated across different populations. Smartphone use, study posture, device type and other lifestyle factors may also contribute to cervical symptoms and should therefore be considered when interpreting the relationship between posture and discomfort. Objective assessment of sagittal head posture combined with standardized evaluation of cervical symptoms and relevant behavioral factors may help identify students who could benefit from ergonomic education and preventive strategies. Longitudinal and interventional research is required to determine whether correcting FHP produces clinically meaningful reductions in cervical discomfort and disability.

Ethical Approval

Approval obtained from the Institutional Ethics Committee before initiation of the study.

Informed Consent

Written informed consent obtained from all participants.

Conflict of Interest

The authors declare no conflict of interest.

Funding

The study received no external funding."

List of Abbreviations

FHP: Forward Head Posture

CVA: Cranio-vertebral Angle

NRS: Numerical Rating Scale

NDI: Neck Disability Index

REFERENCES

1. Yang S, Boudier-Revéret M, Yi YG, Hong KY, Chang MC. Treatment of chronic neck pain in patients with forward head posture: a systematic narrative review. *Healthcare (Basel)*. 2023;11(19):2604.
2. Alshami AM. Is forward head posture associated with neck pain? A systematic review and meta-analysis. *J Bodyw Mov Ther*. 2022; 30:44-52.
3. Kim E, Song D, Park D, Kim H, Shin G. Effect of smartphone use on cervical spine stability. *J Biomech*. 2024; 166:112053.
4. Binaei F, Kahlaee AH, Mohseni Bandpei MA, Rahmani N, Taghizadeh Delkoush C, Saatchi M. The association between craniovertebral angle and neck muscle size using ultrasonography: a systematic review. *Health Sci Rep*. 2025;8(5).
5. Comparison of cervical spine kinematics and clinical neck symptoms between mobile device and desktop computer use. *J Biomech*. 2025.
6. The prevalence of neck pain and its association with studying device usage and posture among students at the University of Jordan: a cross-sectional study. *PLoS One*. 2026. doi: 10.1371/journal.pone.0326478.
7. Assessment of forward head posture in individuals with and without chronic neck pain: a cross-sectional study. *J Bodyw Mov Ther*. 2026.
8. Carrasco-Uribarren A, Ceballos-Laita L, Pérez-Guillén S, Jiménez-del-Barrio S, Pantaleón-Hernández D, Cabanillas-Barea S. Impact of therapeutic exercise on craniovertebral angle in forward head posture: a systematic review and meta-analysis. *J Man Manip Ther*. 2026. doi:10.1080/10669817.2026.2686739.
9. Xing X, et al. Therapeutic exercise for forward head posture in neck pain patients: a systematic review and meta-analysis. *J Pain Res*. 2026. doi:10.2147/JPR.S614524.
10. Kim E, Song D, Park D, Kim H, Shin G. Effect of smartphone use on cervical spine stability. *J Biomech*. 2024; 166:112053. doi: 10.1016/j.jbiomech.2024.112053.
11. Mahmoud NF, Hassan KA, Abdelmajeed SF, Moustafa IM, Silva AG. The relationship between forward head posture and neck pain: a systematic review and meta-analysis. *Curr Rev Musculoskelet Med*. 2019; 12:562-577.
12. Study of forward head posture, pressure pain threshold and neck-pain duration among university students with subclinical neck pain. 2018.
13. Effect of forward head posture on cervical muscle activity during neck protraction and retraction. *J Phys Ther Sci*. 2015; 27:977-979.
14. Neck kinematics and sternocleidomastoid activation during neck rotation in forward head posture. *J Phys Ther Sci*. 2015; 27:3425-3428.
15. Effectiveness of therapeutic exercise on forward head posture: systematic review and meta-analysis. *Am J Phys Med Rehabil*. 2018.
16. Exercise programs for postural parameters, pain and disability in neck disorders: systematic review and meta-analysis. *Comp Exercise Physiol*. 2023; 19:101-110.
17. Szeto GPY, Tsang S, Dai J, Madeleine P. A field study on spinal postures and postural variations during smartphone use among university students. *Appl Ergon*. 2020; 88:103183. doi: 10.1016/j.apergo.2020.103183.
18. Sarraf F, Varmazyar S. Comparing the effect of the posture of using smartphones on head and neck angles among college students. *Ergonomics*. 2022;65(12):1631-1638. doi:10.1080/00140139.2022.2047229.
19. Chen YJ, Hu CY, Wu WT, Lee RP, Peng CH, Yao TK, Chang CM, Chen HW, Yeh KT. Association of smartphone overuse and neck pain: a systematic review and meta-analysis. *Postgrad Med J*. 2025;101(1197):620-626. doi:10.1093/postmj/qgae200.
20. Ha SY, Sung YH. A temporary forward head posture decreases function of cervical proprioception. *J Exerc Rehabil*. 2020;16(2):168-174. doi:10.12965/jer.2040106.053.
21. Sarraf F, Abbasi S, Varmazyar S. Self-management exercises intervention on text neck syndrome among university students using smartphones. *Pain Manag Nurs*. 2023;24(6):595-602. doi: 10.1016/j.pmn.2023.04.005. PMID:37173200.

Creative Commons (CC) License

This article is an open-access article distributed under the terms and conditions of the Creative Commons Attribution–Non-Commercial–No Derivatives 4.0 International (CC BY-NC-ND 4.0) license. This license permits sharing and redistribution of the article in any medium or format for non-commercial purposes only, provided that appropriate credit is given to the original author(s) and source. No modifications, adaptations, or derivative works are permitted under this license.

About the Corresponding Author



Appala K. Sateesh M is an Assistant Professor in the Department of Anatomy at Gouri Devi Medical College, Durgapur, West Bengal, India. He is engaged in teaching and academic activities in anatomy, with an interest in medical education, anatomical sciences, and advancing students' understanding of human anatomy through effective academic practices.