

## Research Article

# Study of spinous Process of Typical Cervical Vertebrae and Clinical Significance

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### Abstract

**Objective:** Aim of the present study is to observe the detailed anatomy of spinous process of typical cervical vertebrae and to note variations if any along with their frequencies of occurrences in Indian population and clinical importance.

**Material and method:** 200 dried typical cervical vertebrae (C3-C6) belonging to both sexes were taken for study from the Department of Anatomy of Hamdard Institute of Medical Sciences & Research, Jamia Hamdard, New Delhi & Career Institute of Medical Sciences and Hospital, Lucknow Uttar Pradesh.

**Result:** It was observed 173 (86.5%) vertebrae with bifid spinous process, 15(7.5%) vertebrae were having partially bifid spinous process and 12(6%) vertebrae were having a non-bifid spinous process.

**Conclusion:** Variations in bifidity of spinous process of typical cervical vertebrae were observed. These variations may be useful for the neurosurgeons, orthopedic surgeons and radiologists for interpreting the skiagrams, computed tomogram and magnetic resonance image scans.

**Keywords:** Typical Cervical Vertebrae, Bifid Spinous Process, Partially Bifid Spinous Process, Non-Bifid Spinous Process, Variations

## 1. Introduction

The C3 to C6 vertebrae belong to the typical cervical vertebrae. The spinous process of typical cervical vertebrae is short and bifid and gives attachment to ligamentum nuchae and extensor muscles of the back. Non-bifid spinous process may affect the curvature of vertebral column by asymmetrical action of extensor muscles. Presence of a non-bifid spine may be misinterpreted in radiological studies and may be responsible for erroneous counting of cervical spines in a skiagram<sup>1</sup>. The objective of our study is to observe the variations in bifidity of spinous process of typical cervical vertebrae.

## 2. Materials & Methods

The study was carried out on cervical vertebrae and included 200 dried typical cervical vertebrae (C3-C6) belonging to both sexes. These typical cervical vertebrae were studied from the Department of Anatomy of Hamdard Institute of Medical Sciences & Research, Jamia Hamdard New Delhi & Career Institute of Medical Sciences and Hospital, Lucknow Uttar Pradesh. Bifidity of spinous process of each cervical vertebra was observed. The spinous process of cervical vertebrae macroscopically divided under three categories, bifid spine, bifid but partially fused and nonbifid spine and photograph were taken.

## 3. Results

We studied the spinous process of 200 human typical cervical vertebrae (C3-C6). Sex of vertebrae had not been determined. It was observed variations in bifidity of spinous process. We were divided spinous process in three categories: if two distinct tubercles at the end of the spinous process are present, spinous process itself is not bifurcated and no cleft is present spine is referred partially bifid. Whereas in bifid spinous process bifurcation must separate both the tubercles and part of the spinous process itself and in non-bifid spine the end of the spinous process is rounded or flattened. 173 (86.5%) vertebrae with bifid spinous process (Figure 1), 15 (7.5%) vertebrae with partially bifid spinous process (Figure 2) and 12(6%) vertebrae with non-bifid spinous process (Figure 3) were observed (Table 1).

**Figure 1: Showing bifid spinous process in typical cervical vertebra. Figure 2: Showing partially bifid spinous process in typical cervical vertebra**



**Figure 3: Showing nonbifid spinous process in typical cervical vertebra.****Table 1: Distribution of spinous process in cervical vertebrae**

Serial no	Type of spinous process in vertebrae	No of vertebrae	% of vertebrae
1	Bifid process	173	86.5
2	Partially bifid	15	7.5
3	Non bifid	12	6

#### 4. Discussion

A bifid spinous process is a feature of the typical cervical vertebrae that includes third to sixth cervical vertebrae<sup>2</sup>. In our study we found three different variations in bifidity of spinous process of typical cervical vertebrae (C3-C6) namely bifid, partially bifid and non-bifid. A spine is referred to as a partially bifid if two distinct tubercles at the end of the spinous process are present and spinous process itself is not bifurcated and no cleft is present. In bifid spinous process bifurcation must separate both the tubercles and part of the spinous process itself and in non bifid spin the end of the spinous process is rounded or flattened<sup>3</sup>.

Similar variations have been observed and studied by other authors. The frequency of bifidity of cervical spinous processes at different vertebral level was examined in a sample of 359 Americans of African (black) and European (white) descent. Significant differences between race/sex subgroups were found at C3-C6 cervical vertebrae. At each level, whites showed a higher frequency of bifidity than blacks and males exhibited higher frequency of bifidity than females<sup>3</sup>. But in our study we were unable to determine sex of vertebrae so we couldn't observe sex difference due to unavailability of whole skeleton. The incidence of bifid spinous processes has being higher in fetuses as compared to that of adults in European and Native Africans<sup>4</sup>. Study of a male cadaver the third, fourth and sixth cervical vertebrae appeared to be normal accept that the spinous process were not bifid<sup>1</sup>. Study of 400 hundred black and white South African populations also showed bifid spinous processes were present significantly more frequently in the white sample (58.9%) than in the black (31.6%). A bifid spinous process occurred most commonly in C2 (89%) followed by C5 (83%), C4 (79%), C3 (59.4%), and C6 (41.7%) in the white sample<sup>5</sup>. In our study we observed and found 86.5% vertebrae with bifid, 7.5% vertebrae with partially bifid and 6% vertebrae with non-bifid spinous process. These variations are helpful for the neurosurgeons, orthopedic surgeons and radiologists for interpreting the skiagram, computed tomogram and magnetic resonance image scans<sup>6</sup>. Implantation of cervical spine instrumentation requires detailed anatomical information to avoid harming the patient<sup>7,8</sup>.

#### 5. Conclusion

In present study we found variations in bifidity of spinous process of typical cervical vertebrae. We studied 200 typical vertebrae and found bifid, partially bifid and non-bifid spinous process in 86.5%, 7.5% and 6% vertebrae respectively.

#### Conflict of interest statement

No financial grants have been received for the study. No other people or organization is associated with the study to influence the work.

#### References

1. Anas I.Y, Esomonu U.G, Dimitrov N.D, Rabiou F.I, Modibbo M.H. and Saleh M.S. Anatomical Variation of the spinous process in the Cervical vertebrae: a case study. *International Journal at Biomedical and Health Sciences*. 2010; 6 (1): 63-67.
2. Williams PL, Warwick R, and Dyson M. Osteology: In Gray Anatomy. 37<sup>th</sup> Ed. Churchill Living Stone. Edinburg, London. 1989: 264-327.
3. Duray SM, Morter HB, Smith FJ Morphological variation in cervical spinous processes: potential applications in the forensic identification of race from the skeleton. *J Forensic Sci*. 1999, 44:937-944.
4. Shore L R. A report on the spinous processes of the cervical vertebrae in the native races of South Africa. *J Anat*. 1931: 65: 482-505.
5. Asvat R. The configuration of cervical spinous processes in black and white South African skeletal samples. *J Forensic Sci*. 2012 Jan; 57(1):176-81. doi: 10.1111/j1556-4029.2011.01942.x. Epub 2011 Oct 31.
6. Partha Sarathi Banerjee<sup>1</sup>, Amit Roychoudhury<sup>2</sup>, Santanu Kumar Karmakar. Morphometric analysis of the cervical spine of Indian population by using computerized tomography. *J Med Allied Sci* 2011; 2 (2): 66-76.
7. Abuzayed. B, Tutunculer. B, Kucukyuruk. B, Tuzgen. S. Anatomic basis of anterior and posterior instrumentation of the spine: morphometric study. *Surg Radiol Anat*. 2010, 32: 75.
8. Moro T, Kikuchi S, Konno S, Nishiyama K. Cervical spinous process bifurcation is not useful as a landmark in posterior cervical spine approach. *Fukushima J Med Sci*. 2007 Jun; 53(1):19.