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Case Report

Short Spinous Process of Cervical Vertebrae in a Sudanese Subject: A Case Report

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Abstract

Introduction: The spinous process is part of the vertebrae and provides muscle attachment for some muscles and ligaments. They are important landmarks and play a role in screw placement during surgical intervention. This report describes a case of a Sudanese with a short cervical spinous process and draws attention to the possibility of anatomical variations in general and the shortage of cervical spinous processes specifically.

Case Report: A 70-year-old Sudanese male presented to the emergency department following a road traffic accident. After standard management and patient stabilization, the X-ray showed that the spinous processes of C 3, 4, and 5 cervical vertebrae were short, and those of C 6 and 7 have abnormal anatomy. The inter-spinous distances were well-maintained. The joints and articulations processes of cervical vertebrae were normal without cortication. The patient was stable and admitted for 24 hr for observation and then discharged on analgesics.

Conclusion: This is the first case report of the short spinous process among Sudanese. Some of the cervical spinous processes were short, and others had abnormal anatomy. No obvious manifestations were linked to the case. Discussion of anatomical variations should be carried out and implemented with care and in line with the normal and latest developments in biological, anthropology, forensic, and related sciences. Such anatomical abnormality should be considered during radiographing, preparation, and surgical intervention planning. The normal adaption resulting from congenital abnormality or variation can be used as a method for reconstruction surgeries and provides alternatives to clinical management.

Keywords: short spinous process, cervical, Sudanese, anatomical variation

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1. Introduction

The cervical part of the vertebral column (C) performs specific tasks. Mainly, it forms stable support while maintaining a significant range of mobility. Moreover, it protects the cervical segment of the spinal cord [1, 2]. Any morphological variation or disorder affecting the cervical vertebrae can significantly lower the quality of life [1].

The cervical spinous process is part of the vertebrae that provides muscle attachment for some muscles in the neck, back, and upper limb. They are important surface landmarks and play a role in screw placement or implants in the cervical spine [3–5].

The cervical spine, apart from the axis and atlas, is developed from cells of the sclerotome of cervical somites [6, 7]. The development of the cervical neural arch begins during the third to sixth week of intrauterine life. The neural arch develops from chondral ossification centers extending from the vertebral body (centrum) and a secondary ossification center on the tip of the spinous process [8]. The development spinous process is completed by the second decade, following the fusion of the secondary ossification centers [8, 9].

Typically, the spinous processes of cervical vertebrae are short and increase in length and possess a bifid end. Bifurcation (bifid) of the cervical spinous processes was described as a characteristic feature [2]. The cervical spinous processes are subjected to variations in regards to the length, types, and mode of bifurcations and deviation from the median plane [10]. These abnormalities can be asymptomatic or detected incidentally, or mimic traumatic lesions and may cause recurrent episodes of pain affecting the quality of life [11]. Congenital variations of the cervical spine can be associated with other abnormalities such as VACTERL (vertebral anomalies, anal atresia, cardiac malformations, tracheo-esophageal fistula, renal anomalies, limb abnormalities) association or clinical syndromes such as Klippel-Feil and Morquio or dystrophic dwarfism, spondyloepiphyseal dysplasia, and osteogenesis imperfect [11, 12].

A few studies researched the anatomy of the cervical vertebra [1, 5, 13–17]. Out of these studies, only two reported the length of the spinous process [13, 14]. The length of the spinous process is measured from the lower posterior tip of the process to the vertebral body centroid [13, 14]. Usually, the length of the spinous process decreased slightly from C 2 to C 3; it remained constant through C 5 and significantly increased at C 7 [13, 14].

Reporting this case report is important because it is the first case describing a short spinous process among Sudanese. It provides a reference value for the cervical spinous process and provides anatomical knowledge about the region to help radiographing and surgical intervention.

This report describes a case of a Sudanese with a short cervical spinous process and draws attention to the possibility of anatomical variations in general and the shortage of cervical spinous processes specifically.

2. Case Report

A 70-year-old Sudanese male was presented to the emergency department in Omdurman Military Hospital (Omdurman, Khartoum), following a road traffic accident (pedestrian road hit). After standard management and patient stabilization, a radiograph of the chest and cervical spine and computed tomography (CT) of the head was requested. Apart from the normal findings in the imaging workup, the cervical X-ray showed that the spinous processes of C 3, 4, and 5 were short, and those of C 6 and 7 had abnormal anatomy.

On reassessment, the patient denied any history of trauma or surgical intervention in the cervical region. The neck examination revealed that there was no surgical scar, palpable spinous process of C 6 and 7, normal range of neck motion, the power of upper limbs was grade five, and the sensation was normal. Further radiological investigations through CT (Figure 1) and 3D construct CT scan of the cervical spine (Figure 2) confirmed the shortage of C 2, 3, 4, and 5, and none of the spinous processes had bifid end. The inter-spinous distances were well-maintained. The joints and articulations processes of cervical vertebrae were normal without cortication. The lengths of the cervical spinous process were measured from the anterior end to the posterior tip of the spinous process. The length was considered the main out of the three measurements done by the same observer (Figure 1).

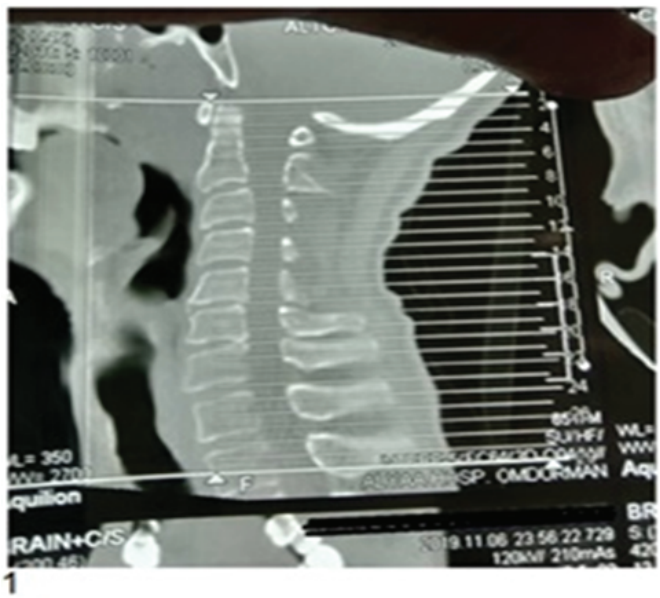

Figure 1: CT scan of the patient's neck. The spinous process of cervical vertebrae appears short.

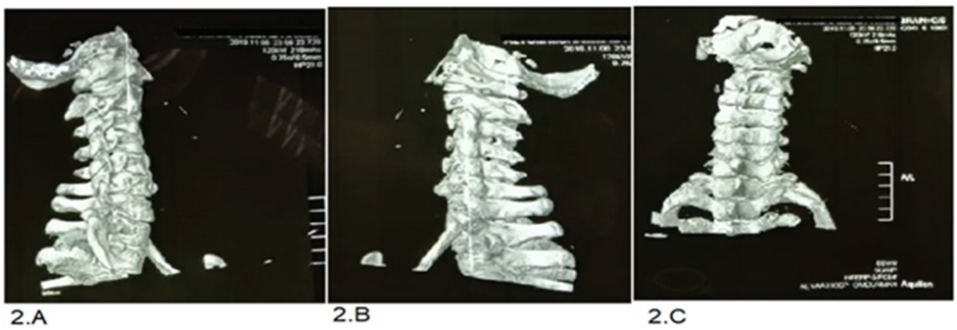

Figure 2: The 3D construct CT scan of the cervical spine. (2A) Right lateral view; (2B) Left lateral view; (2C) Posterior view. The spinous processes are short and have no bifid end.

Table 1: The comparison of the length of the cervical vertebrae.

Spinous process	Current study	Panjabi et al. [13]		Bazaldúa et al. [21]	
		Mean	SD	Mean	SD
C 2	20.58	33.7	1.39	–	–
C 3	8.59	29.6	0.78	15.3	3.11
C 4	10.52	30.3	1.07	15.38	2.61
C 5	16.16	28.5	0.98	16.63	3.04
C 6	32.38	34.2	1.88	21.81	5.00
C 7	33.93	45.7	0.84	28.12	5.86

The patient was stable and admitted for 24 hr for observation and then discharged without complaints on analgesics. The patient was referred to a neurology and orthopedic outpatient clinic for further assessment.

3. Discussion

Shortage of the cervical spinous process can be due to failure of complete fusion of chondrification centers extending from the centrum to the neural arches or arrest of the secondary ossification center in the tip of the spinous process [18]. Also, it can be due to genetic or sporadically in an isolated manner or associated with other organs [19]. The presence of a non-bifid spinous process with normal inter-spinous distances and articulations supports the possibility of arrest of the secondary ossification center on the tip of the spinous process rather than incomplete fusion of the vertebral arch. The shortage of cervical spinous processes is part of neural arch anomalies [20].

In the current case, apart from C 7, 6, and 2, which were the longest, respectively, C3 was the shortest, preceded by C 4 and 5. Despite the difference in length between Panjabi *et al.*, Bazaldúa *et al.*, and the current findings, the pattern of spinous length was

maintained. These findings are in accordance with the standard anatomy literature [21]. The shortage of the spinous process can affect muscle attachment to it and the supporting functions of ligaments. Such affection can limit cervical movements and present some complaints or symptoms. In the present case, the physical examination revealed normal findings. Normal findings in the clinical examination support the possibility of adaptation in regard to muscles and ligament attachments that maintained the normal functions. Such a mode of adaptation can be beneficial for planning reconstruction surgeries on the back of the cervical spine. Also, the size of the screws and surgical implants should be considered in advance because using f regular size can lead to other complications.

Although the cervical spinous process abnormalities are rare, the most commonly reported are non-bifid spine, duplicated spinous process (of the C7), unilateral hyperplasia, deviation of the spinous processes, and non-united secondary ossification centers of the spinous processes [20, 22, 23].

4. Conclusion

This study describes a case report of a Sudanese with short cervical spinous processes and draws attention to the possibility of anatomical variations in general and the specific shortage of cervical spinous processes. Discussion of anatomical variations should be carried out and implemented with care and in line with the normal and latest developments in biological, anthropology, forensic, and related sciences.

The presence of anatomical variation or abnormality can affect clinical evaluation and subsequent surgical intervention or mimic other clinical conditions. The normal adaption resulting from congenital abnormality or variation can be used as a method for reconstruction surgeries and provides alternatives to clinical management. In such spine cases, the implant of screws and relevant manipulation should be adapted according to the variation.

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Ethical Considerations

Written consent and acceptance to participate were obtained from the participant.

Competing Interests

The authors declare no conflict of interest.

Availability of Data and Material

The study data will be available upon reasonable request to the corresponding author.

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References

[1] Swartz, E. E., Floyd, R., and Cendoma, M. (2005). Cervical spine functional anatomy and the biomechanics of injury due to compressive loading. *Journal of Athletic Training*, vol. 40, no. 3, p. 155.

[2] Drake, R., Vogl, A. W., and Mitchell, A. W. M. (2019). *Gray's anatomy: For students*. USA: Elsevier Health Sciences.

[3] Nambiar, S., Mogra, S., Nair, B. U., et al. (2014). Morphometric analysis of cervical vertebrae morphology and correlation of cervical vertebrae morphometry, cervical spine inclination and cranial base angle to craniofacial morphology and stature in an adult skeletal class I and class II population. *Contemporary Clinical Dentistry*, vol. 5, no. 4, pp. 456–460.

[4] Rao, E. V., Rao, S., and Vinila, S. (2016). Morphometric analysis of typical cervical vertebrae and their clinical implications: a cross sectional study. *International Journal of Anatomy and Research*, vol. 4, no. 4.1., pp. 2988–2992.

[5] Chen, C., Ruan, D., Wu, C., et al. (2013). CT morphometric analysis to determine the anatomical basis for the use of transpedicular screws during reconstruction and fixations of anterior cervical vertebrae. PloS One., vol. 8, no. 12, p. e81159.

[6] Kaplan, K. M., Spivak, J. M., and Bendo, J. A. (2005). Embryology of the spine and associated congenital abnormalities. *The Spine Journal*, vol. 5, no. 5, pp. 564–576.

[7] Kim, H. J. (2013). Cervical spine anomalies in children and adolescents. *Current Opinion in Pediatrics*, vol. 25, no. 1, pp. 72–77.

[8] Richardson, P., Drake, R. L., Horn, A., et al. (2018). *Gray's basic anatomy*. China: Elsevier Health Sciences.

[9] Rameez, F., Mufti, M., and Hilal, K. (2017). Hyperplasia of Lamina and Spinous Process of C5 Vertebrae and Associated Hemivertebra at C4 Level. *Journal of Orthopaedic Case Reports*, vol. 7, no. 1, pp. 79–81.

[10] Ludwisiak, K., Podgórski, M., Biernacka, K., et al. (2019). Variation in the morphology of spinous processes in the cervical spine–An objective and parametric assessment based on CT study. *PloS One*, vol. 14, no. 6, p. e0218885.

[11] Farooqi, R., Mehmood, M., and Kotwal, H. (2017). Hyperplasia of lamina and spinous process of C5 vertebrae and associated hemivertebra at C4 level. *Journal of Orthopaedic Case Reports*, vol. 7, no. 1, pp. 79–81.

[12] Solomon, B. D., Raam, M. S., Pineda-Alvarez, D. E. (2011). Analysis of genitourinary anomalies in patients with VACTERL (Vertebral anomalies, Anal atresia, Cardiac malformations, Tracheo-Esophageal fistula, Renal anomalies, Limb abnormalities) association. *Congenital Anomalies*, vol. 51, no. 2, pp. 87–91.

[13] Panjabi, M. M., Duranceau, J., Goel, V., et al. (1991). Cervical human vertebrae. Quantitative three-dimensional anatomy of the middle and lower regions. *Spine*, vol. 16, no. 8, pp. 861–869.

[14] Tan, S., Teo, E., and Chua, H. (2004). Quantitative three-dimensional anatomy of cervical, thoracic and lumbar vertebrae of Chinese Singaporeans. *European Spine Journal*, vol. 13, no. 2, pp. 137–146.

[15] Doherty, B. J. and Heggeness, M. H. (1995). Quantitative anatomy of the second cervical vertebra. *Spine*, vol. 20, no. 5, pp. 513–517.

[16] Greiner, T. M. (2017). Shape analysis of the cervical spinous process. *Clinical Anatomy*, vol. 30, no. 7, pp. 894–900.

[17] Oh, S.-H., Perin, N. I., and Cooper, P. R. (1996). Quantitative three-dimensional anatomy of the subaxial cervical spine. Implication for anterior spinal surgery. *Neurosurgery*, vol. 38, no. 6, pp. 1139–1144.

[18] Moore, K. L., Persaud, T. V. N., and Torchia, M. G. (2018). *The developing human-e-book: clinically oriented embryology*. Amsterdam, The Netherlands: Elsevier Health Sciences.

[19] Chaturvedi, A., Klionsky, N. B., Nadarajah, U., et al. (2018). Malformed vertebrae: A clinical and imaging review. *Insights into Imaging*, vol. 9, no. 3, pp. 343–355.

[20] Ravikanth, R. and Pottangadi, R. (2018). Nonunited secondary ossification centers of the spinous processes of vertebrae at multiple levels presenting as aberrant articulations in an adult. *Journal of Craniovertebral Junction & Spine*, vol. 9, no. 3, pp. 216–217.

[21] Bazaldúa, C., González, L., Gómez, S., et al. (2011). Morphometric study of cervical vertebrae C3-C7 in a population from northeastern Mexico. *International Journal of Morphology*, vol. 29, no. 2, pp. 325–330.

[22] Cho, W., Maeda, T., Park, Y., et al. (2012). The incidence of bifid C7 spinous processes. *Global Spine Journal*, vol. 2, no. 2, pp. 99–103.

[23] Tubbs, R. S., Shoja, M. M., and Loukas, M. (2016). *Bergman's comprehensive encyclopedia of human anatomic variation*. Hoboken, NJ: John Wiley & Sons.