MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.59218/makrjms.2023.11.35.37

A Morphometric Study of Width of the Atlas Vertebra and its Significance

[1]Fatima Begum, [2]Sadakat Ali and [3]Harish Chaturvedi

[1,2]Department of Anatomy, Shri Guru Ram Rai Institute of Medical and Health Sciences, Dehradun, SGRRU, India

[3]Department of Anatomy, Pt JLNGMCH, Chamba, H.P., India

ABSTRACT

Atlas vertebra is located very close to the vital centres of the medulla oblongata which can get compressed by a dislocation of the atlantoaxial joint or instability of this joint. Atlas vertebra helps in complex biomechanical movements of the skull along with weight transmission of skull to spine. Recent developments in fixation technologies and minimally invasive surgical approaches have encouraged researcher to acquire knowledge of various dimensions of atlas vertebrae which is very important for the development of instrumentation related to atlas vertebrae. To determine mean values of the following parameters, Width of the atlas, Outer distance of foramen transversarium, Inner distance of foramen transversarium. In this study, total 120 dry, adult human atlas vertebrae of unknown age and sex were examined in various medical colleges of North India. The following parameters were measured for each atlas by using Digital Vernier Calliper. The mean and standard deviation of all measurements were as follows: Width of the atlas 70.23±7.60, Outer distance of foramen transversarium 57.03±4.79 and Inner distance of foramen transversarium 46.82±2.47. The results of study are similar with Gosavi and Vatsalaswamy[7] Guptha *et al*.[6] and Ansari et al. but differ with Sengül and Kadioglu[3]. The measurements done in this study may be helpful to reducing complications such as vertebral artery injury, spinal cord injury and cranial nerve damage during C1 stabilizing operation.

OPEN ACCESS

Key Words

Atlas vertebra, atlantoaxial joint, foramen transversarium, skull

Corresponding Author

Harish Chaturvedi,
Department of Anatomy, Pt JLNGMCH, Chamba, H.P., India

Author Designation

[1]Research Scholar
[2,3]Professor and HOD

Received: 26 September 2023
Accepted: 10 October 2023
Published: 11 October 2023

Citation: Fatima Begum, Sadakat Ali and Harish Chaturvedi, 2023. A Morphometric Study of Width of the Atlas Vertebra and its Significance. Res. J. Med. Sci., 17: 35-37, doi: 10.59218/makrjms.2023. 11.35.37

INTRODUCTION

The atlas holds the globe of the skull and is devoid of body and spine. It has two lateral masses linked by small anterior and large posterior arch. About 3/5 of the atlantal ring formed by posterior arch. The large size of lateral masses enables screw placement feasibility in almost all patients[1]. In textbooks, atlantal width is between 74 mm and 95 mm in males and between 65 mm and 76 mm in females[2]. However, the distance between tips of the transverse processes of the atlas ranged from 29.8 to 84.9 mm (mean 74.6 mm) in an article[3]. The sulcus arteriae vertebralis (groove for the vertebral artery) is situated on the cranial surface of the posterior arch at its junction with the lateral mass[4]. Craniovertebral junction (CVJ) surgery includes many decompressive and stabilising operations, which includes transarticular screw fixation of the atlas vertebra and posterior screw placement on the lateral mass of atlas vertebra. These kind of operations, usually target the atlas vertebra which is a critical component of the biomechanical complex of CVJ's bony architecture.

To treat the instability of the cervicovertebral junction produced by various traumatic and non-traumatic situations, various surgical procedures such as interspinous wiring, interlaminar clamp, plate and screw fixation are now used. Transarticular and transpedicular screw fixation are also commonly employed in vertebral column stabilisation. Despite the benefits provided by the aforementioned treatments, there are risks that can develop, most notably from incorrect pedicle screw insertion, which can result in harm to critical tissues such as the cranial and spinal nerves, spinal cord and vertebral arteries. Iatrogenic vertebral artery damage is a rare complication encountered during posterior approach cervicovertebral junction procedures (CVJ) [5].

So, this study was undertaken to look for the variations that can occur in the atlas vertebra and to determine the various measurements of the first cervical vertebra quantitatively and analyse their relationship with the vertebral artery foramen and to determine the safe sites for different surgical methods.

MATERIAL AND METHODS

Study was carried out on 120 dry human atlas vertebrae of unknown gender and age which were collected from the department of anatomy of various medical colleges of northern region of India. Damaged vertebrae were excluded. The following parameters were measured for each atlas using a digital vernier caliper that provides accurate resolution up to 0.01 mm.

Dimensions were measured:

- Width of the atlas (Distance between tips of both transverse processes)
- Outer distance of foramen transversarium (Distance between both lateral most edge of the transverse foramen)
- Inner distance of foramen transversarium (Distance between both medial most edge of the transverse foramen)

RESULTS

The mean and standard deviation of all measurements done on width of Atlas vertebrae and foramen transversarium are shown in Table 1 and compare with other authors.

DISCUSSION

The above table shows comparison of mean distance between the inner and outer most edges of foramen transversarium with other published studies. The findings of the present study were in agreement with other published studies as shown in the table.

The measurements done in this study may be helpful in avoiding and reducing complications such as vertebral artery injury, spinal cord injury and cranial nerve damage during a C1 stabilizing operation.

In present study mean width of atlas were 70.23 mm, the mean distance between both lateral-most edge of the transverse foramen were 57.03 mm, the mean distance between both medial most edge of the transverse foramen were 46.82 mm.

Mohd Salahuddin Ansari *et al*. found mean width of atlas were 71.98 mm, the mean distance between both lateral-most edge of the transverse foramen were 58.18 mm, the mean distance between both medial most edge of the transverse foramen were 45.38 mm., similarly mean width of atlas were 72.5 mm, mean distance between both lateral-most edge of the transverse foramen were 57.6 mm and mean distance between both medial most edge of the transverse foramen were 45.2 mm, in Gupta C study. Shilpa N G and Vatsalaswamy P, found mean width of atlas were 69.37 mm, the mean distance between both lateral-most edge of the transverse foramen were 55.66 mm, the mean distance between both medial most edge of the transverse foramen were 45.93 mm.

Göksin Sengül and Hakan Hadi Kadioglu differ as they found the mean width of atlas as 74.6 mm, the mean distance between both lateral-most edge of the transverse foramen as 59.5 mm, the mean distance between both medial most edge of the transverse foramen as 48.6 mm.

Table 1: Atlas vertebrae and foramen transversarium

No. on illustration	Description of parameter	Present study N = 120	Salahuddin *et al*.[8] India 2016 N=30	Gupta *et al*.[6] India, 2015 N = 35	Gosavi and Vatsalaswamy[7] India, 2012 N = 100	Sengul and Kadioglu[3] Turki, 2006 N = 40
1	Width of Atlas Vertebra	70.23±7.60	71.98±4.6	72.5	69.37±6.47	74.6±9.7
2	Outer distance of foramen transversarium	57.03±4.79	58.18±4.26	57.6	55.66±5.01	59.5±3.7
3	Inner distance of foramen transversarium	46.82±2.47	45.38±3.25	45.2	45.93±4.22	48.6±2.9

Therefore the position of foramen transversarium with respect to the tip of the transverse process of the atlas is known the position of the vertebral artery can be located by tracing the attachment of obliqus-capitis superior and obliqus-capitis inferior muscles to the tip of the transverse process.

CONCLUSION

These distances are of significance while locating the position of second part of the vertebral artery during posterior approach surgeries of cervico-vertebral junction [CVJ].

The results of present study show similarity with Guptha *et al*.[6], Shilpa *et al*. and Mohd et al. but differ with Sengul and Kadioglu *et al*.[3], Gosavi and Vatsalaswamy[7], Salahuddin *et al*.[8], Lalitha[9], Patel[10] and Lokanathan[11]. This shows that the foramen transversarium is larger in Turkish population than the Indian population.

REFERENCES

1. de Carvalho, M.F., R.T. Rocha, J.T.S. Monteiro, C.U. Pereira, R.F. Leite and H.L.A. Defino, 2009. Estudo tomográfico do atlas relacionado com a inserção de implantes na massa lateral. Acta Ortopédica Bras., 17: 136-138.
2. Standring, S., 2015. Gray's Anatomy: The Anatomical Basis of Clinical Practice 41st Edition. 41st Edn. Edn., Elsevier,, Amsterdam, Netherlands, ISBN-14: 978-0702052309, Pages: 1562.
3. Sengul, G. and H.H. Kadioglu, 2006. Morphometric anatomy of the atlas and axis vertebrae. Turk. Neurosurg., 16: 69-76.
4. Pait, T.G., K.I. Arnautovic and L.A. Borba, 1997. The anatomy of atlantoaxial complex. Perspect Neurol. Surg., 7: 91-98.
5. Lalit, M., S. Piplani, J.S. Kullar, A.K. Arora, R. Mannan, 2011. The morphological analysis of the superior articular facet of the adult human atlas vertebra. J. Clin. Diagn. Res., 5: 274-277.
6. Gupta, C., P. Radhakrishnan, V. Palimar, A.S. D'souza and N.L. Kiruba, 2013. A quantitative analysis of atlas vertebrae and its abnormalities. J. Morphol. Sci.,, 30: 77-81.
7. Gosavi, S.N. and P. Vatsalaswamy, 2012. Morphometric study of the atlas vertebra using manual method. Malaysian Orthop. J., 6: 18-20.
8. Salahuddin, A.M., S. Mukesh, K.B. Binaya and C. Nilotpal, 2016. A study on the morphometric asymmetry of atlas vertebrae. J. Surg. Academia, 6: 18-24.
9. Lalitha, B., E.V. Rao and B.H.S.Vinila, 2016. Morphometric analyses of atlas vertebrae- a cross sectional study. Indian J. Clin. Anat. Physiol., 3: 305-308.
10. Patel, N.P., D.S. Gupta and N.D. Parmar, 2015. Incidence of ponticles in human atlas vertebrae- a study from south gujarat population. Ind. J. Clin. Anat. Physiol., 2: 135-139.
11. Lokanathan, T.H., A. Ningaiah, S.K. Asharani, Y.A. Balakrishnan and S.Y. Dhananjaya, 2022. Morphological and morphometric analysis of superior articular facet of atlas vertebra. Cureus, Vol. 14, No. 3 .10.7759/cureus.22906