

MORPHOMETRIC STUDY OF THE ATLAS VERTEBRAE

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Abstract

Background: Atlas is first cervical vertebrae, good knowledge about its morphometric parameters is of most importance to neurosurgeons, orthopaedic surgeons dealing with conditions which lead to atlantooccipital and atlantoaxial instability. These anatomical parameters of atlas vertebrae are helpful while performing several procedures like screw fixation, intralaminar clamp, transpedicular screw fixation. The aim is to study the following parameters of atlas vertebrae: Distance between the tips of transverse process of atlas, Distance between the lateral margins of two transverse foramen, Distance between the medial margin of two foramen transversarium, Maximum anteroposterior diameter of vertebral foramen, Anteroposterior diameter of superior articular facet, Transverse diameter of superior articular facet.

Materials and Methods: This descriptive statistical study was conducted on 42 atlas vertebrae obtained from department of Anatomy Siddaganga medical college and research institute Tumakuru from August 2023- Sep 2023. Vernier calliper was used for measuring purpose. Digital camera was used for photography. Descriptive statistics was used to measure Mean, Range and Standard deviation. **Result:** It was observed that the: Mean distance between the tips of transverse process of atlas is 71.34mm, Mean distance between the lateral margins of two transverse foramen is 56.92mm, Mean distance between the medial margin of two foramen transversarium is 45.01mm, Maximum anteroposterior diameter of vertebral foramen is 8.01mm, Mean distance between Anteroposterior diameter of superior articular facet is 16.83mm, Transverse diameter of superior articular facet is 15.09mm. **Conclusion:** Knowledge of the parameters of atlas will be very useful to orthopaedic surgeons and neurosurgeons in performing surgeries like screw fixation, intralaminar clamp to atlas vertebrae and prevent injury to vital structure like vertebral artery.

INTRODUCTION

Atlas vertebrae is the first cervical vertebrae, it transmits weight to axial skeleton and supports cranium.^[1] It is atypical vertebrae and bears direct weight on skull hence called atlas a mythical Greek titan who bore the world on his shoulders. It forms atlantooccipital joint along with occipital condyles of skull and forms atlantoaxial joint along with second cervical vertebral the axis.^[2] C1, C2 vertebrae are atypical vertebrae and share very important relationship with vertebral artery, high incidence of vertebral artery injury during lateral mass and trans articular screw implantation for atlantoaxial fixation,

and lateral approach to foramen magnum region have been reported by various authors.

The third part of vertebral artery is related very close to lateral and superior surface of atlas vertebrae on each side and its injury during surgery will lead to intraoperative bleeding and reduce blood flow resulting in neurological deficits. Hence a thorough 3-dimensional knowledge regarding its anatomy is of at most importance for surgery in craniovertebral region.^[3]

MATERIALS AND METHODS

A descriptive statistical study was conducted in Department of Anatomy Siddaganga Medical College and Research Institute Tumakuru Karnataka

from August 2023 to September 2023. Institutional ethical clearance was obtained. A total number of 42 human dried atlas vertebrae was used for this study.

Inclusion Criteria

Intact bones without any deformity were used

Exclusion Criteria

Broken bones, bones with variations and deformity were excluded from study.

Measurements were taken using vernier calliper that provides accurate resolutions upto 0.01mm. each measurement was taken 2 to 3 times in order to minimize error. All measurements were taken by the same person. Digital camera was used to take photograph.

Parameters Included were

- Distance between the tips of transverse process of atlas
- Distance between the lateral margins of two transverse foramen
- Distance between the medial margin of two foramen transversarium
- Maximum anteroposterior diameter of vertebral foramen
- Anteroposterior diameter of superior articular facet
- Transverse diameter of superior articular facet

Statistical Analysis

Data will be analysed using IBM SPSS (Version 16) software for statistical analysis. Descriptive statistics including, proportions, mean, standard deviation, range, frequencies, were calculated. Statistical test of significance such as chi square test, correlation will be performed to test the relation between the selected variables. P values <0.05 will be considered statistically significant.

RESULTS

It was observed that the

- Mean distance between the tips of transverse process of atlas is 71.34mm
- Mean distance between the lateral margins of two transverse foramen is 56.92mm
- Mean distance between the medial margin of two foramen transversarium is 45.01mm
- Maximum anteroposterior diameter of vertebral foramen is 8.01mm
- Mean distance between Anteroposterior diameter of superior articular facet is 16.83mm
- Transverse diameter of superior articular facet is 15.09mm



Figure 1: Distance between the tips of transverse process of atlas



Figure 2: Distance between the lateral margins of two transverse foramen



Figure 3: Distance between the medial margins of two foramina transversaria



Figure 4: Maximum anteroposterior diameter of vertebral foramen



Figure 5: Anteroposterior diameter of superior articular facet



Figure 6: Transverse diameter of superior articular facet

DISCUSSION

In present study done on 42 atlas vertebrae , it was observed that the

- Distance between tips of transverse process of atlas was found to be 71.34mm
- Distance between the lateral margins of two transverse foramen was 56.92mm
- Distance between the medial margin of two foramen transversarium was 45mm
- Maximum anteroposterior diameter of vertebral foramen was 28mm
- Anteroposterior diameter of superior articular facet was 16.83mm
- Transverse diameter of superior articular facet was 15.09mm

It is seen that from table number 1,3,4,5 the values for various parameters of atlas vertebrae in present study is similar to values noted in previous studies. However in table 2 and 6 there is slight difference in values obtained in present study to that noted in previous studies which could be due to regional variations.

Table 1: Distance between the tips of transverse process of atlas

Serial number	Author	Sample size	Observed values
1.	Swetha rani, ^[4] 2023	100	69.37+ 6.47mm
2.	J.Kaur, ^[5] 2023	50	72.09+ 5.59mm
3.	Chetana thakur, ^[6] 2022	30	69.53 + 4.48mm
4.	Irfan kucugo, ^[7] 2022	17	76.32+ 8.09mm
5.	Subodh kumar, ^[8] 2021	100	69.37+ 6.47mm
6.	Arpan Haldar, ^[9] 2019	24	71.36mm
7.	Lalitha, ^[10] 2016	50	70.25+ 6.86
8.	Present study	42	71.34mm

Table 2: Anteroposterior diameter of superior articular facet

Serial number	Author	Sample size	Observed values Right side	left side
1.	Swetha rani, ^[4] 2023	100	21.24+2.39mm	21.02+ 2.52mm
2.	J.Kaur, ^[5] 2023	50	21.52+ 2.36mm	21.5+ 2.07mm
3.	Chetana thakur, ^[6] 2022	30	19.52+ 2.38mm	19.55+ 2.43mm
4.	Irfan kucugo, ^[7] 2022	17	18.25+ 2.05mm	17.6+ 2.06
5.	Subodh kumar, ^[8] 2021	100	21.24+ 2.39mm	21.02+ 2.52mm
6.	Arpan Haldar, ^[9] 2019	24	17.35mm	16.91mm
7.	Lalitha, ^[10] 2016	50	22.47+ 2.40mm	22.81+ 2.44mm
8.	Present study	42	16.83mm	16.92mm

Table 3: Distance between the lateral margins of two transverse foramen

Serial number	Author	Sample size	Observed values
1.	Swetha rani, ^[4] 2023	100	55.66+ 5.01mm
2.	J.Kaur, ^[5] 2023	50	56.37+ 4.11mm
3.	Chetana thakur, ^[6] 2022	30	56.58+ 4.89mm
4.	Subodh kumar, ^[8] 2021	100	53.66+ 5.01mm
5.	Lalitha, ^[10] 2016	50	54.39+ 4.73mm
6.	Present study	42	56.92mm

Table 4: Distance between the medial margin of two foramen transversarium

Serial number	Author	Sample size	Observed values
1.	Swetha rani, ^[4] 2023	100	45.93+ 4.22mm
2.	J.Kaur, ^[5] 2023	50	44.78+ 3.67mm
3.	Chetana Thakur, ^[6] 2022	30	36.5+ 54.04mm
4.	Subodh Kumar, ^[8] 2021	100	45.93+4.22mm
5.	Present study	42	45.01mm

Table 5: Maximum anteroposterior diameter of vertebral foramen

Serial number	Author	Sample size	Observed values
1.	Swetha rani, ^[4] 2023	100	27.89+ 2.59mm
2.	Chetana thakur, ^[6] 2022	30	28.25+ 3.14mm
3.	Irfan kucugo, ^[7] 2022	17	31.27+ 2.76mm
4.	Subodh kumar, ^[8] 2021	100	27.89+ 2.59mm
5.	Arpan Haldar, ^[9] 2019	24	30.92mm
6.	Present study	42	28mm

Table 6 Transverse diameter of superior articular facet

Serial number	Author	Sample size	Observed values Right side left side	
1.	Swetha rani, ^[4] 2023	100	10.36+ ₋ 1.72mm	10.47+ ₋ 1.61mm
2.	J.Kaur, ^[5] 2023	50	11.21+ ₋ 1.47mm	11.32+ ₋ 1.53mm
3.	Chetana thakur, ^[6] 2022	30	11.37+ ₋ 3.41mm	10.96+ ₋ 2.86mm
4.	Irfan kucugo, ^[7] 2022	17	13.29+ ₋ 1.42mm	12.82+ ₋ 1.70mm
5.	Subodh kumar, ^[8] 2021	100	10.36+ ₋ 1.72mm	10.47+ ₋ 1.61mm
6.	Arpan Haldar, ^[9] 2019	24	14.43mm	14.25mm
7.	Lalitha, ^[10] 2016	50	10.10+ ₋ 9.95mm	9.95+ ₋ 3.17mm
8.	Present study	42	15.09mm	15.47mm

CONCLUSION

Present study may be useful to neurosurgeons and orthopaedicians who routinely operate close to very important structures like vertebral artery and nerve roots in atlantooccipital area in order to avoid damage to them.

Limitations: Sample size was limited. The findings of the study cannot be generalized as the study was done in single centre.

REFERENCES

- Peter LW, Mary D. Gray's Anatomy, 37th edition, New York Churchill Livingstone.2000; 316-319
- Yogesh M, Hemanth raj et al. Morphometric study of atlas vertebrae in south Indian population. International journal of health science and research. 2014; 4(11): 103-110
- Cacciola Francesco, Phalke Umesh, Goel A. Vertebral artery in relationship to C1, C2 vertebrae An anatomical study. Neurology India. 2004; 52(2): 178-184
- Swetha rani, Pankaj kumar ,SM Badar hayat. Morphometric study of the first cervical vertebra (Atlas) in cadaver. European journal of molecular and clinical medicine.2023; 10(4):1325-1329.
- Jasveen kaur, Harpreeth singh Gulati,Kamaljeeth kaur . Morphometric study of Atlas vertebra in relation to Sulcus arteriae vertebralis. Int J Anat Res. 2023 ; 11(2): 8634-39.
- Chetna Thakur et al. Morphometric analysis of Atlas vertebra in northern population of India. Int J Acad Med Pharm 2022 ; 4 (5): 667 – 670.
- Irfan kuccuko et al. Evaluation of Atlas -Anatomic study and clinical implications . Eur J Ther. 2022 ; 28 (2): 96-101.
- Subodh kumar et al. Cadaveric morphometric study of the first cervical vertebra. International journal of science research. 2021; 10 (1) : 33-34.
- Arpan haldar et al. Morphometric analysis of Atlas and axis vertebrae in humans of Indian origin. Internatinal journal of medical and health research. 2019 ; 5 (1) : 120-132.
- Lalitha, Epraimvikram Rao, Shiny vinila BH. Morphometric analysis of Atlas vertebra-A cross sectional study. Indian journal of clinical anatomy and physiology. 2016 ; 3 (3) : 305 -308.