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Original Research Article

MORPHOMETRIC STUDY OF ARTICULAR PROCESSES OF THE HUMAN ATLAS VERTEBRA

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ABSTRACT

Introduction: Atlas is the uppermost cervical vertebra and it has certain anatomical features different from other cervical vertebrae. Thus the unique structure and anatomical location of atlas forms a safety mechanism and guards against injuries.

Material and Methods: Present study 100 human atlas vertebrae was performed in the Department of Anatomy, Government Medical College Aurangabad, Maharashtra, India.The parameters studies were Length of superior articular facet, Width of the superior articular facet, Length of inferior articular facet, Width of the inferior articular facet.

Aims and Objectives: To detailed study of parameters related to superior and inferior articular facets of Atlas vertebrae for references of various surgical procedures related to vertebral displacements.

Discussion: Results of present study tabulated, statistically analysed and compared with previous studies of various authors,

Results and Conclusion: The mean values for the length and width of superior articular facet of atlas on right side were 20.44 mm and 10.62 mm respectively. Similarly the mean values for the length and width of superior articular facet of atlas on left side were 20.75 mm and 10.43 mm respectively. The mean values for the length and width of inferior articular facet of atlas on right side were 17.75 mm and 14.62 mm respectively. Similarly the mean values for the length and width of inferior articular facet of atlas on left side were 17.02 mm and 15.08 mm respectively.These value helps surgeons in various fine difficult surgeries of atlanto-occipital displacement, atlantoaxial displacements.

KEY WORDS: Atlas vertebra, Inferior articular facet, Superior articular facet.

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INTRODUCTION

Atlas, the first cervical vertebra, supports the head. It is unique in that it fails to incorporate a centrum, whose expected position is occupied by the dens, a cranial protuberance from the axis [1]. The atlas has certain anatomical features different from other cervical vertebrae. Thus the unique structure and anatomical location of atlas forms a safety mechanism and guards against injuries [2]. The atlas is located at a

critical point close to the vital centers of the medulla oblongata, which can get compressed by a dislocation of atlanto-axial complex or instability of atlanto-occipital joint. Reduction and rebuilding of the stability of this complex is thus important. A short segment posterior fixation technique is often adopted to preserve the motion of the atlanto-occipital joint [3].

Several surgical techniques, such as interlaminar clamping, interspinous wiring, plate and screw fixation, have been employed to correct the instability of the atlanto-axial complex or occipito-cervical junction caused by numerous traumatic and non-traumatic conditions. Incorrect insertion of a pedicle screw can cause damage to adjacent vital structures such as the spinal cord, nerve roots, cranial nerves and vertebral arteries [4]. As new internal fixation methods evolve, a better understanding of the geometry and dimensions of the bone in question is clearly indicated [5]

Aims and objectives: To study and analyze the morphometry of superior & inferior articulating facets of atlas vertebra and their importance in maintenance of joint stability.

MATERIALS AND METHODS

Present study is descriptive type of observational study and performed in the Department of Anatomy, Government Medical College Aurangabad, Maharashtra, India. Adult human 100 atlas vertebrae of unknown sex were studied. The specimens were dry, free from deformity and fully ossified. Sliding digital vernier calipers, Divider, Measuring Scale were used for measurement of various parameters. All parameters were measured using a callipers accurate to 0.01 mm for linear measurements. Mean and standard deviation of the parameters were worked out, unpaired 't' test was applied wherever required to know the difference in means, if any, amongst the parameters, by using the SPSS statistics program.

Dimensions of superior articular facet of Atlas: This was studied under two heads,

Length of superior articular facet: With the help of vernier callipers the length of superior articular facet was measured as the A-P dimension of articular surface (Fig. 1).

Fig. 1: Showing the measurement of length of superior articular face.

Width of the superior articular facet: With the help of vernier callipers the width of superior articular facet was measured as the transverse dimension of articular surface ((Fig. 2**)**.

Fig. 2: Showing the measurement of width of the superior articular facet.

2. Dimension of inferior articular facet: This was studied under two heads,

Length of inferior articular facet: With the help of vernier callipers the length of inferior articular facet was measured as the A-P dimension of articular surface (Fig. 3).

Fig. 3: Showing the measurement of length of inferior articular facet.

Width of the inferior articular facet: With the help of vernier callipers the width of inferior articular facet was measured as the transverse dimension of articular surface (**Fig. 4**).

Fig. 4: Showing the measurement of width of inferior articular facet.

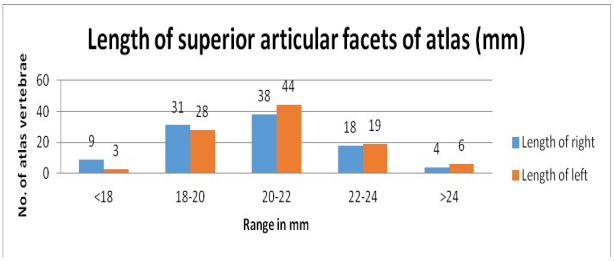
RESULTS

Dimensions of superior articular facet of atlas (mm): The dimensions of the superior articular facet of atlas on both the right and left side were considered under two heads, anteroposterior (length) and the transverse (width).

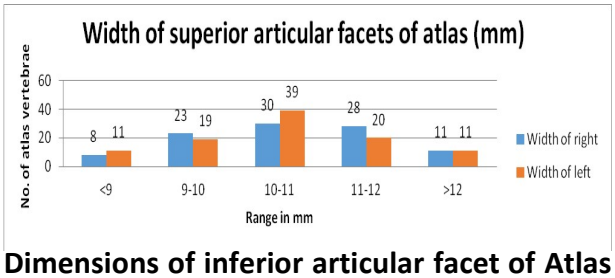
On the right side, the length was found to be having a mean of 20.44 mm with a range extending from 15.96-24.81 mm and standard deviation of 1.8.The width was found to be having a mean of 10.63 mm with a range extending from 8.56-13.61 mm and standard deviation of 1.08.

On the left side, the length was found to be having a mean of 20.75 mm with a range extending from 17.44-24.57 mm and standard deviation of 1.5 .The width was found to be having a mean of 10.41 with a range extending from 8.1-12.82 mm and standard deviation of 1.1. The mean values for length on right and left side, on comparison, were found to be statistically not significant, having a p value of 0.2167. Similarly the mean values for the width on right and left side on comparison were found to be statistically not significant, the p value being 0.1636.

Graph 1: Showing the number of vertebrae lying within specific frequency ranges,



Graph 2: Showing the number of vertebrae lying within specific frequency ranges.



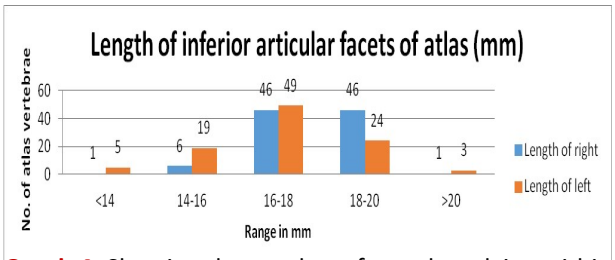
Dimensions of inferior articular facet of Atlas (mm): The dimensions of the inferior articular facet of atlas on both the right and left side were considered under two heads that is anteroposterior (length) and the transverse (width).

On the right side, the length was found to be having a mean of 17.76 mm with a range extending from 13.64-20.85 mm and standard deviation being 1.3 .The width was found to be having a mean of 14.61 mm with range extending from 12.04-17.86 mm and standard deviation being 1.1 .

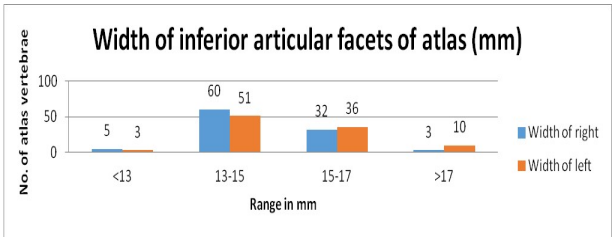
On the left side, the length was found to be having a mean of 17.01 mm with a range extending from 13.11-20.48 mm and standard deviation being 1.7 .The width was found to be having a mean of 15.07 mm with range extending from 12.56-17.56 mm and standard deviation being 1.2 .

The mean values for length on right and left side, on comparison, were found to be statistically not significant, having a p value of 0.0007. Similarly the mean values for the width on right and left side on comparison were found to be statistically not significant, the p value being 0.0077.

Graph 3: Showing the number of vertebrae lying within specific frequency ranges.



Graph 4: Showing the number of vertebrae lying within specific frequency ranges.



DISCUSSION

Superior articular facets of Atlas: The mean value of the length of right sided superior articular facet of atlas was found to be 20.44 mm with range extending from 15.96-24.81 mm while on length of left side the similar values were 20.75 mm and 17.44-24.57 mm respectively. The mean value of the width of right sided superior articular facet of atlas was found to be 10.62 mm with range extending from 8.56-13.61 mm while on width of left side the similar values were 10.43 mm and 8.1-12.82 mm respectively.

The mean values for length on right and left side, on comparison, were found to be statistically not significant, having a p value of 0.2167. Similarly the mean values for the width on right and left side on comparison were found to be statistically not significant, the p value being 0.1636.

On comparison, the results of the present study were found to be correlating well with the observations made by different workers such as Sait Naderi[6], Shilpa N Gosavi[3].

Sait Naderi [6] in his study found the mean values of length of superior articular facet of atlas to be 19.93 mm anatomically and computed tomographically. However the authors found no statistically significant difference between the anatomic and CT measurement in 6 out of 8 measured parameters.

Similarly Gosavi Shilpa [3] and her colleague in their study found the mean values of length and width of superior articular facet of atlas to be 19.93 mm and 10.41 mm respectively.

The studies done by other authors such as Francesco Cacciola [14], Gokflin Fiengul [7] et al showed the mean values of the parameter under discussion to be on lower side as compared to the present study.

Inferior articular facets of Atlas: The mean value of the length of right sided inferior articular facet of atlas was found to be 17.76 mm with range extending from 12.04-17.86 mm while on length of left side the similar values were 17.01 mm and 13.11-20.48 mm respectively. The mean value of the width of right sided superior articular facet of atlas was found to be 14.62 mm with range extending from 8.56-13.61 mm while on

On comparison, the results of the present study were found to be correlating well with the observations made by different workers such as Francesco Cacciola [14], Gokflin Fiengul [7].

Cattrysse E [19] and et al did an anatomical study of 20 atlas vertebrae and found the mean value of the length of inferior articular facet of atlas vertebrae to be 17.7 mm.

Gokflin Fiengul [7] and et al in their study found the mean values of the length and width of inferior articular facet of atlas vertebrae to be 17.3 mm and 14.6 mm respectively. The mean values for length on right and left side, on comparison, were found to be statistically not significant, having a p value of 0.2167. Similarly the mean values for the width on right and left side on comparison were found to be statistically not significant, the p value being 0.1636.Gosavi Shilpa and her colleague did a morphometric study of atlas vertebra using manual method on 100 dried human atlases of unknown sex. The authors found the mean value of the width of inferior articular facet of atlas vertebra to be 14.42 mm.

The studies done by other authors such as Francesco Cacciola [14] and for mean value of the length of inferior articular facet of atlas vertebrae Gosavi Shilpa [3] showed the mean values of the parameter under discussion to be on lower side as compared to the present study. The following table compares the mean values of the present study with those of the others.

CONCLUSION

The mean values for the length and width of superior articular facet of atlas on right side were 20.44 mm and 10.62 mm respectively. Similarly the mean values for the length and width of superior articular facet of atlas on left side were 20.75 mm and 10.43 mm respectively.

The mean values for the length and width of inferior articular facet of atlas on right side were 17.75 mm and 14.62 mm respectively. Similarly the mean values for the length and width of inferior articular facet of atlas on left side were 17.02 mm and 15.08 mm respectively. Mean value of these parameters will definitely help surgeons in screw placement and fixation in atlantooccipital dislocations. Morphological

variations in the superior articular process of atlas are well recognized indications of restricted movements at atlantooccipital joint.

Conflicts of Interests: None

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