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Original Research Paper

Radio Diagnosis

CT QUANTITATIVE ANALYSIS OF ARTICULAR FACETS AND LATERAL MASSES OF ATLAS VERTEBRA.

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KEYWORDS :

INTRODUCTION:

Atlas vertebra and its radiological anatomy:

The atlas is the first cervical vertebra which supports the globular head. It is called as the atypical vertebra as it has no vertebral body as typical vertebrae have. Atlas is basically ring like structure which consists of two arches namely anterior and posterior arches, bilateral lateral masses with projections known as transverse processes.[1]

Each lateral mass bears two articular facets namely superior and inferior articular facets. The superior articular facet (SAF) is kidney shaped and articulates with the occipital condyle to form the atlanto-occipital joint. The inferior articular facet (IAF) is circular and articulates with the axis to form the lateral atlanto-axial joint. The inferior articular facets are oriented obliquely to the transverses plane and faces medially. The wide range of bio-mechanical movements including flexion, extension, lateral movements and rotation is facilitated by these two atlanto-occipital and atlanto-axial joints.[2]

The atlas is situated close to the vital centres of medulla oblongata which can get compressed by the dislocation of the atlanto-occipital and atlanto-axial joints.[3] Therefore, reduction and rebuilding of the stability of this complicated complex is crucial. A short segment posterior fixation technique is frequently chosen to preserve the motion of the atlanto-occipital joint. The different surgical techniques such as interlaminar clamp, interspinous wiring, plate and screw fixation have been implemented to correct the atlanto-occipital and atlanto-axial joints instabilities secondary to various traumatic or non-traumatic pathologies. At present, transarticular and transpedicular screw fixations are used widely for the same purpose.[3,4]

Instead of widely available these surgical techniques, there is possibility of potential risk due to iatrogenic injury to adjacent vital structures such as the spinal cord, nerve roots, cranial nerves and vertebral arteries secondary to incorrect insertion of screws or inaccurate size of the screws.[6]

Thus, the radiological normal anatomy of the atlas is necessary for the radiologist to provide the quantitative reference for these important structures. This study is intended to evaluate the quantitative values of the articular surfaces and lateral masses using the computed tomography (CT), hence to provide the accurate dimensions for surgeons for proper selection of the screws and plates.

Aim of the study:

To estimate the various CT dimensions of articular facets and lateral masses of atlas vertebra.

Materials and methods:

Sample size: 90 normal adults (18 – 75 years of age).

Cross sectional observational study included ninety adults of age ranging from 18 to 75 years both sexes who attended the Department of KVGMCH Sullia for non-enhanced NECT brain with the history of headache, giddiness or stroke were studied. CT brain were performed with the Siemens 16 slice CT machine. The study was done using bone window reconstruction of 1 mm slice thickness with axial, coronal and sagittal sections.

Atlases with pathological features/fractures were excluded from the study. The following parameters were measured for each atlas using. Each measurement was taken three times to minimize error. All measurements were performed by the first author for the sake of consistency.

Various CT dimensions of Atlas:

1. Length, anterior width, middle width and posterior widths of SAF.
2. Length, anterior width, middle width and posterior widths of IAF.
3. Length, width and heights of mid part of lateral masses.
4. Maximum medialisation and cranialisation angles.

Fig 1. Length of SAF

Fig 2. Width of SAF

Fig 3. Length of IAF

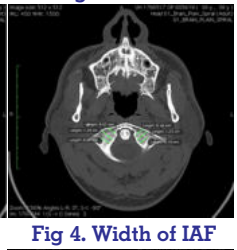

Fig 4. Width of IAF

Fig 5. Length of LM

Fig 6. Width of LM

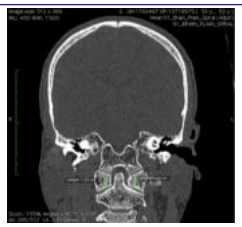

Fig 7. Height of LM

The mean, range and standard deviation were calculated for all measurements for the 100 vertebrae. Significant difference was calculated using the Z test and p= <0.05.

RESULTS:

The various parameters evaluated using CT brain are as follows.

Table 1: Results of measured parameters for SAF:

Sl. no	Parameter	Mean (mm)		SD	
		Right	Left	Right	Left
1.	Length of SAF	20.4	20.1	2.3	2.1
2.	Anterior width of SAF	8.6	8.2	2.1	2.0
3.	Middle width of SAF	9.8	9.9	1.7	1.8
4.	Posterior width of SAF	8.3	8.0	1.5	1.6

Table 2: Results of measured parameters for IAF:

Sl no	Parameter	Mean (mm)		SD	
		Right	Left	Right	Left
1.	Length of IAF	18.4	18.1	2.4	2.5
2.	Anterior width of IAF	8.8	8.4	1.8	1.7
3.	Middle width of IAF	11.0	11.0	1.8	1.9
4.	Posterior width of IAF	8.4	8.6	1.9	2.4

Table 3: Results of measured parameters for LM:

Sl no	Parameter	Mean (mm)		SD	
		Right	Left	Right	Left
1.	Length of mid part of LM	26.1	25.5	2.7	3.2
2.	Width of mid part of LM	11.3	11.2	2.6	2.5
3.	Height of mid part of LM	11.1	11.5	2.1	2.3

Table 4: Results of measured parameters of angulation:

Sl no	Parameter	Mean (degree)		SD	
		Right	Left	Right	Left
1.	Maximum medialisation	29.2	28.6	3.7	3.2
2.	Maximum cranialisation	37.8	38.4	4.9	4.4

Statistical analysis was done to define the mean and SD of above-mentioned parameters.

DISCUSSION:

The proper anatomical knowledge and relationship between the vertebral arteries, atlas and axis vertebrae is precious in the surgical techniques and instrumentations performed for the instabilities of atlanto-occipital and atlanto-axial joints.[2]

Transpedicular screw fixation is one of the currently used technique which involves the C1 lateral mass screws. Unicortical and bicortical lateral mass screws are inserted into the atlas directly underneath the base of the superior arch.

A study done on 120 dry atlas vertebrae by Lynch et al. and it was found that 98% could accommodate 3.5 mm screws at the mid portion of the lateral mass.[5]

Turkey University Faculty of Medicine conducted an anatomical and radiological study lateral mass of atlas and found the minimum height of lateral mass to be 13.66 mm posteriorly and 14.12 mm anteriorly.

Cacciola et al. conducted a cadaveric study of atlas and revealed the thickness of IFA to be 1.7-5.2 mm (average 3.5 mm).[6]

CONCLUSION:

Radiological quantitative data using CT provided in the current study may aid the surgeons operating around the craniovertebral junction and hence to prevent potential risks caused by the inaccurate sized screws.

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