Section A-Research paper

Anthropometric study of atlas articular facet with its anomalies and clinical implications

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Abstract:

Aim & Objective: To study the anthropometric study on articular facet with their anomalies and clinical implications. To compare various dimensions of articular facets of Atlas vertebra. Various measurements like AP diameter and Transverse diameter of superior articular facet of both right and left side of atlas were measured. AP diameter and Transverse diameter of inferior articular facet of both right and left side of atlas were also measured.

Methodology: For the study 50 Atlas Vertebra was taken from A.C.S Medical college, Department of Anatomy. Damaged atlas vertebra was not included in the study. Digital Vernier calliper was used for the measurement. The values were recorded and statistically analysed.

Result and conclusion: The mean value of AP diameter of superior articular facet of both sides were found to be 2.13 ± 0.36 cm. Transverse diameter of superior articular facet of both sides were found to be 1.10 ± 0.2cm. AP diameter of inferior articular facet of both sides were found to be 1.6 ± 0.19cm. Transverse diameter of inferior articular facet of both sides were found to be 1.46 ± 0.13 cm. The results will bring an overall plan for the orthopaedics to handle the case with ease and plan the surgery accordingly.

Keywords: Superior articular facet(SAF), Inferior articular facet(IAF),

INTRODUCTION

Atlas, also known as first cervical vertebra is located between the skull and axis vertebra (second cervical vertebra). Atlas vertebra has special feature with absence of body and spinous process. The shape of the superior articulating facet is oval, concave located on the lateral mass of atlas. The inferior articular facet is circular and located on the lateral mass of atlas inferiorly. The atlas vertebra holds the skull from beneath. The joint formed by the superior articulating facet of atlas vertebra and the occipital condyle is lateral atlanto-occipital joint which is an ellipsoid joint and the joint formed between inferior articulating facet of atlas vertebra and superior articulating facet of axis forms the lateral atlanto-axial joint which is plane synovial joint.

On the supero-medial aspect of atlas vertebra superior articular facets are present and are well known to bear the weight of the head and for nodding movement of the head. The occipital condyles articulate and form lateral atlanto-axial joint. The study performed by Lalit etal revealed different shapes of the superior articular facet like leaf like, oval shape, kidney shape and it had an impact on the atlanto-axial joint by restricting the movements (1). The various head and neck posture and the dimensions of C1 are dependent on factors of craniofacial morphology that includes cranial base (2). The superior articular facet morphology when altered can lead to instability, pain and hypermotility of the cranio-vertebral joint and can lead to arthritic and neurological symptoms (3).

There is correlation between the age of the individual and concavity of superior articular facet of C1 vertebra. As age advances the concavity of superior articular facet deepens and reaches 90 % around 8 years of age. In children the less stability of atlanto-

axial ligaments and joints are due to less concavity of SAF of C1 vertebra. This can have an impact on spinal cord during routine movement of head and neck that can result in shaken baby syndrome (4). The change in morphology of SAF can be a result of trauma, congenital and infection. Various surgical fixations are needed in the repair of altered SAF (5). There are various shapes of the inferior articular facet where circular and drop shapes are the commonest one (6).

The single articulating facet dividing into two might be due to groove or constriction. The grooves are due to pressure facets that are circular and present on the medial side of the articular surface. These pressure facets are due to high pressure in the atlanto-occipital joint (1)

MATERIALS AND METHODS

50 Atlas Vertebras were taken from A.C.S Medical college, Department of Anatomy. The damaged bones were not included in the study. The bones showing the normal bony landmarks were included in the study. Digital Vernier calliper was used for measurement. The power was on, then using the external jaw the maximum length and maximum width of superior and inferior articular facets were measured. Using locking screw, it was locked and the values displayed in LCD display (Figure 1,2,3,4,5).

Figure 1: AP diameter of superior articular facet of atlas

Figure 2: Transverse diameter of superior articular facet of atlas

Figure 3: AP diameter of inferior articular facet of atlas

Figure 4: Transverse diameter of inferior articular facet of atlas

RESULTS

TABLE 1: MAXIMUM AND MINIMUM VALUES OF AP AND TRANSVERSE DIAMETER OF SAF AND IAF OF ATLAS WITH MEAN AND STANDARD DEVIATION

	MAXIMUM VALUE	MINIMUM VALUE	MEAN±SD
AP DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	3cm	1.6cm	2.17 ±0.34cm
TRANSVERSE DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	1.4cm	0.8cm	1.10 ±0.16cm
AP DIAMETER OF LEFT SUPERIOR ARTICULAR FACET	2.9cm	1.4cm	2.10 ±0.39cm
TRANSVERSE DIAMETER OF LEFT SUPERIOR ARTICULAR FACET	1.6cm	0.8cm	1.10 ±0.24cm
AP DIAMETER OF RIGHT INFERIOR ARTICULAR FACET	1.8cm	1.1cm	1.53 ±0.19cm
TRANSVERSE DIAMETER OF RIGHT INFERIOR ARTICULAR FACET	1.8cm	1.2cm	1.45 ±0.13cm
AP DIAMETER OF LEFT INFERIOR ARTICULAR FACET	2cm	1.3cm	1.67±0.20cm
TRANSVERSE DIAMETER OF LEFT INFERIOR ARTICULAR FACET	1.8cm	1.2cm	1.48 ±0.14cm

TABLE 2: STANDARD ERROR, DEGREE OF FREEDOM, P VALUE AND SIGNIFICANCE LEVEL

	STANDARD ERROR	DF	P VALUE	SIGNIFICANCE LEVEL
AP DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	0.073	98	P = 0.3411	Not significant
AP DIAMETER OF LEFT SUPERIOR ARTICULAR FACET				
TRANSVERSE DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	0.041	98	P = 1.0000	Not significant
TRANSVERSE DIAMETER OF LEFT SUPERIOR ARTICULAR FACET				
AP DIAMETER OF RIGHT INFERIOR ARTICULAR FACET	0.039	98	P = 0.0005	Highly significant
AP DIAMETER OF LEFT INFERIOR ARTICULAR FACET				
TRANSVERSE DIAMETER OF RIGHT INFERIOR ARTICULAR FACET	0.027	98	P = 0.2696	Not significant
TRANSVERSE DIAMETER OF LEFT INFERIOR ARTICULAR FACET				
AP DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	0.055	98	P < 0.0001	Highly significant
AP DIAMETER OF RIGHT INFERIOR ARTICULAR FACET				
AP DIAMETER OF LEFT SUPERIOR ARTICULAR FACET	0.061	98	P < 0.0001	Highly significant
AP DIAMETER OF LEFT INFERIOR ARTICULAR FACET				
TRANSVERSE DIAMETER OF RIGHT SUPERIOR ARTICULAR FACET	0.029	98	P < 0.0001	Highly significant
TRANSVERSE DIAMETER OF RIGHT INFERIOR ARTICULAR FACET				
TRANSVERSE DIAMETER OF LEFT SUPERIOR ARTICULAR FACET	0.039	98	P < 0.0001	Highly significant
TRANSVERSE DIAMETER OF LEFT INFERIOR ARTICULAR FACET				

DISCUSSION

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].

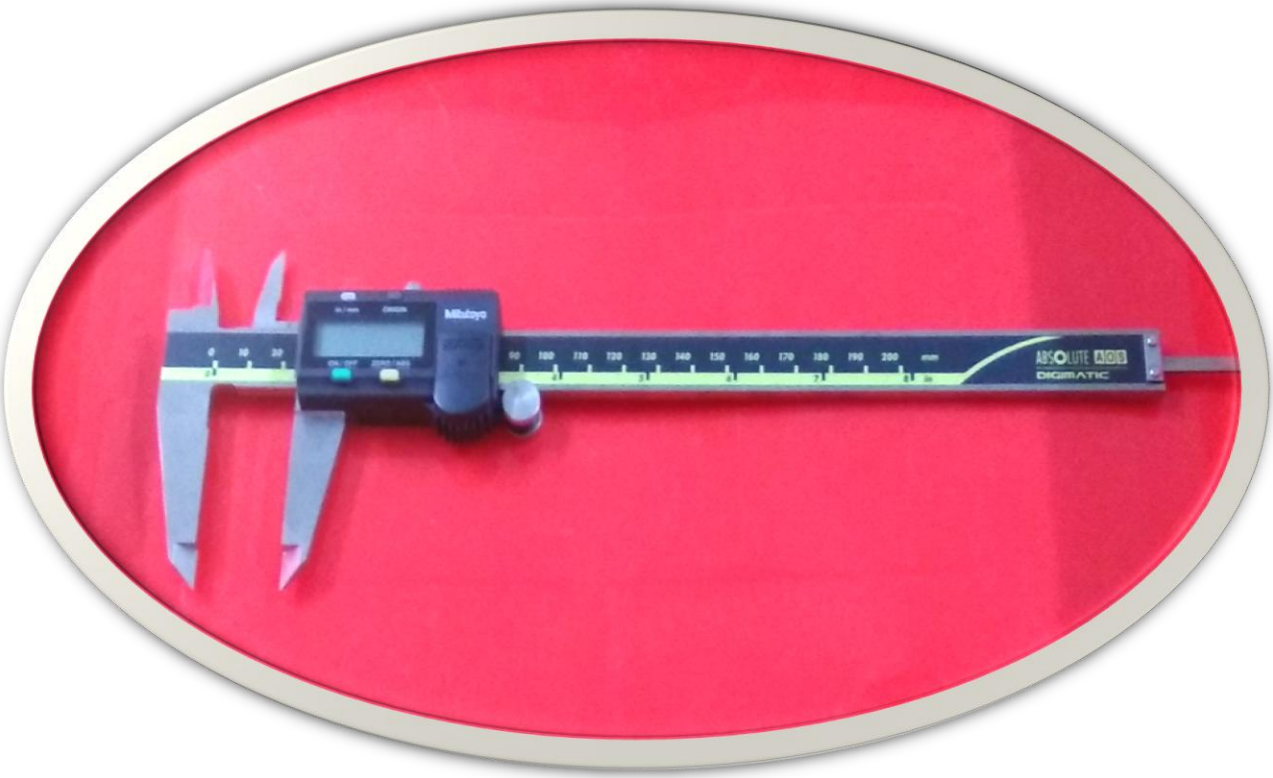

Figure 5: The digital verniercaliper

The mean value of A-P diameter of superior articular facet in Indian population as 19.73 mm for both sides[10]. A study calculated the mean value of A-P diameter of superior articular facet 25.3 ±2.22 mm in Korian population [8]. But in our study calculated mean value on right side-21.7 ±3.4mm and left side was 21.0 ±3.9mm.

In a study the mean transverse diameter of Rt. and Lt. Superior articular process was 7.81±1.28 and 8.33±1.54 mm[9]. But in our study calculated mean value on right side-11.0 ±1.6mm and left side was 11.0 ±2.4mm.

The mean value AP diameter of Inferior articular facet as 15.6 mm for both right and left side [8]. The mean value of A-P diameter of right and left inferior articular facet 17.0± 1.8 and 16.6±1.6 mm respectively in Belgian population[4]. In our study the mean value on right and left being 15.3 ± 1.9 mm and 16.7 ± 2.0mm respectively

The mean value of transverse diameter of inferior articular facet as 14.6±2.5 mm for both side inferior articular facets in Turkish population[6]. Which was found to be very close to our findings on the right and left side the mean value being 14.5± 1.3mm and 14.8 ± 1.4mm respectively.

Superior articular facet splits into two facets . There is splittage of the superior articular facet into two can lead to restriction of movement in the atlanto-occipital joint[11]. The width of superior articular facet was 11.64 mm and length of superior articular facet was 21.99 mm.There was no difference between right and left side[12]. For the instability in the cervical spine Transarticular screw fixation is performed and to implement the procedure the AP and transverse diameter of superior articular facet will be of great use[13].

All cervical flexion and extension are taking place in atlanto-occipital joint. Various injuries and non-injurious causes affects the stability of the cervical spine. The craniovertebral junction stability when altered requires surgical intervention and for fusion needs immobility for a long period[14]. The posterior fixation technique is used to protect the craniovertebral junction motion[15]. The external features of atlas is important

to manage the occipito-cervical and atlantoaxial instability[16] .The right handed individuals use their right hand to lift weight then they tilt their head to their left side and left sided facets are showing increased dimensions due to pressure[17].

AP diameter of right superior articular facet and AP diameter of right inferior articular facet , AP diameter of left superior articular facet and AP diameter of left inferior articular facet , AP diameter of right inferior articular facet and AP diameter of left inferior articular facet, Transverse diameter of right superior articular facet and Transverse diameter of right inferior articular facet , Transverse diameter of left superior articular facet and Transverse diameter of left inferior articular facet showed statistically significant value (Table 2).

AP diameter of right superior articular facet and AP diameter of left superior articular facet, Transverse diameter of right superior articular facet and Transverse diameter of left superior articular facet, Transverse diameter of right Inferior articular facet and Transverse diameter of left Inferior articular facet did not show any statistically significant values (Table 2).

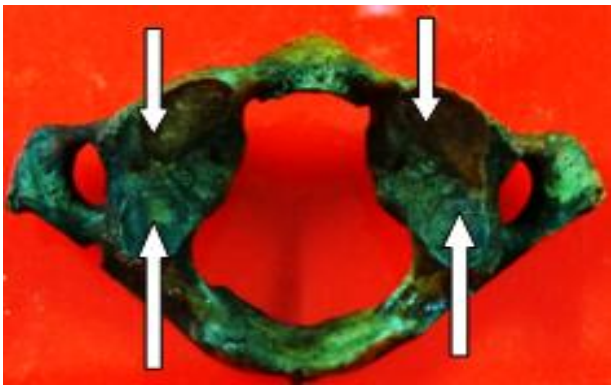

Figure 6: Double facet in the superior articular facets on both sides of atlas vertebra

CONCLUSION Superior articular facet and inferior articular facet measurements will help the Orthopaedic physician to replace the injured articular facet in case of trauma and

congenital abnormalities. Presence of these pressure facets (double facet-figure 6) indicate a greater pressure at these sites during movement at the atlanto-occipital joints in occupational weight lifters and cause neck pain that has to be managed by orthopedic physician .

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