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Length and Thickness of Vertebral Artery Groove of Dry Ossified Human Atlas Vertebra

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Abstract

Context: *The superior surface of the posterior arch of the atlas vertebra behind its lateral mass has a vertebral artery groove. The contents of this groove are third part of vertebral artery, venous plexus and first cervical nerve. Morphometric data of vertebral artery groove is helpful for the spine surgeons to avoid iatrogenic injury of these vital structures during posterior approach.*

Materials and Methods: *A cross-sectional, analytical type of study was conducted in the Department of Anatomy, Dhaka Medical College, Dhaka from January 2012 to July 2013. Inner and outer groove length and thickness of the vertebral artery groove was measured with the help of flexible metallic wire and digital slide calipers.*

Results: *There was no significant difference (P>0.10) in the mean length of inner border between right and left groove for vertebral artery. But outer border of left groove for vertebral artery was larger than right groove for vertebral artery (P<0.001). The mean thickness of the groove for the right and left vertebral artery was not significantly different (P>0.50).*

Key words: *vertebral artery groove, morphometry*

Introduction:

There are seven cervical vertebrae, among them atlas is the first[1]. It is ring shaped and does not have a body and spinous process like other cervical vertebrae[2]. The vertebral arch becomes modified to form a thick lateral mass on each side joined at the front by a short anterior arch and a longer posterior arch at back. The posterior arch forms three fifth of the circumference of the atlantal ring[1]. Groove for vertebral artery is present on the superior surface of the posterior arch behind the lateral mass[3]. Third part of vertebral artery and first spinal nerve runs in the groove for vertebral artery[4]. Anatomical variations of this groove of atlas vertebra may cause diminish blood flow to the brain by the vertebral artery. The critical location of vertebral artery may complicate the approach during decompressive procedures in atlanto axial region[5].

Morphology of this groove provides a safety guideline for the surgeons to avoid potential injury to the vertebral artery during plate osteosynthesis, wiring and lateral mass fixation[6]. The posterior arch of first cervical vertebra has been extensively investigated for its clinical significance in connection with craniovertebral junction and for vascular lesion of posterior cranial fossa[7].

The present study was undertaken to find out morphometric variation of the vertebral artery groove of atlas vertebrae collected from Bangladesh.

Materials and Methods:

152 atlas vertebrae were collected from Department of Anatomy of Dhaka Medical College and other government and non-government medical colleges in Dhaka city.

At first, groove for vertebral artery was identified at posterior arch of atlas vertebra. The most anterior and most posterior point of inner and outer border

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of groove for vertebral artery were identified and marked by a pencil. A flexible wire was placed on inner and outer border of vertebral artery groove of atlas vertebra(Fig.-1 & 2). Then the wire was straightened and the reading was recorded with the help of digital slide calipers. The measurements were taken from both right and left groove for vertebral artery. To measure the thickness of the groove a dot was given on the superior surface at the middle of the vertebral artery groove. Another dot was given on inferior surface at the middle of the vertebral artery groove (Fig-3). Thickness of vertebral artery groove was measured as distance between determined two points with the help of digital slide caliper and the reading was recorded. The measurements were taken for both right and left groove for vertebral artery following the method of Ravichandran[4].

Fig.-1 *Photograph showing the measurement of length of inner border of the groove for vertebral artery by using flexible metallic wire.*

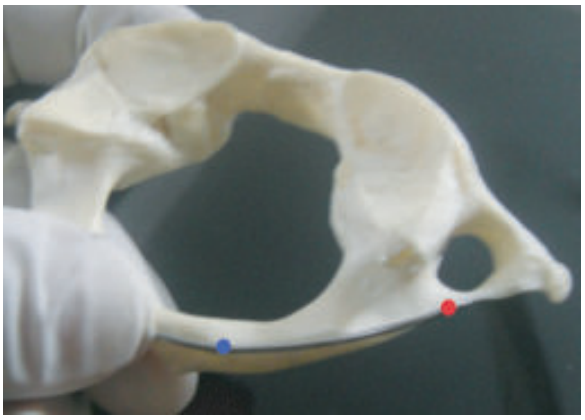

Fig.-2: *Photograph showing the measurement of length of outer border of the groove for vertebral artery by using flexible metallic wire.*

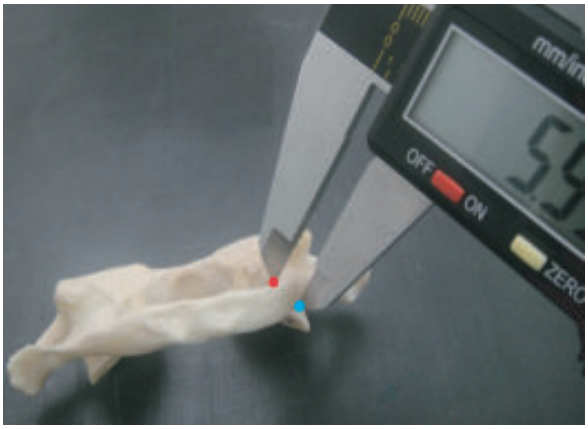

Fig.-3 *Photograph showing the measurement of thickness of vertebral artery groove by using digital slide calipers.*

Ethical clearance: This study was approved by the Ethical Review Committee of Dhaka Medical College, Dhaka

Results: The results are shown in table I and II.

Table-I

Length (mm) of the inner and outer border of groove for vertebral artery of atlas vertebra

Inner border			Outer border		
Right	Left		Right	Left	
Mean±SD	Mean±SD	*P value*	Mean±SD	Mean±SD	*P value*
10.26±1.64	10.01±1.54	0.127^{ns}	14.76±2.72	15.89±2.53	0.0001***
(6.78 15.05)	(6.55 14.40)		(10.19 24.09)	(9.31 27.02)	

Figures in parentheses indicate range. Comparison between right and left side done by paired Student's 't' test, ns = not significant, ** = significant at P<0.01, *** = significant at P<0.001

Table-II
Thickness of groove for vertebral artery of atlas vertebrae

Thickness (mm) of groove for vertebral artery		
Right	Left	*P value*
Mean±SD	Mean±SD	
3.97±1.00	3.98±0.93	0.898^{ns}
(1.27 6.99)	(1.03 6.20)	

Figures in parentheses indicate range. Comparison between right and left side done by paired

Student's't' test, ns = not significant

Discussion:

Ravichandran[4] and Carvalho[8] found no significant difference in mean the (±SD)length of inner and outer border of groove for vertebral artery between right and left side irrespective of sex and the result was dissimilar to the result of the present study. The atlas vertebrae of the present study were collected from Bangladesh. The mean (±SD)length of inner and outer border of vertebral artery groove reported by Ravichandranand Carvalho was smaller (P<0.001) than the value of the present study. Ravichandran and Carvalho collected atlas vertebrae from Tamilnadu, India and from Brazil respectively. The peoples of India and Brazil are also mixed race. The dissimilarity in the findings of length of vertebral artery groove could not be explained. Ravichandran[4] and Sengul[9]carried out a study on atlas vertebrae collected from India and Turkey and they are mixed race. In their study there was no significant difference in the mean value of thickness of groove for vertebral artery between right and left side. Carvalho[8]carried out a study with cadavers of Brazil and their result was similar (p>0.01) with the result of the present study. The study report of Gosavi and Vatsalaswamy[10] was also found similar to mean (±SD)thickness of the groove for vertebral artery of present study (p>0.01).

Conclusion:

In the present study the length of outer border of left groove for vertebral artery was larger than that of right groove for vertebral artery. Further radiographic and computed tomographic study of living atlas vertebrae and comparison between the radiographic findings with the morphometric study of human dry ossified atlas vertebrae are recommended.

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