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Original Research Article

STUDY OF HUMAN ATLAS VERTEBRAE FOR THE PRESENCE OF RETROARTICULAR GROOVE OR CANAL IN NORTH INDIANS

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ABSTRACT

Background Atlas is the first cervical vertebra articulating above with the occipital condyles of the skull and below with the axis vertebra. Anatomy of this first cervical vertebra show great morphological variations. Atlas bony out growths known as Ponticles which can be lateral or posterior are commonly found. These ponticles can compress the third part of vertebral artery leading to vertebrobasilar insufficiency. Atlas vertebra is approached in a number of surgical procedures like transpedicular screw fixation, transarticular screw fixation interlaminar clamp and for interspinous wiring.

Aim: To find out the incidence of retroarticular groove or canals in North Indian population in order to avoid postoperative complications arising due to these anatomical variations.

Material and Methods: The present study was done on fifty dry adult human atlas vertebrae of unknown sex taken from Department of Anatomy, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. They were carefully studied for the presence of retroarticular groove or canal.

Results: The retroarticular groove or canal were found in eight vertebrae (16%). Presence of these retroarticular canals predisposes to Barre –Lieou and Cervicogenic syndromes especially in neck movements.

Conclusion: These bony bridges embracing the vertebral artery are responsible for vertigo and vertebrobasilar insufficiency**.** The present study can be helpful to radiologists, anthropologists and neurosurgeons to avoid many postoperative complications.

KEY WORDS: Cervical, Axis, Occipital, Vertebrobasilar, Transpedicular.

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INTRODUCTION

Atlas the first cervical vertebra supports the head. It consists of short anterior and longer posterior arch. The superior surface of the posterior arch bears a wide groove for vertebral artery, venous plexus and first cervical nerve [1]. Frequently the bony spurs arise from the anterior and posterior margins of the groove known as ponticles converting the groove into aforamen [2,3]. The third part of vertebral artery appears from foramen transversarium of

the atlas, turns backwards and medially behind the lateral mass of the atlas, and lies in the neurovascular groove on posterior arch of the atlas. It then passes through the opening in anterior part of posterior atlanto-occipital membrane and enters the foramen magnum. The vertebral artery in its way from foramen transversarium to the cranial cavity is vulnerable to damage or distortion from external factors like bony or ligamentous structure like retro-articular canal which may cause external pressure on vertebral artery [4].The compression of vertebral artery will cause vertebro basilar insufficiency [5]. These indicate the ossification of posterior atlantooccipital membrane [6]. The aim of the study is to determine the incidence of these ponticles in north Indians. This might help to explain the correlation between the occurrence of bony ponticles and vertebral artery entrapment. Recently, transarticular and transpedicular screws fixation has been widely used in stabilizing the cervical column. Inappropriate insertion of pedicle screws can cause damages to the upper cervical spine, care has to be taken to avoid injury to the vertebral artery lying in the retroarticular groove. Iatrogenic injury to the vertebral artery adjoining vital structures such as the spinal cord, nerve roots, cranial nerves, and vertebral arteries [7]. When exposing is the most commonest intra-operative complication during a posterior approach [8]. A short segment posterior fixation technique is often adopted to preserve the motion of the atlanto-occipital joint [9,10]. The present study was done to find the incidence of retroarticular anatomical variation in the atlas vertebra either in the form of retroarticular groove or canals in North Indians.

MATERIALS AND METHODS

Fifty dry adult human atlas vertebrae of unknown age and sex were taken from Department of Anatomy, Sri Guru Ram Das Institute of Medical Sciences and Research, Amritsar. All atlas vertebrae were cleaned thoroughly. Before the present study it was ensured that all the vertebrae were intact and were free of any trauma or metastatic growth. They were numbered from one to fifty. Each vertebra was examined carefully for the presence of retroarticular groove or bony spurs forming canal or foramen on the right as well as left side.

OBSERVATIONS

Eight atlas vertebrae (16%) out of fifty showed the presence of retroarticular/ retrotransverse groove or canal. The findings are summarized in Table 1.

Table 1: Showing number of vertebrae having Retroarticular groove or canal.

Sr. No.	Presence of Retroarticular Groove/Canal	Number	Percentage
1	Groove on right side	2	4%
2	Groove on left side	1	2%
3	Groove on both sides	1	2%
4	Canal on right side	1	2%
5	Canal on left side	1	2%
6	Canal on both sides	0	0%
7	Groove on right side and canal on left side	1	2%
8	Groove on left side and canal on right side	1	2%

Fig. 1: Showing Left retroarticular canal (LRC) and Right retroarticular groove (RRG).

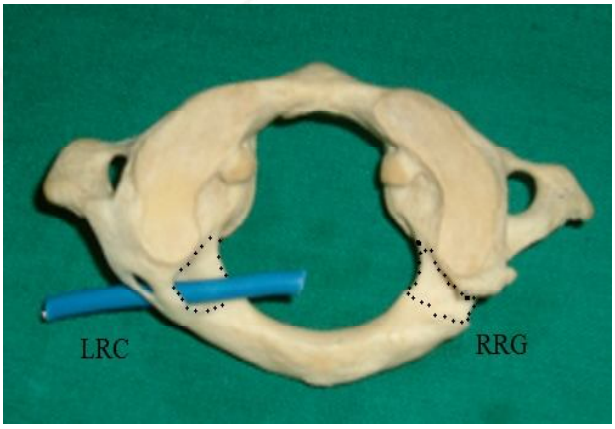

Fig. 2: Showing Right retroarticular groove (RRG) and Left retroarticular groove (LRG).

Table 2: Comparison of work done by different authors.

Sr. No.	Author	Year	No	Retrotransverse/Retroarticular Groove			Retrotransverse/Retroarticular Canal			Right Side Groove And left	Left sided Groove And right	Double Canal
				Right	Left	B/L	Right	Left	B/L			
1	Velenae [16]	1977	71	15	5	19	1	1	1	5	1	-
2	Gupta et al [17]	1979	123	13	8	10	6	3	5	5	1	-
3	Bilodi and Gupta [18]	2005	34	-	1	1	-	-	-	-	2	-
4	Malukar et al [19]	2011	80	2	3	2	1	2	1	-	1	-
5	Present Study	2016	50	2	1	1	1	1	0	1	1	-

DISCUSSION

Atlas vertebra has a entirely different structure from the rest of cervical vertebrae and also at the same time most variable vertebra in man[11]. A number of studies have been conducted on atlas vertebrae but little is done for incidence of retroarticular groove or foramina [12]. Retroarticular grooves or canals cause compression of artery during extreme rotator movement of neck or during surgery causing cerebrovascular incidents [13]. Knowledge of incidence of these variations should help the physicians, radiologists and neurosurgeons in a given population [14,7]. Ponticles are bony spurs arising from posterior surface of lateral mass and from posterior arch of atlas forming "Retro lenticular vertebral artery Ring" [15].The presence of retroarticular groove or canal was first studied by Velenae et al [16] in Romania. Later on Gupta et al [17]and Bilodi and Gupta [18] studied the incidence of the retroarticular groove or canal. The present study showed the presence of retroarticular groove in eight atlas vertebrae (16%). This is comparable to the range described by authors in different population[10,4].

The incidence is low as compared to previous workers like Velenae et al [16], Malukar et al [19] (Table 2) The difference in incidence can be due to difference in the number of vertebrae studied. No vertebra showed the presence of double retroarticular groove or canal in the present study. These ponticles may either be due to ossification of posterior atlanto- occipital membrane[5] or may represent the remnants of proatlas [17]. Presence of ponticles in atlas vertebrae predisposes the person to vertebrobasilar insufficiency, Barre Lieou and cervicogenic syndrome especially on doing neck movements. The left vertebral artery has a larger diameter than the right hence left vertebral artery is more prone to compression [20]. But the present study showed more number of vertebrae showing ponticles on the right side hence the right vertebral artery is more prone to compression. Karau P et al [21] distinguished retroarticular canal on the right side in 14.6% of atlas vertebrae and on the left side in 13.6% of atlas vertebrae. Cacciola et al [22] observed that the groove for the vertebral artery was completely converted into a foramen only in one out of twenty sides while on the right side in two and bilaterally in one vertebra on right side in another study [23]. The occurrence of inomplete foramen transvesarium can be confused with fractures and other anomalies and hence should be known to radiologists for accurae interpretation of radiographs and computed tomographic scans [11]. Incomplete posterior arch variation is of significant importance to orthopedician as its co-existence with fractures may result in instability in the cervico-occipital region and recognition of this variant early in life may prevent serious neurological deficits in subjects having any defects in the posterior arch, by restricting their neck movements and activities like strenuous sports [24].

CONCLUSION

The retroarticular canal by compressing the vertebral artery and first cervical nerve lead to a number of syndromes causing vertigo and vertebra basilar insufficiency. The radiologists may misinterpret these variations with the fracture of atlas vertebra. The incomplete canals may dislodge the vertebral artery and injure it during posterior cervical trauma. Knowledge of such variations is important for physicians, otirhinolaryngologists, neurologists and orthopaedicians.

Conflicts of Interests: None

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