

PONTICULUS POSTICUS OF THE ATLAS VERTEBRA

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ABSTRACT

Atlas is the first cervical vertebra. It articulates with the occipital bone above and the axis vertebra below. It plays an important role in movement of the skull and the neck. A rare variation of the atlas vertebra is found where the posterior arch of the atlas had one accessory foramen just behind each lateral mass. In the atlas vertebra, this retroarticular canal or the lateral bridge are examples of bony outgrowths which may cause external pressure on the vertebral artery as it passes from the foramen transversarium of the vertebra to the foramen magnum of the skull. The knowledge of this variation may be of importance to orthopedic surgeons, neurosurgeons, radiologists and anthropologists. Of the 80 atlas vertebrae observed 17.5 % showed presence of retro transverse groove or canal.

Key-words: Arcuate foramen, Atlas vertebra, Ponticulus posticus, Vertebral artery

INTRODUCTION

Atlas is the first cervical vertebra. It is ring shaped and does not have a body like other cervical vertebrae. It has two arches named anterior and posterior arch. The anterior arch is shorter than the posterior arch and articulates with the dens of the axis vertebra. The posterior arch bears a groove on its superior surface for the vertebral artery and the dorsal ramus of the first cervical spinal nerve. It has two transverse processes, each one of which bears a foramen transversarium. The vertebral artery passes through this foramen. The atlas has two lateral parts called lateral masses. The lateral masses articulate with the occipital condyles to form ellipsoid type of synovial joints. We noted abnormal foramina/groove in the posterior arch of the atlas vertebra called Atlas bridges also called ponticles, which are arched bony outgrowths occurring on the atlas vertebra over the third segment of the vertebral artery. The artery, after leaving the foramen transversarium of the atlas vertebra lies on the posterior arch, and then it pierces posterior atlantooccipital membrane to enter the vertebral canal. Occurrence of atlas bridges predispose to vertebrobasilar insufficiency. The aim of this study was to determine the incidence of “arcuate foramen” or groove on atlas vertebrae which explains vertebral artery entrapment.

MATERIAL AND METHODS

A total of 80 dry human atlas vertebrae constituted material for the present study which was collected from

Anatomy departments. Observations were made for the presence of the retrotransverse groove or canal on both sides of atlas vertebrae.

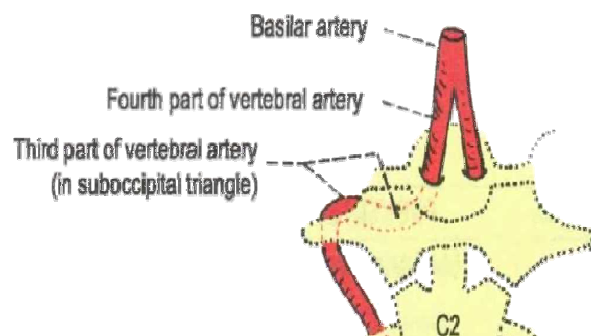


Fig 1: Third part of vertebral artery lying on posterior arch of atlas

Table 1: Distribution of Vertebrae according to side of Retro transverse groove/canal

Presence of retro transverse groove / canal	No. of vertebrae
Retro transverse groove on right side	2
Retro transverse groove on left side	3
Retro transverse groove on both sides	2
Retro transverse canal on right side	1
Retro transverse canal on left side	2
Retro transverse canal on both sides	1
Retro transverse groove on right side and retro transverse canal on left side	2
Retro transverse groove on left side and retro transverse canal on right side	1

RESULTS

Out of eighty atlas vertebrae which we had observed, fourteen atlas vertebrae (17.5%) showed retrotransverse groove / canal on either side or on both sides. The findings were mentioned in table 1.

Table 2: Percentages of vertebrae according to side

Findings	Right	Left	Bilateral
Retro transverse groove	2 (2.5%)	3 (3.75%)	2 (2.5%)
Retro transverse canal	1 (1.25%)	2 (2.5%)	1 (1.25%)
Right groove & left canal	---	---	2 (2.5%)
Left groove & right canal	---	---	1 (1.25%)
Double canal	---	---	---

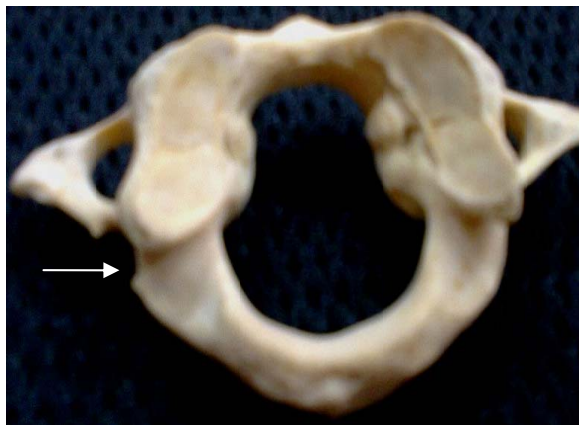


Fig 2: Groove on left side



Fig 3: Groove on right side & Canal left side

DISCUSSION

The ponticulus posticus means "little posterior bridge" in Latin. It was defined as an abnormal small bony bridge formed between the posterior portion of the superior articular process and the posterolateral portion

of the superior margin of the posterior arch of the atlas. The sulcus situated on the posterolateral margin of the atlas forms a groove for the vertebral artery which varies in size and depth, ranging from merely an impression to a clear groove or sulcus for the passage of the artery. At times, the sulcus is bridged by an anomalous ossification and a posterior ponticulus is occasionally formed.



Fig 4: Canal on right side



Fig 5: Groove on both sides

It forms the arcuate foramen that contains the vertebral artery and the suboccipital nerve. It can be a possible cause of posterior circulation ischemia, cervicogenic headache and clinical complaints such as vertigo, neck pain of discopathy are reported. Ponticle formation stated by many authors is a regressive and morphological phenomenon. These characteristics not only serve as anthropological data but may also help in identifying the impact of complete arcuate foramen on the signs and symptoms of vertebrobasilar insufficiency.

The findings were observed in 17.5% in the present study which was less as compared to the findings of Veleanu et al (67.60%) & Gupta et al (43.90%) and more to the findings of Bilodi AK et al (14.70%).We

could not find double canal in any atlas vertebra while it was found in 2.94% cases in the study done by Bilodi AK et al. There was no significance difference regarding the incidence of retro transverse groove/canal on right or left side of atlas.

Foramen arcuate or Ponticulus Posticus is associated with Barre-Lieou syndrome, which represents symptoms of headache, retro-orbital pain, vasomotor disturbance of the face and recurrent disturbances of vision, swallowing and phonation due to alteration of blood flow within the vertebra, therefore, Foramen arcuate is a potential clinical/surgical significant anatomical variant of the atlas.

CONCLUSION

Out of 80 atlas vertebrae observed, 14 atlas vertebrae (17.5%) showed retro transverse groove / canal on either side or on both sides. Proper identification of this anomaly on preoperative lateral radiographs should alert the surgeon to avoid using the ponticulus posticus as a starting point for a lateral mass screw in order to not injure the vertebral artery. Ponticulus posticus has become an important anomaly of the atlas, as the use of lateral mass screws for the fixation of the atlas has become common for the treatment of atlantoaxial instability. A broad dorsal arch of the atlas is the best indication for this modified screw trajectory. However, in patients with ponticulus posticus, and resulting arcuate foramen carrying vertebral artery, it can be mistaken for a broad dorsal arch and the surgeon may insert the screw into the ponticulus posticus. This can result in an injury to the vertebral artery, and lead to

stroke or even death by thrombosis, embolism or arterial dissection.

REFERENCES

1. Breathnach, A. S. Frazer's Anatomy of the Human Skeleton. 6th ed. London, J. & A. Churchill, 1965. p. 29.
2. Bilodi AK, Gupta S.C. Presence of retro transverse groove or canal in atlas vertebrae. *J. Anat. Soc. India* 54 (1) 16-18 (2005)
3. Cakmak, O.; Gurdal, E.; Ekinici, G.; Yildiz, E. & Cavdar, S. Arcuate foramen and its clinical significance. *Saudi. Med. J.*, 26:1409-13, 2005.
4. Cho, Y. J. Radiological Analysis of Ponticulus Posticus in Koreans. *Yonsei. Med. J.*, 50(1):45-9, 2009.
5. Gupta SC, Gupta CD, Arora AK, Maheshwari BB. The Retro transverse groove / canal in Indian Atlas Vertebrae *Anat anz* 145 (1979)514-516.
6. Hasan, M.; Shukla, S.; Siddiqui, M. S. & Singh, D. Posterolateral tunnels and ponticuli in human atlas vertebrae. *J. Anat.*, 199(3):339-43, 2001.
7. Krishnamurthy, A.; Nayak, S. R.; Khan, S.; Prabhu, L. V.; Ramanathan, L. A.; Ganesh Kumar, C. & Prasad Sinha, A. Arcuate foramen of atlas: incidence, phylogenetic and clinical significance. *Rom. J. Morphol. Embryol.*, 48:263-6, 2007.
8. Lamberty, B. G. H. & Zivanovic, S. The Retro-articular vertebral artery ring of the atlas and its significance. *Acta Anat.*, 85:113-22, 1973.
9. Mitchell, J. The incidence of the lateral bridge of atlas vertebra. *J. Anat.*, 193:283-5, 1998b.
10. Satheesha NAYAK B. Abnormal foramina on the posterior arch of atlas vertebra. *International Journal of Anatomical Variations* (2008) 1: 21–22
11. Taitz, C. & Nathan, H. Some observations of the posterior and lateral bridge of the atlas. *Acta Anat. (Basel)*, 85:113- 22, 1986.
12. Veleanu C, Barzu S, Panescu S & Udroui C (1976) cited by Veleanu C, barz S, Panescu S & Udroui C – Retro transverse groove or canal of Atlas & its significance *Acta Anatomica Basel* 97 (1977) 400- 402.
13. Young, J. P.; Young, P. H.; Ackermann, M. J.; Anderson, P. A. & Riew, K. D. The ponticulus posticus: implications for screw insertion into the first cervical lateral mass. *J. Bone Joint Surg. Am.*, 87:2495-8, 2005.