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Ponticulus posticus upon routine evaluation of cervical spine x-ray in head injury patient: Case reports

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ABSTRACT

Introduction: Ponticulus posticus or known as foramen arcuate is an anatomic variation of the first cervical vertebra origin from calcification of the posterior atlantooccipital membrane. The vertebral artery passes through this canal. This canal can be complete or incomplete and can also be unilateral or bilateral. Often related to symptoms of headaches, vertebrobasilar insufficiency, or acute hearing loss. Whereas, imaging studies show the presence of a partial osseous bridge on the upper surface of the atlas. This study aimed to present two cases of ponticulus posticus in head injury patients.

Case presentation: We reported 2 cases of ponticulus posticus found incidentally in head injury patients at our institution. The patients were managed conservatively for 5 days and sent home with no neurological deficit and complication.

Conclusion: Ponticulus posticus is often ruled out in pre-admission screening. Neurosurgeons should consider this to predict the neurological deficit.

Keywords: foramen arcuate, head injury, ponticulus posticus, posterior atlantooccipital membrane.

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INTRODUCTION

Ponticulus posticus is an anatomic variant of the first cervical vertebral and associated with the vertebral arteries. Incidental findings are commonly visualized from lateral cervical plain X-rays taken for routine neurosurgery examination. Ponticulus posticus in Latin means small posterior bridge.¹ The overall incidence of ponticulus posticus has been reported as 16.7%, with more incidence occurring higher in women compared to men.^{2,3} There are variations seen in imaging study according to Miki *et al.* which are partial, total, and calcified forms of ponticulus posticus.³ As a result of the ossification of posterior atlanto-occipital, arcuate foramen develops in which vertebral artery and the back branch of C1 spinal nerve passes through (Fig. 1).⁴

Based on data from a meta-analysis by Elliott *et al.*,⁵ the frequency of ponticulus posticus was found in 18.8% of post mortem examinations, 17.2% of computed tomography (CT) scans, and 16.6% of radiographic examinations. Most patients who have ponticulus posticus have no

symptoms. The emergence of clinical signs of vertebrobasilar insufficiency develops only in 5.5% of patients in the case of cyclical strangulation that forms in the area of the osseous ring anomaly.⁶

This bone bridge often contributes to neck pain or chronic headaches, migraine, dizziness, shoulder pain, or some form of orofacial pain. Maxillofacial surgeons have reported surgical significance during the management of atlantoaxial stability for atlas fixation. During neuro intervention, pedicle screw insertion can cause injury to the vertebral artery and suboccipital nerve. It can cause reduced blood circulation and

headaches after surgery. Surgeons who are experts in such cases recommend using modified screw passages to avoid piercing the vertebral arteries and closely related structures. Casual movement such as flexion and neck extension or continuous trauma in people with arcuate foramen can suppress and limit the movement of the vertebral artery.^{7,8}

There are several reports dedicated to the treatment of compression syndrome in patients with these anomalies. Most of the reports discussed conservative treatment.^{8,9} Meanwhile, the previous study noted that there were recurrence

Figure 1. The forms of the vertebral sulcus. A. Normal sulcus vertebralis. B. Partial arcuate foramen. C. Total arcuate foramen

symptoms that often occur in 50 – 60% of patients, who need a repeat treatment course. Only a few journals described the surgical treatment of Kimmerle's anomaly, which is the posterior midline approach to decompress the vertebral artery at the V3 segment. Regression of clinical signs of vertebrobasilar is observed in 90% of patients who are operated on.^{6,10-14}

CASE PRESENTATION

Case 1

The patient was a 27-year-old male riding motorcycle in a high-velocity collision with another motorcycle from the opposite. He experienced posterior neck pain but no neurological deficit. His pain improved with physical therapy and oral medications. Deep tendon reflexes in both upper and lower extremities were normal and symmetrical with no pathological reflexes. Head CT scan was within normal limit and cervical spine radiographs revealed diffuse complete arcuate foramen on C1 (Fig. 2A).

Case 2

The patient was a 34-year-old male with a chief complaint of a decrease of consciousness after suddenly falling during riding a motorcycle. He complained of headache and posterior neck pain. However, no other neurological deficit was found. Headache was improved with medication. Neck pain persisted

for about 2 months and improved with physical therapy and analgesic. Deep tendon reflexes in both upper and lower extremities were normal and symmetrical with no pathologic reflexes. Head CT scan was within normal limit and cervical spine radiographs revealed diffuse complete arcuate foramen on C1 (Fig. 2B).

DISCUSSION

The vertebral arteries enter through the arcuate foramen, namely through the osseous fissure arch, potentially causing periodic disturbances in arterial blood flow and the phenomenon of suppression in the periarterial sympathetic plexus, especially during rotation, flexion, and expansion of head movements and cervical curves. The result of this disorder is induction of the transient phenomenon of vertebrobasilar insufficiency or symptoms that resemble Barre-Lieou syndrome. Furthermore, is characterized by traumatic or osteoarthritic degeneration in the third and fourth cervical vertebrae, which results in impaired blood circulation which induces symptoms from cranial nucleus projections, especially cerebral conjugations V and VIII. These symptoms are not only cervical pain, headaches that are focused on the occipital part, ringing in the ears (tinnitus), visual disturbances, loss of consciousness, vasomotor disturbances on the face, and disorders of swallowing and phonation, but there can also be

episodes of depression and anxiety as well as memory and attention difficulties.^{15,16}

There are several studies that show that knowledge of the presence or absence of variations in the anatomy of the atlas is important during the planning of neurosurgery operations related to the craniovertebral junction. Therefore, vertebral arteries have a risk of injury during surgery with a posterior approach to the craniovertebral junction area such as lateral dissection and C1 decompression laminectomy or other stabilization procedures such as inserting screws into the lateral mass of the atlas. This latter procedure is widely used for the management of atlantoaxial instability.^{17,18}

Vascular injury during surgery can be a cause of massive bleeding and can cause cerebral arterial blood flow to decrease. Early recognition of specific anatomic areas including the presence of arcuate foramen can reduce the risk of vertebral artery injury during surgery at the craniovertebral junction.¹⁹ In addition, a potential relationship between anatomic variations in the atlas and the onset of acute hearing loss has also been investigated. This can be associated with functional disorders in the occipitocervical junction area, in the form of hypermobile or hypomobile atlantooccipital articulation.²⁰⁻²²

Clinical and radiological findings in this case indicate a possible relationship between ponticulus posticus and the emergence of chronic tension-type headaches. The only abnormal findings during the investigation are complete arcuate foramen on the surface of the superior atlas and loss of normal cervical curvature. The relationship between headaches and arcuate foramen has been thoroughly investigated in the past, showing that this anatomic variation can be a cause of cervicogenic headaches and migraines. The mechanism of induction of these symptoms is potentially analogous to those mentioned above, namely transient ischemic compression of the vertebral artery during its journey through the arcuate foramen and/or increased tension in the dura mater in the occipitocervical junction area.²³

Figure 2. A. Case 1. B. Case 2. Cervical lateral radiograph shows complete type arcuate foramen (red asterisk).

CONCLUSION

Ponticulus posticus is often ruled out. Clinical manifestations can differ in both severity and symptoms experienced by patients. Pre-admission cervical x-ray screening is important for the presentation of this anomaly and to detect vertebrobasilar insufficiency.

CONFLICT OF INTEREST

There is no competing interest regarding the manuscript.

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AUTHOR CONTRIBUTION

All of the authors equally contribute to the study from the case selection, data gathering, and data analysis until interpreting the case study outcome through publication.

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