

Fenestrated Vertebral Artery in A Routine Cadaveric Dissection

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Abstract

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BACKGROUND: Anomalies associated with the vertebral arteries are relatively rare. The vertebral arteries arise from the first part of the Subclavian artery and pass through the transverse foramina of C6 through C1.

CASE PRESENTATION: However, in this article, we describe a unique variation in the anatomical orientation of the right vertebral artery during a routine cadaveric neck dissection where the right vertebral artery gives an oblique branch from the extradural segment (C2) forming a fenestrated Vertebral artery.

CONCLUSION: Despite the lack of established clinical significance, multiple co-morbid vascular malformations are yet associated with the Vertebral artery fenestration with a possibility of iatrogenic injuries if not taking into cognisance.

Introduction

Vertebral artery (VA) is an important blood vessel in the craniocervical transition region because it contributes significantly to the posterior part of the brain's circulation. The VA is divided into four parts and two segments, extradural segment (including prevertebral -V1, cervical -V2, and Atlantic -V3 parts), and intradural segment, as its fourth, or intracranial part (V4) [1].

True anomalies of the origin of the VA are relatively rare. However, there are already documented anatomical variants of the VA such as asymmetry of the VA due to hypoplasia resulting in its absence or termination into the Posterior Inferior Cerebellar Artery (PICA), partial or complete

duplication of the VA, fenestration of the VA, variable orientation of the ostium, and variable origins of the VA [2].

However, the most common anomaly is an origin from the aortic arch (4%), with the anomalous vertebral artery usually arising between the left common carotid and left subclavian arteries [3].

We present for the first time, to the best of knowledge, a fenestrated vertebral artery in routine student cadaveric dissection. A VA is said to be fenestrated when a single vessel lumen divides into two separate conduits that eventually rejoin distally to form the primary vessel [4]. This is opposed to VA duplication, where the vessel has two origins that distally fuse at varying locations in the cervical region [5].

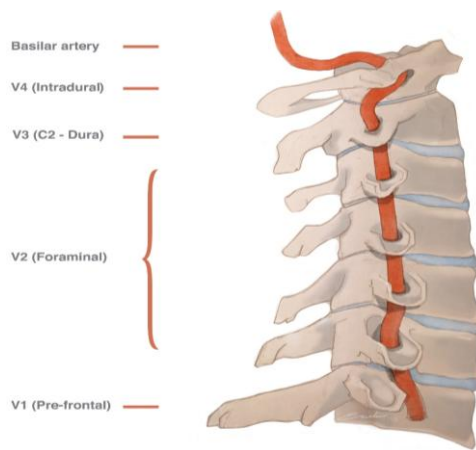


Figure 1: Schematic of the normal course of the VA

Case Report

During a routine cadaveric neck dissection by medical students of a 72-year-old man at the University of Medicine and Health Sciences, St. Kitts & Nevis, an unusual oblique branch coming off the right VA at the extradural segment (Atlantic – V3 part) specifically in the suboccipital triangle and lateral to the rectus capitis was observed. While exploring the neck, the greater occipital nerve was identified and followed deeply, the semispinalis capitis muscle was reflected and the muscles that bound the suboccipital triangle (Obliquus capitis inferior muscle, Rectus capitis posterior major muscle and Obliquus capitis superior muscle) where identified. While exploring the content of the suboccipital region (vertebral artery and suboccipital nerve) this unusual branch was found.

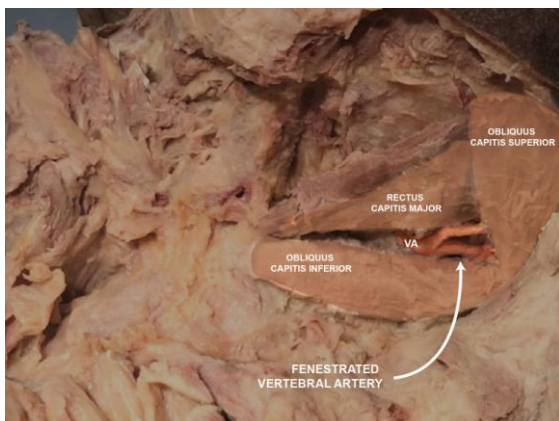


Figure 2: Fenestration of the right Vertebral Artery (V3 part) in the Suboccipital triangle

However, the branch could not be followed right away as it was a systematic dissection. The left vertebral artery did not present such anomaly, and the rest of the structures in the posterior neck on both sides were normal. Subsequently, upon dissection of the brain, the anastomosis of the vertebral arteries forming the basilar artery where normal depicting a

reunion of the branches.



Figure 3: Angiogram of a fenestrated VA

Discussion

The pair of vertebral arteries arise as the first branches of the subclavian arteries. They rise through the neck and go through the transverse foramina of C6 through C1, they then pass through the dura and arachnoid space and pass through the foramen magnum. Both the vertebral arteries join and combine to create the basilar artery. Clinically Oriented Anatomy textbook by Moore refers to this as the “posterior circulation of the brain” [6].

The vertebral arteries will typically branch into four different segments and are named: V1 (pre-foraminal), V2 (foraminal), V3 (Atlantic, extradural or extraspinal) and V4 (intradural or intracranial). The V3 segment showed the variation in this dissection. The V3 segment passes through the transverse process of the axis and crosses laterally through the transverse foramen of the atlas. The VA then makes its way through dura and arachnoid to become V4 which continues to the pons. The path of the V3 is very long and tortuous, allowing for movement of the head and neck [2].

The vertebral arteries develop from longitudinal anastomosis, linking the embryonic first to seventh cervical intersegmental arteries. The seventh cervical intersegmental artery persists and develops into the base of the subclavian artery as well as the proximal part of the vertebral artery [7], the first to the sixth cervical intersegmental arteries regresses to give

rise to the remaining part of the vertebral artery [8].

A VA is said to be fenestrated when a single vessel lumen divides into two separate conduits that eventually rejoin distally to form the primary vessel, as shown in the angiogram in Figure 3 [4]. This is opposed to VA duplication, where the vessel has two origins that distally fuse at varying locations in the cervical region [5].

Several theories have been proposed as to the aetiology of the VA fenestration such as; failure of the second intersegmental artery to regress [7], and failure of the plexiform anastomosis to involute [9] resulting in extracranial fenestration. Whereas, the persistence of fetal anastomotic vessels has been thought to result in intracranial VA fenestrations [9], [10].

Autopsy and angiographic studies suggest that the incidence of vertebral artery fenestration is 0.23%-1.95% [6]. Although fenestration of the VA can occur either intra- or extracranially, the extracranial fenestration at the upper cervical level is more commonly reported [6]. Even though the clinical significance of the fenestrated VA is yet to be determined, several vascular malformations and embryological abnormalities have been associated with it, such as; saccular aneurysm formation [11], intracranial aneurysms [12], arteriovenous malformations and middle cerebral artery fenestrations [11], corpus callosum agenesis, trigeminal artery persistence, and epidermoid cyst [10], [11].

Given these associated variations, it will be imperative for vascular and Neurosurgeons to investigate patients radiologically for further associated vascular abnormalities should a fenestrated VA be observed intraoperatively or while working the patient up for surgery to prevent iatrogenic injuries.

In conclusion, the vertebral arteries are the major suppliers for the posterior circulation of the brain. They are rarely associated with variations. The authors herein present a case of anatomical variation in a 72-year-old male cadaver that demonstrated an oblique branch coming off the right VA at the extradural segment. This unusual branching of the VA

at this level is referred to as a fenestration, which could be a possible cause of iatrogenic injuries during endovascular investigations or procedures.

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