A Previously Unreported Arterial Variant of the Suboccipital Region Based on Cadaveric Dissection

Christian Fisahn¹,²  Brittni Burgess²  Joe Iwanaga²  Fernando Alonso¹  Jens R. Chapman¹
Rod J. Oskouian¹  R. Shane Tubbs²

¹ Swedish Medical Center, Swedish Neuroscience Institute, Seattle, Washington, United States
² Seattle Science Foundation, Seattle, Washington, United States

Address for correspondence Christian Fisahn, MD, Swedish Medical Center, Swedish Neuroscience Institute, 550 17th Avenue, Seattle, WA 98122, United States (e-mail: christian.fisahn@gmail.com).

Introduction

The atlas is surrounded by several arterial anomalies, and it has a unique shape involving a complex relationship with the vertebral artery (VA).¹ The complexity of its architecture poses potential of a high complication risk for surgeries occurring in the atlas region. Having a complete understanding of the various anomalies preoperatively can dramatically reduce the risk of surgical insult during neurosurgical procedures. Herein we report a case of an arterial variant found just below the posterior arch of C1.

Case Report

During the routine dissection of the right suboccipital region via a posterior approach, an unusual bulge was identified just inferior to the inferior capitis oblique muscle. With further dissection, the structure was identified as a tortuous internal carotid artery.

Keywords

- anatomy
- anomaly
- carotid artery
- C1
- suboccipital triangle

Abstract

Introduction  Several arterial variants have been reported to occur around the posterior arch of the atlas. Understanding the various anomalies and diagnosing them preoperatively can dramatically reduce the risk of surgical insult during neurosurgical procedures. Herein we report a case of an arterial variant found just below the posterior arch of C1.

Case Report  During the routine dissection of the suboccipital region via a posterior approach, an unusual bulge was noted just inferior to the inferior capitis oblique muscle (► Fig. 1). This vascular structure was appreciated after the semispinalis capitis muscle had been reflected inferiorly. Initially, the variant vessel was thought to be a malpositioned and enlarged VA. However, the ipsilateral VA was found to be in a normal location within the suboccipital triangle and passed over the posterior arch of the atlas as it normally does. It was of a normal caliber. No other neurovascular or muscular variants were identified on the left or right side.

Conclusion  Arterial variants around the posterior arch of C1 are surgically significant and can result in catastrophic injuries if unappreciated. Most of these variants will be related to the vertebral artery. To our knowledge, an arterial variant of the internal carotid artery in this location, as reported herein, has not been previously reported.
right sides of the specimen. With further dissection, the vascular structure was shown to be the distal part of the internal carotid artery. This vessel course more posteriorly than usual came into the suboccipital region as a large loop and then traveled superiorly into the carotid canal—the latter being in normal fashion.

**Discussion**

Arterial variations involving vessels around the atlas are not uncommon. For example, extracranial-extradural variants of the PICA have been reported from 5 to 20% during lateral suboccipital, far-lateral, or upper cervical approaches. The course of this vascular variant is of surgical importance as it can be confused with V3 branches (muscular, meningeal, posterior spinal). Common persistent carotid-vertebrobasilar anastomoses that might be observed in the suboccipital region include persistent hypoglossal and proatlantal arteries. The hypoglossal artery arises from the cervical internal carotid artery at the C1–C3 level, extends through the hypoglossal canal and joins with the basilar artery close to the pontomedullary junction, and has a prevalence of 0.02 to 0.1%. The proatlantal artery, thought to be manifested as the horizontal segment of the adult VA, can arise from the internal or external carotid arteries and joins distally with the vertebrobasilar system.

Our case is unique in that the cervical internal carotid artery was found to enter the suboccipital region as a large looped vessel before continuing along its normal course to enter the carotid canal. Damage to the vessel at this point could have devastating outcomes. The presence and route of such arterial variants can be best confirmed with a three-dimensional computed tomography angiography (3D-CTA) to avoid any injury to them during common neurosurgical procedures such as midline approaches to the posterior cranial fossa, C1–C2 screw fixation, and C1/2 puncture, a procedure commonly performed to collect cerebrospinal fluid. Interestingly, after identifying our case, a review of our hospital’s database identified an adult patient with a similar finding in the suboccipital region that appears to be consistent with our cadaveric case (~Fig. 2). This case was found incidentally for evaluation of headache. Although cases of significant tortuosity of the cervical part of the internal carotid artery have been reported, known to our knowledge, they have been so deviated as to enter the suboccipital region inferior to the posterior arch of C1.

**Conclusion**

Atlas arterial variants are surgically significant and may influence approaches for several upper cervical spine pathologies. Arterial anomalies can be identified preoperatively utilizing 3D-CTA to minimize risk of complications during neurosurgical procedures. When not performed, the surgeon should be aware of the possibility of the rare variant identified in the current case to minimize complications and avoid morbidity.

**Disclosure**

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

**Informed Consent**

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent form is available for review by the Editor-in-Chief of this journal on request.
References
5 Kirkland JD, Dahlin BC, O’Brien WT. The transclival artery: a variant persistent carotid-basilar arterial anastomosis not previously reported. J Neurointerv Surg 2016 neurintsurg-2016-012464.rep
7 Cohen JE, Grigoriadis S, Itshayek E. Type II proatlantal artery (occipital subtype) with bilateral absence of the vertebral arteries. Clin Anat 2011;24(08):950–952