

Case report

A case of bilateral absence of carotid canals in human skull

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Abstract:

Anatomical variation in the lower limb was found during routine dissection in a 75-year-old male cadaver in the Morphology Laboratory at the University of Pamplona. While examining 25 skulls present in the department of Anatomy, Universiti Sains Malaysia, we found that in one of the skull the floor of the carotid canal was absent on both the sides. The absence of the floor, exposed the roof of the carotid canal which appeared as a deep groove extending on the under surface of the petrous temporal bone. Following review of literature, we found that absence of the carotid canal is a very rare anomaly and has a great clinical importance. Exposed internal carotid artery in the absence of floor can make it at risk of injury during skull base surgeries. Therefore, we decided to report this case.

Keywords: skull; internal carotid artery; carotid canal; petrous temporal bone; floor

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Introduction:

The carotid canal is a bony canal present in the petrous part of the temporal bone. Normally it begins as a large circular foramen (inferior opening of the carotid canal), on the inferior surface of the petrous part of the temporal bone and then runs forwards and medially to open on the posterior wall of the foramen lacerum¹¹. It contains the internal carotid artery (ICA) along with accompanying venous and sympathetic nervous plexuses. Abnormalities of this canal are very rare. Pastor Vazques et al. studied 538 skulls for the abnormalities of the floor of the carotid canal and only in 2 skulls they found bilateral absence of carotid canal⁶. Similarly Sharma, PK et al. found absence of the floor of the carotid canal in only one skull, out of 325 skulls studied¹⁰. Mohamed Abo Aoun et al. reported that the inferior wall is seen defected in 5 skulls of all specimens (3.3%), while the superior wall is found defected only in one skull (0.66%)⁵.

Studies on the variants of carotid canal reported that it may be unilateral³ or bilateral¹⁰. Other studies suggested that absence of the floor and agenesis of the carotid canal is associated with agenesis of the carotid artery^{1,8}. Quint et al. also

reported that out of four patients with carotid canal underdevelopment, two had associated aneurysm of circle of Willis and one had skull base rete mirabile supplying an abnormal mesh of vessels in the basal cisterns⁸.

Failure of closure of the floor of carotid canal can be either primary defect, due to failure of ossification during the embryonic period or secondary defect in which failure to close caused by anomalies of the internal carotid artery⁶. Further they stated that according to the degree of the failure to close, defects can be classified into major and minor. They refer partial failure in closure of carotid canals as minor defects and total absence of the floor as the major defects. Minor failure appeared as holes or fissures in the floor. Minor defects are associated with a very thin bony floor, which results due to failure of ossification and therefore can be considered as primary defect.

Since the carotid canals in the skull base form secondary to the presence of the embryonic ICA, absence or hypoplasia of a carotid canal may suggest a congenital ICA abnormality⁸.

Whatever the origin and degree of the failure of closure, absence of carotid canal means a lack of

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protection of the ICA, in cases of trauma, to tumors of skull base and to injury during surgery on the skull base.

Case report:

We studied 25 dry human skulls available in the Department of Anatomy, Universiti Sains Malaysia. The base of each skull was inspected for the presence or absence or any other abnormalities of the carotid canals. Necessary photographs were taken by Nikon 5100 digital camera.

Out of 25 skulls examined, in one male skull we noticed abnormality of carotid canals. This skull was comparatively very light and its bony walls were quite thin. In this skull the floor of the carotid canal was absent on both the sides. In place of the carotid canals there were deep grooves extending from, supposed to be inferior opening of the carotid canal to the foramen lacerum. The groove on the

right side was quite deeper than the left side. Right groove was about 24mm long and left one was 21mm. it was also observed that bony plate in the floor of posterior cranial and anterior cranial fossae were quite thin paper like. Apart from these the anterior wall of the bony part of the external auditory canal was also very thin.

Discussion

In cases of skull base surgery, the position, dimensions and extensions of the carotid canal are of vital importance for the identification and isolation of the internal carotid artery during its petrous course ⁴. It is a common belief among surgeons that, the exposure of the internal carotid artery at the level of the carotid canal is the most difficult manipulation during skull base surgeries ⁹. The absence of the floor of the carotid canal makes exposure of the internal carotid artery vulnerable

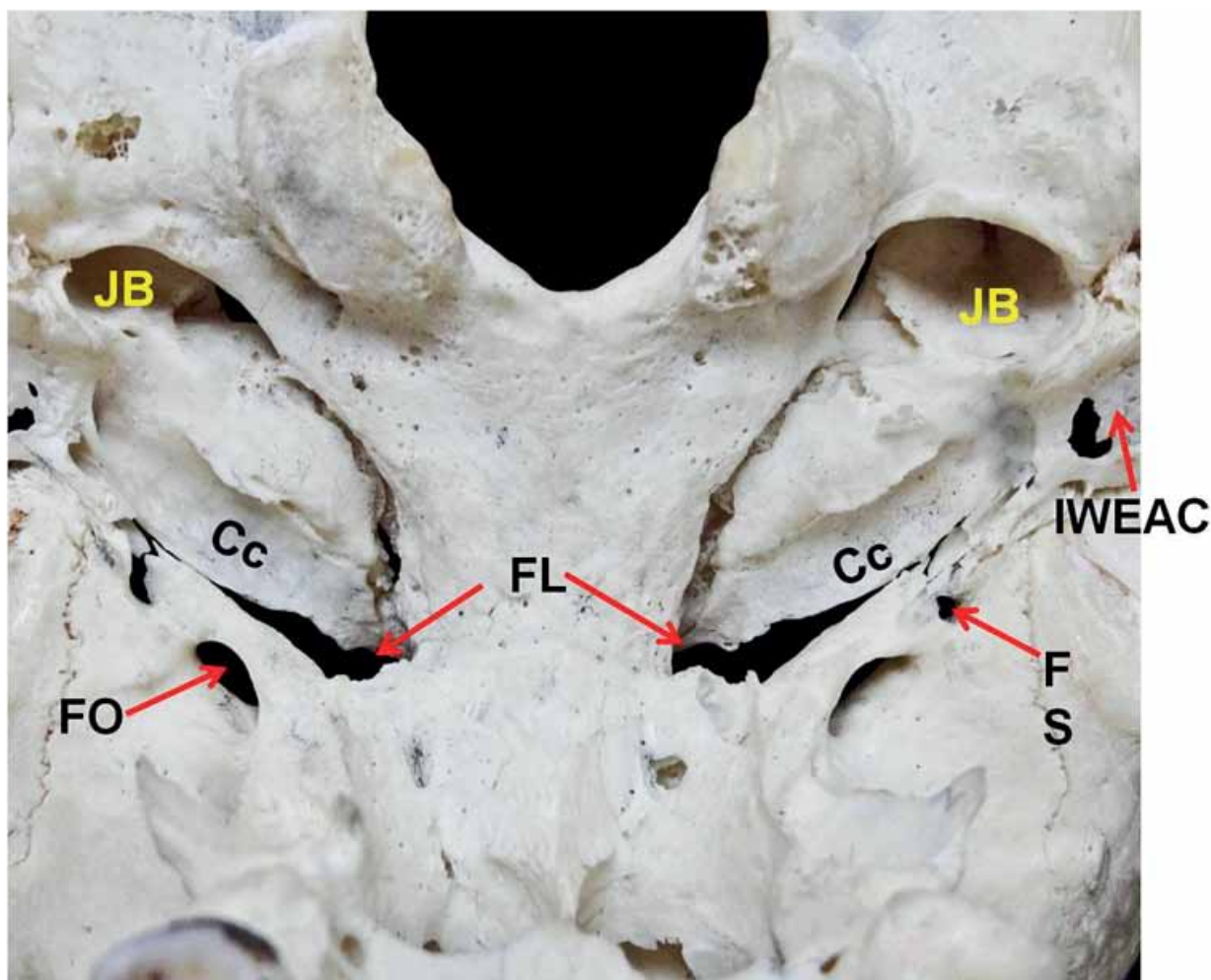


Figure 1: A photograph of the base of the skull

JB- Jugular Bulb, CG - Carotid Groove, FO- Foramen Ovale, FL- Foramen Lacerum, FS- Foramen Spinosum

IWEAC- Inferior wall of External Auditory Canal

during surgical approaches and may give rise to complications during skull base surgeries.

Anomalies of the carotid canal can be attributed to either developmental defects of internal carotid artery or primary failure of ossification of carotid canals^{2, 8, 10}. Developmental defects such as hypoplastic internal carotid artery would likely result into hypoplastic carotid canal as it is proven fact that the ossification of the petrous part of the temporal bone occurs after the development of the ICA⁷. The lack of floor of carotid canal can develop secondary to abnormalities of internal carotid artery. One such abnormality is congenital aneurysm of internal carotid artery which prevents proper ossification the floor of carotid canal. Pastor Vazquez *et al.* found that the major failure, always bilateral was present in two skulls and minor failure in four. Minor defects in the form of holes were unilateral in two skulls and bilateral in one, while fissuring was also bilateral⁶.

In the present case, the absence of a definitive groove on both the sides indicates a normal internal

carotid artery. In our opinion bilateral absence of the floor of the carotid canals in this case is being attributed to the failure of ossification rather than anomalies of internal carotid artery. This view is further substantiated by the presence of very thin orbital roof, anterior and inferior bony wall of the external auditory canal and floor of posterior cranial fossa.

Conclusion

It is quite clear that whatever the basis and degree of the failure of closure, deficiency of carotid canal results to a lack of protection of the internal carotid artery that make it exposed and vulnerable to trauma, to any growth in this region and to injuries during surgery on the skull base

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Conflict of interest: None declared

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