Dorello's Canal

The interest of Dorello's Canal has been revived because of advances in the surgery of the petroclival region.\(^1\) \(^2\) \(^3\) \(^4\) \(^5\) \(^6\) \(^7\)

The definition of the Dorello's canal, remains a controversial subject. Tsitsopoulos et al. propose a new definition of Dorello's canal boundaries. Further microanatomic studies of the Dorello's canal may still contribute to the recognition of the anatomic variations that exist. The sixth nerve is different in several ways from the other cranial nerves, especially regarding the entrapment of the nerve inside the Dorello's canal and the angulations that it follows along its long course, mainly within venous blood and detailed knowledge of the microanatomy of this area is crucial for the surgical procedures in the petroclival area.\(^8\)

The bow-shaped bony enclosure surrounding the abducens nerve and the inferior petrosal sinus as the two structures merge with the cavernous sinus. It is sometimes found at the tip of the temporal bone.

The concave intracranial surface of the clivus is lined by a thick double layer of dura that contains the basilar venous plexus. This venous plexus forms a venous confluence with the posterior cavernous sinus and the inferior petrosal sinus, which contains an osteofibrous compartment known as Dorello's canal.

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Fig 2. Superior view of the cranial skull base. The arrow indicates passage of the abducens nerve in the region subsequent to clivus and leading itself to the Dorello's channel.

http://www.scielo.br/img/revistas/anp/v67n1/a22fig02.jpg
To avoid the differences usually encountered in the description of this area, Destrieux et al. preferred to consider a larger space that they have named the petroclival venous confluence (PVC). It was located between two dural layers: inner (or cerebral) and outer (or osteoperiosteal). The PVC was quadrangular on transverse section. The posterior petroclinoid fold and the axial plane below the dural foramen of the abducens nerve limited the PVC at the top and bottom, respectively. Its anteroinferior limit was the posterosuperior aspect of the upper clivus and outer layer of the dura mater. Its anterior limit was the vertical plane containing the posterior petroclinoid fold, and its posterior limit was the inner layer of the dura. The PVC was limited laterally by the medial aspect of the petrous apex and medially by the virtual sagittal plane extending the medial limit of the inferior petrosal sinus upward. The PVC was a venous space bordered by endothelium and continuous with the cavernous sinus, the basal sinus of the clivus, and the inferior petrosal sinus. There were trabeculations between the two dural layers. The petrosphenoidal ligament of Gruber may be regarded as a larger trabeculation, and it divided the PVC into a superior and an inferior compartment. The abducent nerve generally ran through the inferior compartment, where it was fixed to the surrounding dura mater. This nerve was only separated from venous blood by a meningeal sheath of varying thinness lined with endothelium.

Today Dorello's canal is widely recognized as a key landmark in skull base surgery of the petroclival region and holds clinical significance due to its relation to the abducens nerve and surrounding vascular structures. Yet, although academics such as Primo Dorello and Giuseppe Conte Gradenigo are recognized for their work on the canal, it is important not to forget the others throughout history who have contributed to the modern-day understanding of this anatomical structure. In fact, although the level of anatomical detail found in Dorello's work was previously unmatched, the first description of the canal was made by Wenzel Leopold Gruber in 1859, almost 50 years prior to Dorello's landmark publication. Another critical figure in building the understanding of Dorello's canal was Harris Holmes Vail, a young otolaryngologist from Harvard Medical School, who in 1922 became the first person to describe Dorello's canal in the English language. Vail conducted his own detailed anatomical studies on cadavers, and his publication not only reaffirmed Dorello's findings but also immortalized the eponym used today—“Dorello's canal.” In this article the authors review the life and contributions of Gruber, Dorello, Gradnigo, and Vail, four men who played a critical role in the discovery of Dorello's canal and paved the way toward the current understanding of the canal as a key clinical and surgical entity.

Measurements

The first microanatomic study of the Dorello's canal was performed by Umansky et al and reported in 1991.

This study represents a significant contribution to the knowledge of this specific area. The authors used the operating microscope to present a series of measurements concerning the Dorello's canal's anatomic elements. They also defined its complex relationship to the cavernous, basilar, and inferior petrosal sinuses. Further, they noted the controversies surrounding the canal's definition and proposed their own opinion in this topic.

Canal measurements were performed and its anatomical relationship with the sixth cranial nerve is described. Angulations of variable degrees were observed in the course of the nerve inside and outside the canal. The influence of this relatively tortuous course of the abducens nerve upon its vulnerability in some pathological conditions is discussed.
Magnetic resonance imaging anatomy

The goal of the study of Yousry et al. was to identify reliably the cisternal segment of the abducent nerve by using the three-dimensional Fourier transform constructive interference in steady-state (3-D CISS) magnetic resonance (MR) imaging sequence to define landmarks that assist in the identification of the abducent nerve on MR imaging and to describe the nerve's relationship to the anterior inferior cerebellar artery (AICA).

A total of 26 volunteers underwent 3-D CISS MR imaging, and 10 of these volunteers also underwent MR angiography in which a time of flight sequence was used to identify the facial colliculus, the abducent nerve and its apparent origin, Dorello's canal, and the AICA. The authors identified the abducent nerve with certainty in 96% of 3-D CISS sequences obtained in the axial and sagittal planes and in 94% obtained in the coronal plane. The nerve emerged from the pontomedullary sulcus in 94% of cases. The facial colliculus could always be identified, and Dorello's canal was identified in 94% of cases. In 76.6% of cases, the abducent nerve was seen to contact the AICA, which passed inferior to the nerve in 63.8% of cases and superior to it in 29.8%.

The anatomical course of the abducent nerve and its relationship to the AICA and other blood vessels can be reliably identified using a 3-D CISS MR sequence with the facial colliculus and Dorello's canal serving as landmarks.12

The subarachnoid space inside the dural sleeve of the abducens nerve can be defined by using thin-slice MRI scans. Enlargement of the dural sleeve at the petroclival region may coexist with the abducens nerve palsy. It has been documented in the study of Ozveren et al. that the arachnoid membrane forms a membraneous barrier between the subarachnoid and subdural spaces within Dorello's canal.13

5) Spetzler RF, Daspit C Ph., Pappas CTE: The combined supra- and infratentorial approach for lesions of the petrous and clival regions: experience with 46 cases. 1 Neurosurg 76:588-599. 1992
7) Sekhar LN, Javed T, Jannetta PJ: Petroclival meningiomas. In Sekhar LN, Janecka IP (eds): Surgery of


