

Introduction

We present a novel sinus recently identified in the floor of the porus trigeminus of Meckel's cave. This sinus lies between the superior and inferior petrosal sinuses and, due to its location, has important surgical implications and may contribute to unusual presentations. A review of the current literature on similar variants in this region is discussed, along with our cadaveric findings.

Methods and Materials

Twenty-five latex-injected cadavers (50 sides) underwent dissection of the skull base. Specifically, the dural venous sinus structures located at the porus trigeminus were evaluated using a surgical microscope. Samples were submitted for histological analysis. A retrospective review of cadaveric radiological images was also conducted to visualize this venous sinus.

Fig 1. Left-sided sinus of the porus trigeminus (arrows), noting the reflected trigeminal nerve (V) at the entrance to Meckel's cave. The superior petrosal sinus (SPS) connects with the sinus of the porus trigeminus anteriorly and posteriorly and inferiorly, with the inferior petrosal sinus (IPS). VI=abducens nerve, *=cavernous sinus..

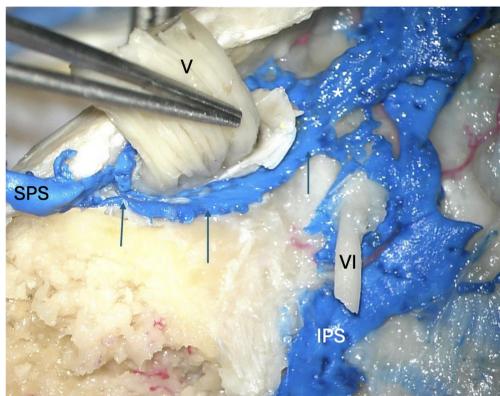
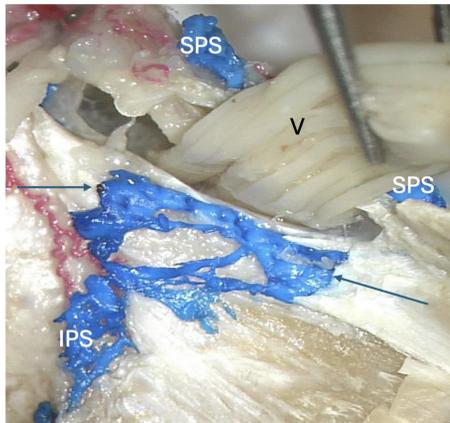


Fig 2. Right-sided sinus of the porus trigeminus (arrows). In this specimen, the sinus of the porus trigeminus connects to the junction of the basilar venous plexus (BVP) and inferior petrosal sinus (IPS) anteriorly. Note the trigeminal nerve (V), abducens nerve (VI), and right internal carotid artery (ICA).



Fig 3. Right-sided sinus of the porus trigeminus (*). The trigeminal nerve (V) is reflected laterally with the overlying the superior petrosal sinus (SPS). In this case, the sinus is plexiform in nature and connected inferiorly to the inferior petrosal sinus (IPS). Note the dorsal meningeal artery traveling with and toward the inferior petrosal sinus.



Results

For cadaveric specimens, the sinus of the porus trigeminus was observed on eight sides (16%). The sinuses always traveled in the floor of the porus trigeminus and were, on average, 3.5 mm in width and 10 mm in length. These were variably connected to the superior petrosal sinus above but more often to the inferior petrosal sinus or basilar venous plexus. One sinus drained directly into the cavernous sinus. Histologically, these structures were consistent with a dural venous sinus. A sinus of the porus trigeminus was identified in 10% of radiological images.

Fig 4. Left-sided sinus of the porus trigeminus (*). In this case, it travels about halfway along the floor of the porus trigeminus and drained laterally, deep to the trigeminal ganglion to enter the veins of the foramen ovale (not shown). SPS=superior petrosal sinus, V=trigeminal nerve.

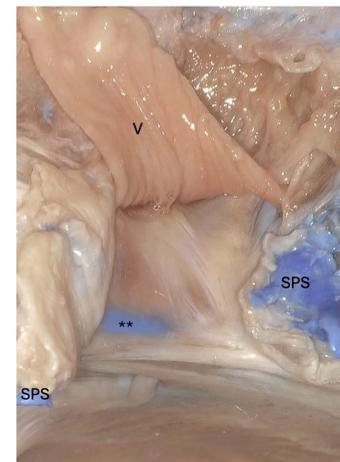


Fig 5. Right-sided sinus of the porus trigeminus (arrows) traveling below the trigeminal nerve (V) and its entrance into Meckel's cave. II=optic nerve, ICA=internal carotid artery, III=oculomotor nerve, DS=dorsum sellae, CS=cavernous sinus, VI=abducens nerve, IPS=inferior petrosal sinus, SPS=superior petrosal sinus, VA=vertebral artery.

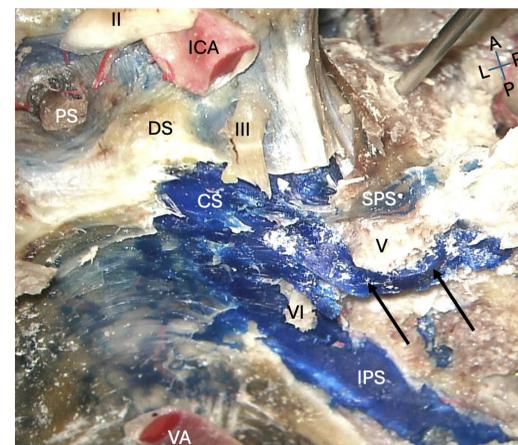


Fig 6. Oblique section through the petrous part of the temporal bone at the level of the porus trigeminus (PT). Note the superior petrosal sinus (SPS) and sinus of the porus trigeminus (arrows) and their relationship to the trigeminal nerve at the entrance into Meckel's cave. The sinus of the porus trigeminus has all of the typical features of a dural venous sinus.

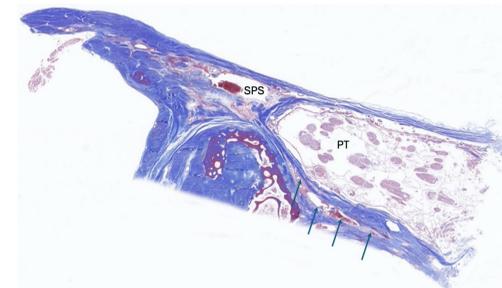
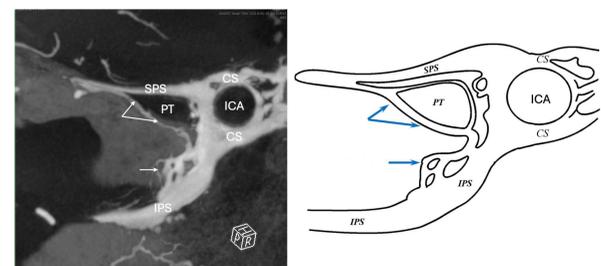


Fig 7. Multiplanar reconstruction (MPR) and schematic drawing show the left porus trigeminus (PT), bordered inferiorly by the sinus of the porus trigeminus (double arrows). Traveling above the porus is the anterior part of the superior petrosal sinus (SPS). Also, note a channel (single arrow) that connects, via an additional small plexus, with the inferior petrosal sinus (IPS) and the cavernous sinus (CS) more anteriorly.



Discussion

Surgeons must account for variations of the superior petrosal vein coursing below or around Meckel's cave, as it can narrow the porus trigeminus and limit visualization. Venous variants may alter angles of approach and limit surgical maneuverability. Preservation of collateral venous flow should be prioritized. Surgeons may sacrifice venous structures during dissections, but variations in venous anastomoses raise the risk of significant postoperative complications, including cerebellar swelling, hemorrhage, and, in rare cases, brain death.

Conclusions

Surgery in and around the opening to Meckel's cave could encounter the dural venous sinus of the porus trigeminus. Knowledge of such a variant will minimize operative and interventional complications and aid in radiological diagnoses.

The authors sincerely thank those who donated their bodies to science so that anatomical research could be performed.