Anatomy of the Petrosal Fissure: Implications for Skull Base Surgery

Maged T. Ghoche M.D, Maria José Pachón-Londoño M.D, Vita A. Olson B.A, Estefana Bcharah, Charbel Moussalem M.D, Devi P. Patra M.D, Bernard R. Bendok M.D MSCI

1Department of Neurological Surgery, Mayo Clinic, Phoenix, AZ.; 2Precision Neuro-therapeutics Innovation Lab, Mayo Clinic, Phoenix, AZ.; 3Neurosurgery Simulation and Innovation Lab, Mayo Clinic, Phoenix, AZ.; 4Department of Radiology, Mayo Clinic, Phoenix, AZ.; 5Department of Otolaryngology-Head & Neck Surgery, Mayo Clinic, Phoenix, AZ.

Introduction

The petrosal fissure, the most distinct, largest, and deepest fissure of the cerebellum, plays a crucial role in skull base surgery. Understanding its detailed anatomy is essential for neurosurgeons to navigate this region safely and effectively. This review aims to provide a comprehensive analysis of the petrosal fissure's anatomy, highlighting its relevance to surgical approaches and implications for clinical practice.

Objective

To delineate the anatomical features of the petrosal fissure and explore its significance in surgical procedures involving the cerebellopontine angle and surrounding structures.

Methods

A literature review of PubMed, Scopus, and Google Scholar was conducted, focusing on articles published prior to 2024. Cadaveric and clinical studies focusing on cerebellar anatomy, neurovascular relationships, and surgical techniques were included. Data were synthesized to provide a detailed description of the petrosal fissure and its clinical significance.

Results

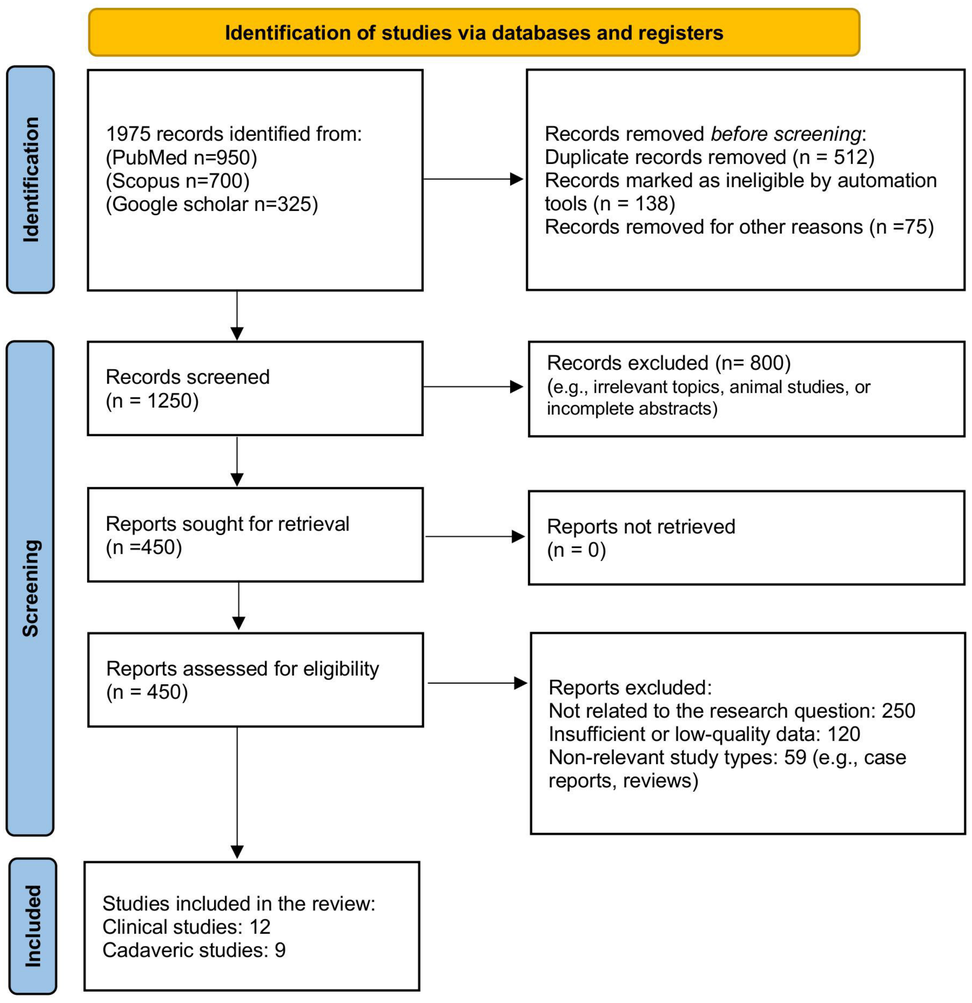

Figure 1. PRISMA Flow Chart

In total, 12 clinical studies and 9 cadaveric were retrieved. The anatomical analysis of the petrosal fissure reveals the following key features:

1. Location and Structure:
The cerebellopontine fissure is a V-shaped structure that separates the petrosal surface of the cerebellum from the middle cerebellar peduncle and pons.
In 10 cadaveric specimens, the petrosal fissure extended laterally and symmetrically from the cerebellopontine fissure apex, running 0.5–1 cm caudal to the petrosal-tentorial junction and dividing the cerebellum into superior and inferior semilunar lobules. Its length ranged from 15.9 to 23 mm, with an average depth of 14 mm.

2. Neurovascular Structures:
Venous Anatomy: The vein of the cerebellopontine fissure originates in the suprafloccular cistern, courses along the superior limb of the fissure, and drains into the superior petrosal vein (SPV). Among 15 patients and 8 cadaveric specimens, 77% had a single SPV, 20% had two SPVs, and 3% had three SPVs. In 50 patients, this vein exhibited several tributaries with 29 variations, including the veins of the cerebellomedullary fissure, lateral medulla, pontomedullary sulcus, and middle cerebellar peduncle.
Arterial Anatomy: In 10 cadaveric specimens, 25% of the petrosal fissure received a major tributary from the lateral branch of the AICA, while 50% exhibited smaller AICA branches within the fissure. Occasionally, cortical branches of the SCA extended into the petrosal fissure.

3. Surgical Approaches:
The petrosal fissure offers access to the middle cerebellar peduncle, lateral pons, and cranial nerves within the cerebellopontine angle. Splitting the fissure enables a direct lateral approach, reducing cerebellar retraction and minimizing the risk of injury to critical structures.

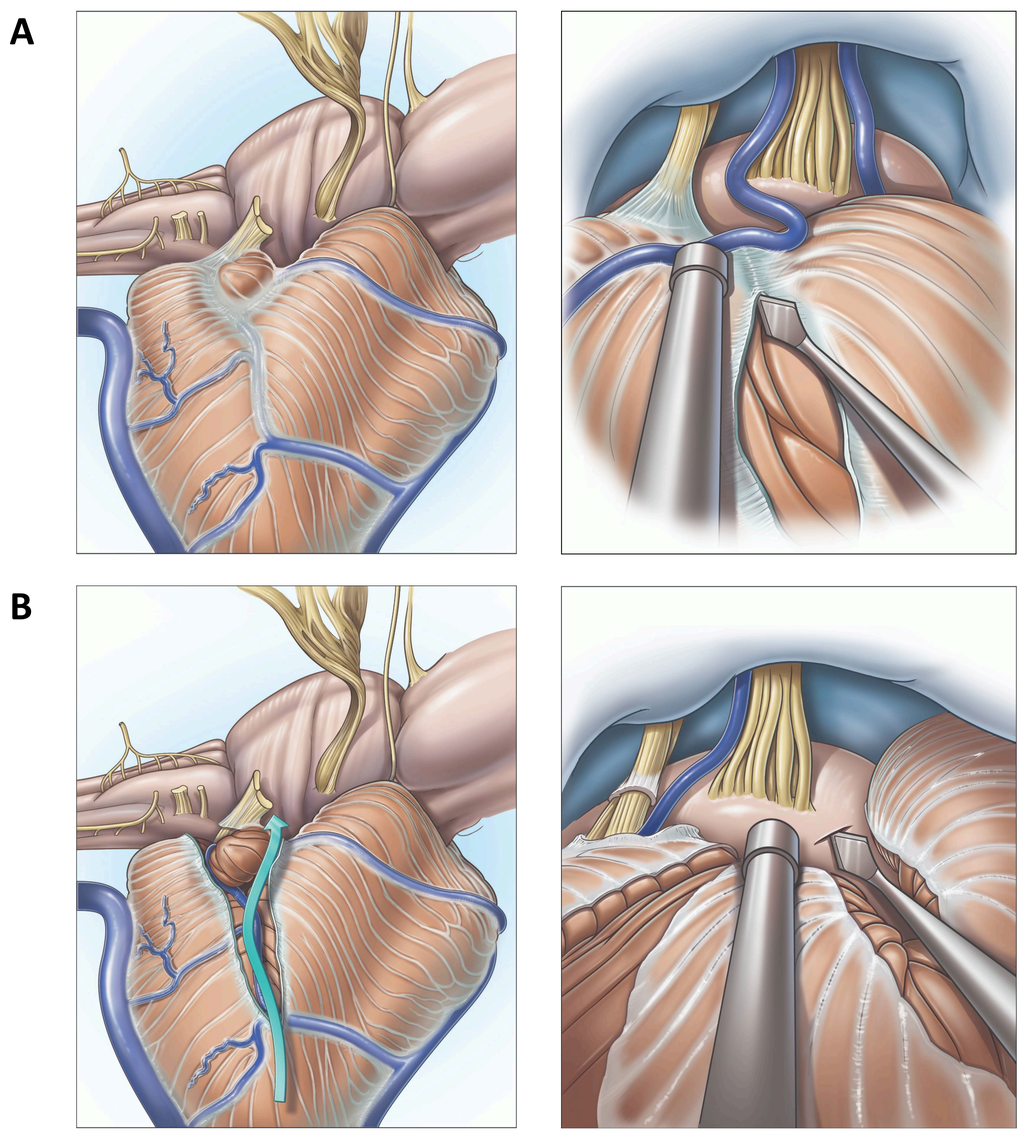

Image 1: Illustrations depicting the surgical approach (A) before and (B) after splitting the petrosal fissure, highlighting the improved access to the middle cerebellar peduncle, lateral pons, and cerebellopontine angle structures.

Conclusions

A detailed understanding of the petrosal fissure's anatomy is vital for neurosurgeons performing skull base surgeries. The fissure's location, structure, and surrounding neurovascular relationships must be carefully considered to optimize surgical outcomes and minimize complications. Further anatomical studies and advanced imaging techniques are recommended to enhance the precision of surgical interventions in this complex region.

Contact

Charbel K. Moussalem
Mayo Clinic
5777 E Mayo Blvd, Phoenix, AZ 85054
moussalem.charbel@mayo.edu

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