Surgical anatomy and dissection of the petrous and peripetrous area
Anatomic basis of the lateral approaches to the skull base

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Summary. The purpose of this study is to review the topographic anatomy of the petrous and peripetrous structures, with emphasis on the relationships important to the lateral approaches to the posterior and lateral skull base. Surgical exposure of the clivus, the posterior aspect of the petrous bone, the ventral aspect of the brain stem, and of all the intradural structures in the area, remains difficult because of the presence of the so-called “petrous and peripetrous complex”. However, the lateral approach to the skull base is the most suitable approach if the lesion lies lateral to the cavernous portion of the internal carotid artery, and of course if the lesion develops laterally behind the petrous apex. Consequently, neurosurgeons should be familiar with the anatomy of the intrapetrous cavities and their contents, and with the relationships in the area. Middle cranial fossa dissections (dry and fresh specimens) allow us to study the anatomical relationships between the intrapetrous carotid artery, the facial nerve, the porus, the cochlea, the geniculate ganglion and the petrosal nerves, the trigeminal ganglion and nerve, the auditory tube and the middle ear. While briefly reviewing some approaches (anterior petrosectomy, sub-temporal preauricular infratemporal fossa approach, pre-sigmoid approach), we explore the concept of the approach and the limitations of surgical technique and exposure.

Anatomie chirurgicale et dissection de la région pétreuse et péri-pétreuse: bases anatomiques des abords latéraux de la base du crâne


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plexus, with the following elements:
- the petrous cavities and their contents (the middle ear, the bony labyrinth with the cochlea and the semicircular canals, the petrous segment of the internal carotid artery and its canal, the facial nerve within the internal auditory meatus and facial canal);
- the sinus “triangle” (sigmoid sinus, superior and inferior petrosal sinuses, jugular bulb);
- the jugular foramen and its contents.

The study of dry and fresh specimens using middle cranial fossa dissections allowed a comprehensive review of the relationships between all the structures in this complex area.

Material and method

Our dissections were carried out on 12 petrous bones, after selective injections of colored latex (Latex Néoprène Dupont-de-Nemours 671) into the carotid artery, the vertebral artery, the internal jugular vein, and directly into the straight and lateral sinuses. Dissections were performed under magnification (Carl Zeiss Opmi 9-FC), using Kodak films (Kodak Ektachrome 160T) for colored illustrations.

Dry specimen dissection (Figs. 1 and 2)

A dry specimen of a burred bony labyrinth was used to show the ventral segment (cochlea) and the dorsal segment (vestibule and semicircular canals). Its length was about 2 cm, located in the long axis of the pyramid.

The relationships between the lateral tract of the lateral semicircular canal and the second portion of the facial nerve, and between the ampullae of the superior and lateral semicircular canals and the genu of the facial nerve are important. These bony landmarks are used as a guideline when burring to avoid damage to the facial nerve during posterolateral approaches.

The cochlea lies near the cortical substance of the petrous apex. The relationships between the cochlea and the carotid canal in this particular case should be noted: the canal is partially covered by the cochlea (33% of cases for Paullus et al [6]). Thus it is impossible to displace the carotid artery downwards from above without entering the cochlea (with hearing loss). In the same way, the artery cannot be displaced from its canal without invasion of the cochlea unless an anterior and lateral approach is used.

Finally, there are the relationships between the third portion of the facial nerve and the mastoid air cells. (The facial canal was catheterized with a yellow suture representing the facial nerve as seen in Fig. 1).

Fresh specimen dissections

The superior petrosal sinus lies above the petrous ridge (Fig. 3). The horizontal segment of the petrosal portion of the carotid artery may be covered by bone right up to its entrance into the cavernous sinus [13]. However, in our dissections, the trigeminal ganglion and the horizontal segment were separated only by a dural layer (Fig. 3) as described by Pait [5]. If the floor of the middle cranial fossa is burred, the facial nerve within the internal auditory meatus, the geniculate ganglion, the greater petrosal nerve, the tensor tympani muscle, and the middle ear will be exposed (Fig. 4). Burring the bone medial to the horizontal segment of the petrous carotid artery gives access to the inferior petrosal sinus (Figs. 5 and 6). The sinus is in fact very large, and its caliber (4 to 7 mm in our dissections) is often underestimated by surgeons.

Legends for Figs. 1-9

1, Carotid canal; 2, Cochlea; 3, Facial n. (position of the genu); 4, Facial n. (facial canal); 5, Facial n. (extracranial portion); 6, Superior semicircular canal; 7, Lateral semicircular canal; 8, Posterior semicircular canal; 9, Petrous apex; 10, Mastoid air cells; 11, Trigeminal ganglion; 12, Trigeminal root; 13, Middle meningeal a.; 14, Petrous part of the internal carotid a. (horizontal segment); 15, Superior petrosal sinus; 16, Anterior inferior cerebellar a.; 17, Facial n.; 18, Vestibular n.; 19, Greater petrosal n.; 20, Genuculate ganglion; 21, Tensor tympani m.; 22, Tympanic cavity; 23, Malleus; 24, Uecus; 25, Petrous part of the internal carotid a. (genu); 26, Cochlear n.; 27, Inferior petrosal sinus; 28, Glosso-pharyngeal n.; 29, Trochlear n.; 30, Catheter within the auditory tube; 31, Petrous part of the internal carotid a. (vertical segment); 32, Facial n. (second portion); 33, Clivus; 34, Pons; 35, Abducens n.; 36, Medulla oblongata; 37, Basilar a.; 38, Vertebral a.; 39, Internal carotid a. (upper cervical segment); 40, Internal jugular v.; 41, Accessory n.; 42, Vagus n.; 43, Parietal venous plexus.