Petroclival meningioma

Petroclival meningiomas are lesions arising from the upper two thirds of the clivus with dural attachment centered on the petroclival junction. They are seated medial to the internal auditory meatus and posterior to the gasserian ganglion. This differentiates them from clivus meningiomas that arise close to the midline of the clivus.\(^1\)\(^2\).

Classification

They frequently invade the cavernous sinus and the Meckel's cave area.

Sekhar et al. have developed a useful scheme that is based on the tumor's anatomical location along the clivus, mainly along the upper, middle, or lower clivus.\(^3\)

Ichimura et al. classified this tumors into four subtypes according to the main attachment and trigeminal nerve deviation into, upper clivus (UC), cavernous sinus (CS), tentorium (TE), and petrous apex (PA).

The characteristic symptom was ataxia in the UC type (37.5%), abducens nerve palsy in the CS type (64.3%) and trigeminal neuropathy, mainly neuralgia in the PA type (80.0%) with a higher statistical difference from other subtypes.

This classification is useful to predict the relation between the tumor and the cranial nerves based on symptoms and images. The anterior transpetrosal approach could be used for all four subtypes and with an absolute indication in the UC and TE types showing middle fossa extension.\(^4\)

see also Orbitosphenopetroclival meningioma

see also Sphenopetroclival meningioma.

Natural History

Although the natural history of these tumors involves a slow course, the incidence of cranial nerve deficits and the extent of tumor resection vary widely in the literature. Some reviews on this topic have been conducted, but data remain fragmentary and based on retrospective case series, which hinders attempts at meta-analysis.\(^5\)

Clinical Features

These disorders appear due to the cranial nerves and brainstem compression, as well as some vertebrobasilar circulation anomalies.

Diagnosis

One of the most important and useful pieces of information in the preoperative evaluation of a large petroclival meningioma is the running course of the abducens nerve. The abducens nerve is small and has a long intracranial course, making it prone to compression by the tumor at various anatomical points. In relatively large tumors, it is difficult to confirm the entire course of the abducens nerve, even by heavy T2-thin slice imaging. Yang et al. report a case of successful preoperative estimation of the course of the abducens nerve that aided in its complete preservation during the resection of a large petroclival tumor.\(^6\)
Treatment

see Petroclival meningioma treatment.

Outcome

The petroclival meningioma impairment scale (PCMIS) provides a specific tool for quantitative assessment of the patient's state.

The rarity of the tumor, different treatment philosophies, and variations in reporting complicate the outcome analysis. With this limitation in mind, Diluna et al. analyzed the literature on this disease and report the combined outcomes in a unified fashion in hopes that it will serve as a starting point for further prospective analysis. Data was extracted from all available reports on MEDLINE/PubMed published in English. All studies were retrospective and uncontrolled. The majority of studies represent the experience of a single surgeon at a single institution. Of the 19 studies with detailed demographic and outcome data, no data met criteria for meta-analysis. A total of 1000 patients were reported. The mean age of the patients was 50 years. The male to female ratio is 1:3. GTR (gross total resection) was reported in 49% of patients. Thirty-four percent of patients experienced some neurological deficit in the early postoperative period (<3 months). The most common morbidities reported were cranial nerve deficits (34.4% [range: 20 to 79%]) with facial nerve injury accounting for 19%, followed by motor deficits (14%), infection rates (1.6%), CSF leaks (5%), hemorrhage (1.2%), and hydrocephalus (1%). Death within 1 year of surgery was reported for 1.4% of patients. Once considered untreatable, petroclival meningiomas can now be approached relatively safely. There, however, still remains an ∼34% morbidity with the most common being cranial nerve. Despite this, >75% of patients return to independence at 1 year, many of which will resume employment. The nature of this study limits the conclusions that can be drawn; however, it provides some generalizations that may help guide patient questions regarding treatment outcomes.

They were originally considered largely unresectable. Until the 1970s, resection carried a 50% mortality rate, with very high rates of operative morbidity if attempted. However, in the past 40 years, advances in neuroimaging and approaches to the region were refined, and results from resection of petroclival meningiomas have become more acceptable. Today, the developments of a multitude of surgical approaches as well as innovations in neuroimaging and stereotactic radiotherapy have proved powerful options for multimodality management of these challenging tumors.

Outcomes can be improved, however by improving patients' psychosocial support; striving to decompress, preserve, and minimize dissection of ill-defined planes of cranial nerves; and using Simpson Grade 4 gamma knife approaches when radicality is precluded. Currently, the performance of transpetrosal surgery for petroclival meningiomas is a major undertaking that significantly affects a patient's health for several years; however, the combined transpetrosal surgical approach allowed a high degree of tumor control with relatively little neurological morbidity.

Petroclival meningiomas smaller than 2 cm carry a much smaller surgical risk than large tumours, and in unselected series the small tumours dilute information regarding the problematic larger tumours. Numbers for the rate of gross total resection and surgical morbidities given in the published unselected series differ widely: gross total resection between one-third and two-thirds, and surgical morbidity also between one-third and two-thirds.
Case series

see Petroclival meningioma case series.

Case reports

A 35-year-old male patient presented with dysphagia and impaired consciousness. Magnetic resonance imaging (MRI) showed a mass lesion with a wide base located at the clivus and anterior part of brain stem. Following surgical preparations, the mass was resected through the endoscopic endonasal transclival route. Presigmoid and lateral suboccipital approaches are the most popular methods for petroclival tumors. However, the disadvantages are restricted surgical corridor to reach the anterior lesions of the brain stem, and surgical manipulations that should be performed between the cranial nerves to gain access into the pathological structures. The alternative endoscopic endonasal transclival method, which is preferred to reach these lesions anteriorly, does not have these disadvantages. The endoscopic endonasal transclival route is suitable for meningiomas located in the retroclival area. With advances in endoscopic technology and surgical experience, full endoscopic endonasal transclival approach will be an alternative for the treatment of posterior circulation aneurysms, most of the extradural and intradural lesions of the ventral aspect of brain stem, and neuralgia secondary to vascular compression.

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