Introduction

Meningiomas arising at the falcotentorial junction and in the pineal region are rare and account for about 1% of all intracranial meningiomas. Moreover, few reports in the modern literature describe these lesions, and to-date less than 100 cases are documented.

Historically, meningiomas of the falcotentorial junction were described as a subtype of meningiomas of the posterior falx by Cushing and Eisenhardt in their seminal work on meningiomas in 1938 (1). However, previous surgical reports can be found in works by Olivecrona in 1934 (2) and Balado and Tiscornia in 1927 (3). There have also been controversies as to the exact definition of pineal region meningiomas since their first description by Sachs in 1962 (4) and then Piatt and Campbell in 1983 (5). This initial series included meningiomas of the falcotentorial junction. In contrast, Stein stated that only meningiomas of the velum interpositum and freely lying in the pineal region should be considered as pineal region meningiomas (6). More recently, Konovalov considered all meningiomas in the vicinity of the pineal gland irrespective of their insertion on the falcotentorial dura as meningiomas of the pineal region (7). In contrast, Tung and Apuzzo distinguish pineal region meningioma arising from the falcotentorial junction and secondarily extending into the pineal region and the posterior third ventricle from meningiomas taking origin from the velum interpositum without dural attachment occupying the pineal region and the posterior third ventricle (8). We will describe the falcotentorial junction and pineal region meningiomas together and mention nuances in their respective management when necessary.

Special Considerations

Classification

Yasargil’s classification of tentorial meningiomas is the most used and defines 10 types of tumors according to their location on the cerebellar tentorium. Falcotentorial meningiomas are referred as T3–T8 (8–10) (Fig. 53.1A). Falcotentorial meningiomas can be further divided according to their insertion and projection on sagittal magnetic resonance imaging (MRI) as anterior or posterior and superior or inferior, and on axial MRI as midline symmetrical and midline asymmetrical (11–13) (Fig. 53-1B). Pineal region meningiomas can be classified as free-lying masses in the pineal space without dural attachment, tumors attached to the tentorium and/or the falx without functional compromise of the venous system, or tumors with attachment but with occlusion of the galenic system (7).

In 1995, Asari et al. collected 38 surgical patients with falcotentorial meningiomas described in the literature (13). Since then another 53 falcotentorial and pineal region meningiomas were described in various series (7,9,14–16) for a total number of 91. The proportion of these tumors ranges from 0.3 to 1% of different meningioma series (7,14,15).

Clinical Presentation and Natural History

The most prominent and frequent presenting clinical symptoms or signs of falcotentorial and pineal region meningiomas are headaches, gait disturbances, mental changes, papilloedema, and, less frequently, hearing impairment, visual disturbances, pyramidal deficits, diplopia or other cranial nerve deficits, urinary incontinence, or Parinaud’s sign. Obstructive hydrocephalus is present in the majority of the cases at the time of diagnosis as pineal region and falcotentorial meningiomas are often discovered when the tumors are already large due to the paucity and relative unspecific character of the symptoms. Several authors have noted the infrequency of Parinaud’s sign compared with other pineal region tumors. In our experience of nine falcotentorial meningiomas, Parinaud’s sign was never present preoperatively.

Diagnostic Studies

MRI is nowadays the gold standard diagnostic tool for meningiomas. Falcotentorial meningiomas appear as other
intracranial meningiomas on MRI: they are iso- or hypointense on T1 and T2 sequences, and they enhance more or less homogeneously upon gadolinium injection on T1-gated sequences (Fig. 53-2A,C, and E). Asari et al. found a correlation between homogeneous enhancement and meningotheliomatous features at histology as well as between heterogeneous enhancement and transitional or malignant histology (12). MRI is also used to study the invasion of meningiomas into the falcotentorial dura, which often do but may not necessarily enhance. The role of angio-MRI to study the arterial supply and especially the patency of the venous system is not clear, but it still remains inferior to digital subtraction angiography (DSA).

DSA allows studying details of the vascular anatomy, which is highly complex in this region. The arterial supply of tumors attached to the falcotentorial dura comes mainly from the internal carotid artery (ICA) meningeal branches supplying the falx and the tentorium, especially the Bernasconi-Cassinari tentorial artery (Fig. 53-3A, B). In addition, vascularization from the following arteries is common: the posterior choroidal arteries, the superior cerebellar artery (SCA), the posterior cerebral artery (PCA), the pericallosal arteries, and the meningo-hypophyseal trunk branches. Feeding from branches of the external carotid artery (ECA), such as the occipital artery, is frequent as well. Meningiomas of the velum interpositum freely lying in the pineal region are frequently attached to the tela choroidea and are more often supplied by posterior choroidal arteries (7,8,12,13,15,17). Asari et al. have carefully studied the displacement of the arterial and venous systems by falcotentorial meningiomas (13,18). The PCA is generally displaced in the quadrigeminal cistern and the posterior choroidal arteries are displaced anteroinferiorly. The vein of Galen and the internal cerebral veins are displaced anteriorly and inferiorly (Fig. 53-3C) by anterior and superior tumors, and superiorly by inferior falcotentorial meningiomas. Occlusion or stenosis of the straight sinus and the vein of Galen is common (Fig. 53-3C, D); however, compromise of the internal cerebral veins or the basal veins of Rosenthal is less frequent. Occasionally a blood flow inversion can be seen in these veins (Fig. 53-3D). It must, however, be kept in mind that not visualizing a venous sinus or a vein encased in a tumor on DSA does not mean that the structure is occluded and that it could be safely sacrificed without meticulous intraoperative examination. Collateral circulation often develops (Fig. 53-3C, D). Embolization of these tumors has been described as difficult and often not possible, and therefore, the usefulness of such a procedure remains unclear.

Surgical Technique

General Considerations

From a surgical point of view, falcotentorial and pineal region meningiomas represent challenging lesions that sum up the complexity of surgical approaches to the pineal region and of meningioma resection in deep locations.

Surgery of pineal region and falcotentorial meningiomas shares much with surgical techniques for other pineal and pineal region tumors, which can be accessed by the occipital transtentorial approach or the infratentorial supracerbellar approach. However, surgery is rendered more difficult by the specific features of meningiomas such as dural attachments, which in meningiomas are deeply located and difficult to approach, as well as venous sinus invasion, which compromise the deep venous flow draining vital cerebral structures.