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Neurootological Findings in Meningiomas of the Internal Auditory Canal and Cerebellopontine Angle

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Meningiomas arise from arachnoid villi, the apparatus responsible for cerebrospinal fluid absorption, in proximity to a major vein or dural sinus and might also be present along neural foramina at the base of the skull. In the cerebellopontine angle (CPA), 80–90% of tumors are acoustic neurinomas and only 10–15% are meningiomas, which usually originate from the meningeal lining of the petrous bone adjacent to the sigmoid or superior or inferior petrosal sinuses. Meningiomas of the petrous bone can prolapse into the CPA and internal auditory canal (IAC) or can arise directly in the IAC, growing out into the CPA. As meningiomas usually do not invade the cranial nerves in the IAC and CPA, their surgical removal can be achieved with preservation of the facial, cochlear, and even vestibular nerves, provided that the operative approach does not destroy the labyrinth, as would occur in a transotic or translabyrinthine approach.

Therefore, the correct preoperative diagnosis of meningiomas is desirable so that the surgeon can opt for a transtemporal approach, which enables the preservation of not only facial nerve function but also vestibular and cochlear function. We set out to determine whether any neurootological findings in tumors of the IAC or CPA were characteristic of meningiomas and would indicate preoperatively that a tumor originated from the meninges.

MATERIALS AND METHODS

From 1980 to 1996, 11 patients with histologically confirmed meningiomas of the CPA or IAC (or both) were operated on via the enlarged middle cranial fossa approach described by Wigand et al. [1]. Of these patients, 8 were female and 3 male, the age range was 37–70 years, and the mean age at time of presentation to our institution was 56 years. The lesion occurred on the left side in eight patients and on the right side in three. Localization of the tumors was intracanalicular in two patients, intra- and extracanalicular in six patients, solely extracanalicular in one patient, and extracanalicular touching the tentorium in two patients.

According to the classification of Wigand et al. [1], the tumor size was type A (confined to the IAC) in two patients, type B (maximal diameter of 2.5 cm into the CPA) in six patients, and type C (more than 2.5 cm into the CPA) in three patients.

Preoperatively patients complained of progressive hearing loss in seven cases and of sudden hearing loss in three cases. Seven patients suffered from dysequilibrium and five from tinnitus of the affected ear. No other cranial nerves were involved on clinical testing. The preoperative neurootological testing consisted of (1) a search for spontaneous nystagmus and positional or positioning nystagmus under Frenzel glasses and on electronystagmography, (2) caloric testing, (3) ocular motor function tests (saccadic, slow-pursuit eye movement), (4) optokinetic test, (5) rotatory testing, (6) testing of the vestibulospinal reflexes, and (7) brainstem evoked-response audiometry (BERA).

Preoperatively, all patients had pure-tone and speech audiograms, neuroradiological imaging using magnetic resonance imaging or computed tomography (or both). Operative management consisted of total removal of the meningioma through an enlarged transtemporal approach, with attempts made to preserve the facial, cochlear, and vestibular nerves.

RESULTS

Preoperative BERA

Five patients had pathological BERA. Interpeak latencies J1–J3 were prolonged in two patients, interpeak latency J1–J5 was prolonged and peak J3 was missing in one patient, and only peak J1 was preserved in two patients. One patient had completely normal results and, in one patient, data are missing. Four patients had pro-

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found sensorineural hearing loss on the affected side, so that no relevant results could be gained.

Preoperative Vestibular Results

The caloric testing showed absent caloric reaction in one patient, reduced ipsilateral caloric reaction (hypoexcitability) in five patients, and normal caloric reaction in five patients. Spontaneous nystagmus was present in no patient, but positional or positioning nystagmus was demonstrated in 7 patients. The vestibulospinal reflexes were pathological in eight patients. No signs of central vestibular lesion were noted in any patient.

Altogether, six patients had a peripheral vestibular lesion on the affected side, and two patients had nonspecific minor vestibular deficits. Among three patients with completely normal vestibular results, two had pathological findings in BERA tests.

In summary, the vestibular testing plus the BERA showed abnormal results in 10 patients that were compatible with acoustic neurinoma.

DISCUSSION

In a 16-year period from 1980 to 1996, 11 patients with meningiomas of the IAC or CPA were operated on at the Ear, Nose, and Throat Department of the University of Erlangen-Nuremberg in Erlangen, Germany. The clinical symptomatology was exclusively audiovestibular, with hearing loss in 10 patients, dysequilibrium in 7, and tinnitus in 5. In contrast, Sekhar and Jannetta [2] reported on 22 patients with CPA meningiomas, among whom trigeminal neuralgia and facial numbness were the most common presenting complaints. However, Sekhar and Jannetta predominantly operated on large meningiomas that extended to the tentorium and clivus. Also, Granick et al. [3] found in their series of 32 CPA meningiomas fifth cranial nerve symptoms second most frequent after audiovestibular problems, which generally are accepted by other authors as the most common complaints [4]. Granick et al. [3] studied the histopathology of the temporal bone in three patients with meningiomas in the region of the internal auditory meatus and demonstrated as one cause of the symptoms nerve compression and atrophy from the tumor mass.

Our results and the literature show that the clinical manifestations of meningiomas that are restricted to the IAC or CPA (or both) are the same as those of acoustic neurinomas, which comprise 80% of all CPA tumors.

Our preoperative neurootological workup showed six patients with a peripheral vestibular lesion on the affected side, two patients with minor vestibular deficits, and three patients with completely normal vestibular tests, two of whom had prolonged J1-J5 interpeak latencies in the BERA. Altogether, a single patient had normal vestibular and BERA tests, which might be found in type A acoustic neurinomas also. Our results and those of the literature prove that, preoperatively, neurootological testing cannot differentiate between acoustic neurinomas and meningiomas of the IAC or CPA. The diagnosis may be possible intraoperatively, as the tumor mass can display adhesions to the dura and bone, is abnormally red, and usually does not show invasion of cranial nerves.

Though neurootological testing does not enable differentiation between neurinomas and meningiomas in the IAC or CPA, other methods are available. In 1985, Laird et al. [5] called computed tomography the most useful method for differentiating a meningioma from a neurinoma, the meningiomas displaying characteristic findings such as a hyperdense tumor mass relative to surrounding brain tissue, sometimes even with calcification, as compared to neurinomas, which are isodense or hypodense relative to brain tissue. In addition, meningiomas characteristically are broad-based masses aligned with the petrous ridge. With the use of magnetic resonance imaging, adhesions to the tentorium or petrous bone can be visualized in meningiomas, as can the lack of an intracanalicular tumor portion, which, in contrast, is regularly present in acoustic neurinomas.

Preoperatively, normal neurootological test results can only hint at the presence of a meningioma and must be assessed together with the more important neuroradiological results to arrive at a suspicion of meningioma in the IAC or CPA.

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