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Posterior Petrous Face Meningiomas: An Algorithm for Surgical Management

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Objective: The objective of the present study was to report our surgical strategy in the management of 81 patients with posterior petrous face meningiomas.
Study Design: Retrospective study.
Setting: This study was conducted at a quaternary private otology and cranial base center.
Patients: Of 139 patients with posterior fossa meningioma, 81 occurred on the posterior petrous face of the temporal bone and were the object of this study.
Interventions: Thirty-one patients were approached by the enlarged translabyrinthine approach. The enlarged translabyrinthine approach with transapical extension Type II was performed in 29 patients. The combined retrosigmoid-retrolabyrinthine approach was chosen in 8 cases. The modified transcochlear approach Type A with permanent posterior transposition of the facial nerve (FN) was performed in 6 patients. Two patients underwent a retrolabyrinthine subtemporal transapical approach. One patient underwent a transpetrous middle cranial fossa approach. Four patients with intracanalicular meningiomas were operated on through the enlarged middle cranial fossa approach.
Results: Total removal of the tumor (Simpson Grades I and II) was achieved in most patients (92.5%). The FN was anatomically preserved in 79 of the 81 (97.5%) patients. Five patients had less than 1 year follow-up, and 2 patients were lost to follow-up and were excluded in evaluation of the final FN outcome. At 1-year follow-up, 46 patients (63%) had Grade I to II, 19 (26%) had Grade III, 4 (5.4%) had Grade IV, 1 (1.3%) had Grade V, and 3 (4.1%) had Grade VI. Hearing-preserving surgery was attempted in 15 patients (18.5%) with preoperative serviceable hearing. Of these 15 patients, 11 had their hearing preserved at the same preoperative level, and 4 experienced postoperative deafness. Postoperatively, a new deficit of 1 or more of the lower cranial nerves was recorded in 3 patients. One patient experienced subcutaneous cerebrospinal fluid collection that required surgical management.
Conclusion: Total tumor removal (Simpson Grades I–II) remains our treatment of choice and takes priority over hearing preservation. Subtotal resection is indicated for older and debilitated patients with giant lesions to relieve the tumor compression on the cerebellum and brainstem. Subtotal removal is also preferred in the face of the absence of a plane of cleavage between the tumor and the brainstem, in the presence of encasement of vital neurovascular structures, in elderly patients with tumors adherent to preoperatively normal facial or lower cranial nerves.
Key Words: Cerebellopontine angle—Meningioma—Posterior fossa—Posterior petrous face—Surgical management.
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Meningiomas constitute approximately 14% to 20% of all intracranial neoplasms and represent the second most common tumor of the cerebellopontine angle (CPA) after vestibular schwannoma, accounting for 6% to 15% of all neoplasms at this site (1–4). As stated by Henschen (5), the first reported case of a posterior petrous face meningioma (PPFM) was by Rokitansky in 1855.

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Castellano and Ruggiero (6) classified posterior fossa meningiomas according to their site of dural origin into 5 groups: cerebellar convexity, tentorium, posterior surface of the petrous bone, clivus, and foramen magnum. Desgeorges et al. (7) adopted this classification and further subdivided PPFMs on the basis of the exact site of implant in relation to the internal auditory canal (IAC). They designated meningiomas located anterior to the IAC, tumors centered on the IAC, and tumors located posterior to the IAC. Different combinations of the above are common (Fig. 1). Pure intracanalicular meningiomas are not considered in the classifications as separate entities because they are very rarely encountered neoplasms. The variable

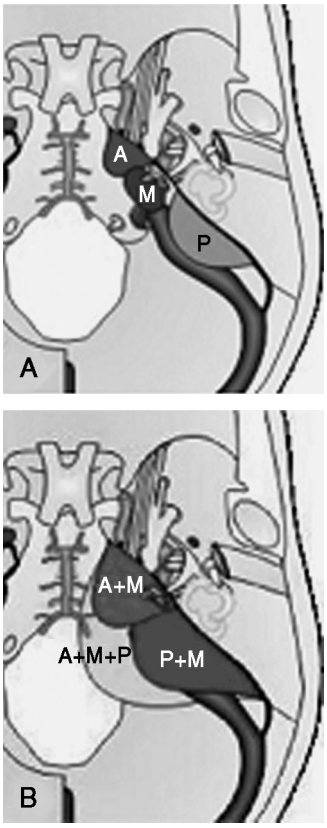

FIG. 1. Schematic drawing illustrating the different types of meningiomas related to the posterior surface of the temporal bone according to the classification of Desgeorges et al. On the basis of the exact site of implant in relation to the IAC, meningiomas may be located anterior to the IAC (*Type A*), centered on the IAC (*Type M*), and posterior to the IAC (*Type P*) (*A*). Different combinations of the above are common and summarized (*B*).

location of these tumors, the large tumor size at diagnosis, their frequent encroachment on neurovascular structures, and their potentially invasive behavior are some of the criteria that make the resection of these lesions difficult.

The aim of the present study is to report our surgical strategy in the management of PPFMs based on our experience in treating 81 of these patients.

METHODS

The charts from those patients with a histologic diagnosis of meningioma surgically treated at the Gruppo Otologico Piacenza–Rome during the period from December 1988 to July 2006 were examined retrospectively. Of 1,738 CPA tumors, 139 (7.9%) were posterior fossa meningiomas. Among them, there were 81 (58.2%) meningiomas occurring on the posterior petrous face of the temporal bone and were included in this study. Patients with tentorial, clival, petroclival, or jugular foramen meningiomas were excluded from the analysis. Also excluded were patients with neurofibromatosis Type 2. All patients underwent a complete otologic and neurologic examination. Preoperatively, 45 patients underwent gadolinium (Gd)-enhanced magnetic resonance imaging (MRI), 8 patients underwent computed tomography with contrast administration, and 28 patients underwent both computed tomographic scan and Gd-enhanced MRI. Arteriovenous magnetic resonance angiography was performed in 5 patients, and 4-vessel angiography was performed in 8 patients. The preoperative and postoperative facial nerve (FN) function was graded according to the House-Brackmann scale. Hearing results were evaluated according to the modified Sanna classification (Table 1) (8). Pure-tone average was calculated as the mean of 500, 1,000, 2,000, and 4,000 thresholds. All tumors were graded pathologically according to the World Health Organization 1993 classification system (9). The extent of tumor removal was classified according to the Simpson scale (Table 2) (10).

TABLE 1. *Modified Sanna classification (8) for reporting hearing results*

Class	Pure-tone average (dB)	Speech discrimination score (%)
A	0–20	100–80
B	21–30	79–70
C	31–40	69–60
D	41–60	59–50
E	61–80	49–40
F	≥81	39–0

RESULTS

Demographic Data

The relevant patient demographic characteristics among different groups are presented in Table 3. There were 61 (76%) women and 20 (24%) men, providing a female/male ratio of 3:1. The mean age of patients at the time of surgery was 52.2 ± 12.4 years (range, 26–77 yr). Forty-two (51.9%) tumors were on the left side, and 39 (48.1%) were on the right side. The follow-up (consisting of clinical evaluation, hearing tests, and serial computed tomographic and MRI scans) of the series ranged from 1 to 96 months (mean, 23.8 ± 19.7 mo). Two patients were lost to follow-up.

Classification of the Tumor

Distribution of tumors according to the classification system of Desgeorges et al. (7) was as follows: Type A, 4 patients (4.9%); Type M, 14 patients (17.2%); Type P, 7 patients (8.6%); Type AM, 19 patients (23.4%); Type

TABLE 2. *Classification of tumor resection according to Simpson grading (10)*

Grade	
I	Total resection of the tumor with excision of its dural and bony attachment
II	Total resection of the tumor and coagulation of its dural attachment
III	Total tumor resection without resection or coagulation of its dural attachment and its extradural extension (e.g., infiltrated sinus or bone)
IV	Subtotal tumor resection

TABLE 3. *Demographic and clinical characteristics of the study patients*

	Type of tumor							
Characteristic	A 4	M 14	P 7	AM 19	PM 9	AMP 15	Intracanalicular 13	Total 81
Age (yr)								
Mean ± SD	45 ± 10.1	55.8 ± 12.4	48.2 ± 11.5	54.4 ± 10.3	54.6 ± 11.4	52.8 ± 14.2	44.8 ± 14.7	52.2 ± 12.4
Range	31–55	38–77	36–72	36–73	40–72	27–75	26–75	26–77
Sex (n)								
Males	0	5	1	5	0	5	4	20
Females	4	9	6	14	9	10	9	61
Tumor size (cm)								
Mean ± SD	2.2 ± 0.7	2.5 ± 1.1	3.1 ± 1.8	275 ± 0.9	2.4 ± 1.6	3.5 ± 1.1	—	2.6 ± 1.3
Range	1–3	1–4.5	1–5	1–4	1–6	2–6		0–6
Symptom								
Progressive HL	2	13	1	14	6	10	11	57
Sudden HL	0	1	1	0	1	2	0	5
Tinnitus	2	9	0	3	7	6	9	36
Vertigo	0	1	2	3	2	4	6	18
Instability	0	8	3	12	4	8	7	42
Headache	0	1	3	1	0	1	0	6
Trigeminal neuralgia	0	1	0	1	0	1	0	3
Asymptomatic	0	0	1	0	0	0	0	1
Facial paresis	0	1	0	0	0	1	2	4
Gait ataxia	0	2	0	1	1	0	0	4
Hemifacial spasms	0	1	0	1	0	0	2	4
Facial anesthesia	2	0	0	2	0	2	0	7

HL indicates hearing loss; SD, standard deviation.

PM, 9 patients (11.1%); and Type AMP, 15 patients (18.5%) (Fig. 2). An intrameatal extension of the tumor was identified in 11 (16%) of the 68 tumors mentioned above. The remaining 13 patients (16%) had pure intracanalicular lesions. Tumor size measured as the largest tumor diameter of the extracanalicular component of the tumor as observed on MRI ranged from intracanalicular to 6.0 cm, with a mean of 2.6 ± 1.3 cm.

Clinical Data

Hearing loss (76.5%), tinnitus (44.4%), instability (51.8%), and vertigo (22.2%) were the most common presenting complaints. Preoperative signs and symptoms, evaluated in relation to the classification of Desgeorges et al. (7), are summarized in Table 3. The mean length of symptoms previous to presentation was 17.7 ± 18.1 months (range, 1 wk to 113 mo).

Treatment

Seventy-nine patients underwent a primary operation, and 2 patients presented with a recurrent tumor operated on elsewhere by the suboccipital approach.

The enlarged translabyrinthine approach (ETLA) was used in 30 patients, 14 of whom had a tumor centered on the IAC (Type M), 8 had a Type PM tumor, and 9 had an entirely intracanalicular tumor. Tumors centered on the IAC extending anteriorly in 14 patients (Type AM) and tumors involving the whole surface of the temporal bone (Type AMP) in 16 patients were removed via the ETLA with a transapical (TA) extension Type II. The ETLA-TA is an anterior extension of the ETLA in which the IAC is drilled for 360 degrees of its circumference, providing the surgeon increased exposure of the CPA in the direction of the petrous apex and prepontine cistern. To achieve this goal, once the dura of the IAC is exposed for 270 degrees as in the ETLA, bone is further removed inferior to and superior to the IAC toward the petrous apex. The contents of the IAC with the surrounding dura are shifted inferiorly with the suction irrigator to allow for drilling of the anterior wall of the canal. The surgical details of this approach have already been published (11). The combined retrosigmoid-retrolabyrinthine (RS-RL) approach was chosen in all 7 patients with a tumor located posteriorly to the IAC (Type P) and in 1 patient with a tumor centered on the IAC extending posteriorly (Type PM) without intrameatal involvement. The modified transcochlear approach (MTCA) Type A with permanent posterior transposition of the FN was adopted for Type AM tumor removal in 5 patients and for Type A tumor removal in 1 patient. Two patients with Type A tumor underwent a combined retrolabyrinthine subtemporal TA approach. In 1 patient with Type A tumor, a transpetrous middle cranial fossa approach was performed. Four patients with intracanalicular meningiomas underwent an enlarged middle cranial fossa approach (EMCFA). In 2 patients (1 Type M, 1 Type AMP), the FN had to be sacrificed because there was tumor infiltration, and a sural nerve grafting in the CPA was performed.

Histology

The histologic examination of the tumors according to World Health Organization classification (9) revealed the following subtypes: meningioendothelial (39 patients),

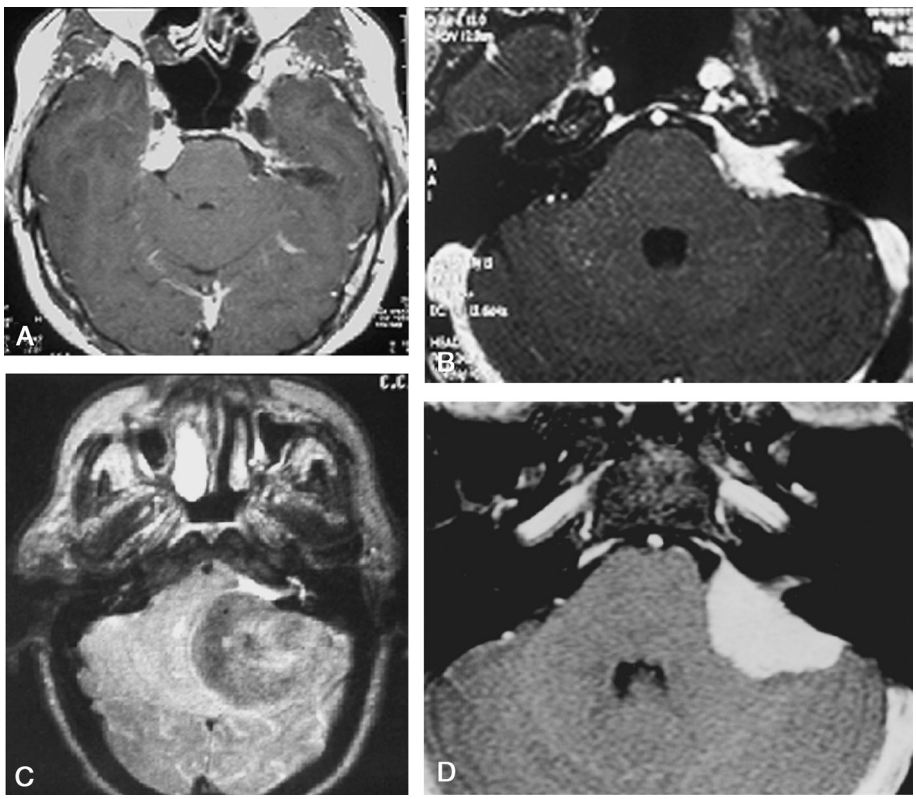

FIG. 2. *A*, Axial contrast-enhanced T1-weighted MR image showing a small right-sided posterior petrous face meningioma lying anterior to the IAC (Type A). *B*, Axial MRI angiography showing a left-sided posterior petrous face meningioma centered on the IAC (Type M). *C*, Axial T2-weighted MR image showing a slightly hypointense left-sided huge posterior petrous face meningioma lying posterior to the IAC (Type P). *D*, Axial contrast-enhanced T1-weighted MR image showing a meningioma involving the whole posterior surface of the right temporal bone (Type AMP).

transitional (20 patients), psammomatous (2 patients), fibroblastic (15 patients), angiomatous (3 patients), and mixed (2 patients).

Tumor Removal/Recurrences

Gross total tumor removal (Simpson Grade I–II) was achieved in 75 patients (92.5%) (Table 4).

Four patients had subtotal tumor removal because of the tumor's tight adherence to the brainstem that led to changes in the patient's vital signs during the dissection of the tumor. Subtotal removal was also accomplished in 1 patient in which no cleavage plane between the tumor and cerebellum was found. A 75-year-old woman with normal preoperative lower cranial nerve function had a residual tumor left in the region of the lower cranial nerves.

All patients with subtotal tumor removal were followed radiographically for 23 ± 8.5 months (range, 15–36 mo), and 5 showed no evidence of regrowth. In the remaining case in which the tumor was left on the cerebellum surface, an MRI performed 1 year later showed a 2.5-cm CPA mass. A second operation was

TABLE 4. *Extent of resection according to Simpson scale (10) and follow-up*

	Tumor type							
	A	M	P	AM	PM	AMP	Intracanalicular	Total
	4	14	7	19	9	15	13	81
Simpson grade								
I-II	4	13	7	17	8	13	13	75
III	—	—	—	—	—	—	—	—
IV	—	1	—	2	1	2	—	6
Follow-up (mo)								
Mean ± SD	45.7 ± 33	32.2 ± 21.5	30 ± 24.3	19.2 ± 11.9	25.4 ± 15.5	18.2 ± 14.7	14.6 ± 5.5	23.8 ± 19.7
Range	12–91	2–74	5–66	2–42[a]	8–48	1–37	4–24	1–96

[a]Two patients were lost to follow-up.

planned, but the patient did not consent to a second surgery. This patient received stereotactic radiotherapy. The same patient was subsequently lost to follow-up.

No residual/recurrence has been detected on annual MRI scanning in the rest of the patients.

Facial Nerve Results

Facial nerve function was reported for 3 specific intervals: preoperative, immediately postoperative, and after a minimum of 1 year of follow-up. Tables 5 and 6 show the outcome of FN function depending on tumor location and surgical approach.

Preoperatively, 78 patients (96.3%) had Grade I FN function, 1 (1.2%) had Grade II (intracanalicular), 1 had Grade III (intracanalicular), and 1 had Grade VI (Type M). The FN was anatomically preserved in 79 of the 81 (97.5%) patients. Two patients (2.5%) were noted to have FN transection after the tumor was removed. Seventy-four patients (91.3%) had a follow-up period for postoperative FN function of at least 1 year. Five patients had less than 1 year follow-up, and 2 patients were lost to follow-up and were excluded in evaluation of the final FN outcome. At 1-year follow-up, 46 patients (63%) had Grades I to II, 19 (26%) had Grade III, 4 (5.4%) had Grade IV, 1 (1.3%) had Grade V, and 3 (4.1%) had Grade VI. The 2 patients with intracanalicular tumors with preoperative FN paresis showed no improvement in their FN function. The 6 patients who were operated on by MTCA-A underwent permanent posterior transposition of the FN. At 1-year follow-up, 3 of these patients reached Grade III, 2 had Grade IV, and 1 had Grade VI. The 2 patients (1 with Type M tumor and 1 with Type AM tumor) who had interruption of the FN during the tumor removal had nerve reconstruction with a sural nerve graft in the CPA. One (Type M) of these 2 patients had preoperative Grade VI and did not recover its function, and the remaining one (Type AM) reached Grade 3 after 1 year of follow-up.

TABLE 5. *Facial nerve outcome based on tumor type*

Tumor type	Preoperative (n = 81)	Immediate postoperative (n = 81)	At 1-yr follow-up (n = 74)
A	4 (I)	3 (I)	3 (I)
	—	1 (VI)	1 (III)
M	13 (I)	2 (I)	7 (I)
	1 (VI)	3 (III)	1 (II)
	—	1 (IV)	3 (III)
	—	2 (V)	1 (IV)
	—	6 (VI)	1 (VI)
P	7 (I)	6 (I)	5 (I)
	—	1 (VI)	1 (III)
AM	19 (I)	1 (I)	5 (I)
	—	1 (II)	2 (II)
	—	1 (III)	6 (III)
	—	2 (IV)	3 (IV)
	—	14 (VI)	1 (VI)
PM	9 (I)	3 (I)	5 (I)
	—	1 (II)	4 (III)
	—	1 (III)	—
	—	1 (IV)	—
	—	3 (VI)	—
AMP	15 (I)	2 (I)	5 (I)
	—	2 (II)	3 (II)
	—	1 (IV)	3 (III)
	—	10 (VI)	1 (V)
	—	—	1 (VI)
Intracanalicular	11 (I)	4 (I)	8 (I)
	1 (II)	3 (II)	2 (II)
	1 (III)	2 (III)	2 (III)
	—	4 (VI)	—

TABLE 6. *Facial nerve outcome based on surgical approach*

Surgical approach	Preoperative 81	Immediate postoperative 81	At 1-yr follow-up 74
MTCA Type A	6 (I)	6 (VI)	3 (III)
	—	—	2 (IV)
	—	—	1 (VI)
Middle fossa transpetrous	1 (I)	1 (I)	1 (I)
Retrolabyrinthine subtemporal-transapical	2 (I)	2 (I)	2 (I)
ETLA	29 (I)	7 (I)	18 (I)
	1 (III)	3 (II)	2 (II)
	1 (VI)	5 (III)	7 (III)
	—	2 (IV)	1 (IV)
	—	2 (V)	1 (VI)
	—	12 (VI)	—
RS-RL	8 (I)	7 (I)	6 (I)
	—	1 (VI)	1 (III)
ETLA-TA Type II	29 (I)	3 (I)	10 (I)
	—	3 (II)	5 (II)
	—	1 (III)	7 (III)
	—	3 (IV)	1 (IV)
	19 (VI)	1 (V)	
	—	—	1 (VI)
EMCFA	3 (I)	1 (I)	1 (I)
	1 (II)	1 (II)	2 (II)
	—	1 (III)	1 (III)
	—	1 (VI)	—

EMCFA indicates enlarged middle cranial fossa approach; ETLA, enlarged translabyrinthine approach; ETLA-TA type II, enlarged translabyrinthine approach with transapical extension type II; MTCA, modified transcochlear approach; RS-RL, retrosigmoid-retrolabyrinthine approach.

Hearing Status

Our protocol of patient selection for hearing preservation is very strict. We were' not tempted to preserve hearing in Types M, AM, and PM tumors larger than 2 cm irrespective of the preoperative hearing status and in patients with unserviceable preoperative hearing (Sanna Classes C, D, E, F). The preoperative ipsilateral hearing was already compromised (pure-tone average >30 dB and speech discrimination score <70%) in 47 of the 81 patients (58%). In the remaining 34 patients, the tumor was larger than 2 cm.

Hearing-preserving surgery was attempted in 15 patients (18.5%) with preoperative serviceable hearing (Sanna Classes A and B) through the EMCFA (4 patients), the RL-RS approach (8 patients), the middle cranial fossa transpetrous approach (1 patient), and the

TABLE 7. *Hearing results based on tumor type and surgical approach*

Case	Tumor type	Approach	Preoperative class	Postoperative class
1	A	Middle fossa transpetrous	A	A
2	A	Retrolabyrinthine subtemporal-transapical	A	F
3	A	Retrolabyrinthine subtemporal-transapical	B	B
4	P	RS-RL	A	A
5	P	RS-RL	A	A
6	P	RS-RL	A	A
7	P	RS-RL	A	A
8	P	RS-RL	A	A
9	P	RS-RL	A	A
10	P	RS-RL	B	B
11	PM	RS-RL	B	F
12	Intracanalicular	EMCFA	A	A
13	Intracanalicular	EMCFA	A	A
14	Intracanalicular	EMCFA	B	F
15	Intracanalicular	EMCFA	B	F

EMCFA indicates enlarged middle cranial fossa approach; RS-RL, retrosigmoid-retrolabyrinthine approach.

retrolabyrinthine-subtemporal-TA (2 patients). The results with respect to hearing preservation are summarized in Table 7.

Complications

There were no perioperative or postoperative deaths in this series. A deficit of 1 or more of the lower cranial nerves was recorded in 3 patients with Type M tumors: 1 of them had paralysis of cranial nerves IX and X; 1 had paralysis of cranial nerves IX, X, and XI; and the remaining one had an isolated loss of cranial nerve IX. On long-term follow-up, all patients were able to compensate well for their lower cranial nerve deficits by the help of speech and swallowing rehabilitation.

One patient (1.2%) operated on through a RS-RL approach for a Type P tumor experienced subcutaneous cerebrospinal fluid collection that required surgical management. At the revision surgery, a defect in the dura was identified as the route of the leak. There were no patients of cerebrospinal fluid rhinorrhea.

One patient with Type AM tumor had transient paralysis of cranial nerves III, IV, and VI. Subcutaneous abdominal hematoma at the site of fat harvest occurred in 1 patient operated on via the ETLA.

DISCUSSION

In our opinion, surgery should be the primary treatment for PPFMs. Recently, radiotherapy has been advocated as a primary therapeutic option in patients with CPA meningiomas (14,15). We do not consider radiotherapy as an adequate primary treatment of these tumors. The efficiency of radiotherapy in long-term tumor control is still unknown, and further studies with longer follow-up are necessary. However, radiotherapy may constitutes a good alternative to surgery in selected cases in which there are serious contraindications to surgery (i.e., critical general medical conditions, elderly patients) and in cases with partial excision or with high risk of recurrence. All the patients in our series were informed of the risks and benefits of surgical excision, stereotactic radiosurgery, or observation with serial imaging.

Although total tumor removal is expected most patients, subtotal removal is considered in patients in which a total removal would carry a high risk of neurologic deficits. Preoperatively, the decision for subtotal removal can be taken in the presence of giant lesions where the plan can be tumor debulking to relieve the tumor compression on the cerebellum and brainstem particularly in elderly patients. Intraoperatively, subtotal removal is preferred in the face of the absence of a plane of cleavage between the tumor and the brainstem, in the case of encasement of vital neurovascular structures, in elderly patients with tumors adherent to preoperatively normal facial or lower cranial nerves.

Nowadays, 2 principal approaches are being adopted to remove PPFMs irrespective to the tumor location and size: the translabyrinthine approach (3,16,17) (which is mainly used in patients in which hearing is unserviceable) and the retrosigmoid approach (4,16,18–22), with the latter being preferred by many.

In our center, we adopt an individualized strategy based on the tumor location, tumor size, the presence of the tumor at the fundus of the IAC, and the preoperative hearing level in addition to considering the patient's age. Figure 3 displays the algorithm we propose to decide which surgical approach can be used in PPFMs.

Tumors Lying Posterior to the IAC

Tumors lying posterior to the IAC (Types P and PM) on patients with good preoperative hearing can be approached via the combined RS-RL route. We stopped performing the classic retrosigmoid approach. Adding a retrolabyrinthine craniotomy offers the advantage of obtaining a significant increase of the surgical field by displacing the sigmoid sinus forward, with avoidance of cerebellar retraction. In Types P and PM tumors on patients with bad preoperative hearing, in elderly patients, or in patients with a poor general status, we aim for minimal cerebellar retraction, and the ETLA is our route of choice.

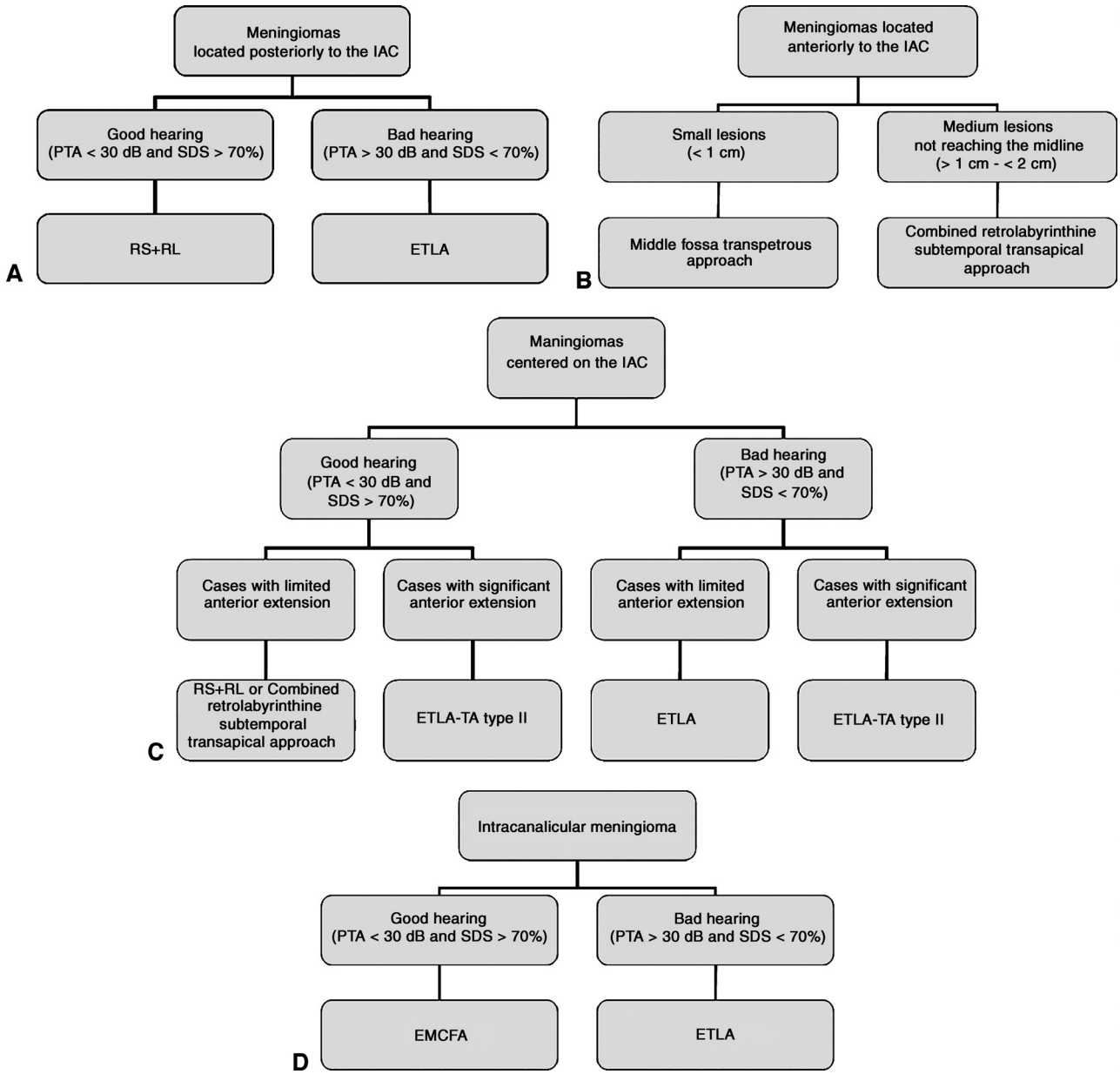

FIG. 3. *A–D*, Algorithms for the surgical management of the various types of posterior petrous face meningiomas. SDS indicates speech discrimination score.

Tumors Centered on the IAC

Small meningiomas centered on the IAC without extension into the IAC (Type M) and with good preoperative hearing are managed with an RS-RL approach. Patients with anterior extension (Type AM) can be managed with a retrolabyrinthine subtemporal TA approach. Patients with a Type M tumor in which hearing preservation is not attempted are best managed with the ETLA. If significant anterior extension is present, an ETLA-TA Type II is adopted. Among the advantages of this approach, we outline the possibility of removal of the dura of the anterior wall of the IAC that might be involved in meningiomas and the better control of the prepontine cistern, trigeminal nerve up to the Meckel cave, abducent nerve, and basilar artery.

Alternatives to the ETLA-TA Type II approach to access tumors with anterior extension have included the petrosal approach (17), the MTCA Type A approach (23), and the RS approach (4,16,18–22). The MTCA Type A needs posterior transposition of the FN. We used the MTCA for Type A and Type AM tumors before adopting the concept of TA extension of the ETLA. We still consider the MTCA only in rare cases of meningioma with concomitant invasion of the prepontine cistern (23). The ETLA-TA Type II approach provides a wide access to the anterior compartment of the CPA

without any cerebellar retraction providing better access to the site of origin of meningiomas and reduces recurrence. Disadvantages of this approach are hearing loss and increased drilling time.

Tumors Lying Anterior to the IAC

Further difficulty was encountered in tumors located anteriorly to the IAC (Type A). These patients usually have good preoperative hearing. They are managed according to the following paradigm: small lesions are managed by a middle fossa transpetrous approach as described by House et al. in 1986 (24). These authors reported the use of this approach for anterior superior CPA lesions as an alternative to the transcochlear approach where hearing preservation was desirable; medium lesions not reaching the midline can be managed through a retrolabyrinthine subtemporal TA approach with or without transtentorial extension.

Intracanalicular Tumors

Intracanalicular meningiomas can be resected via the EMCFA to preserve hearing, whereas the ETLA is performed in patients with preoperative unserviceable hearing.

Comparison of outcomes in different series is difficult to achieve because various topographic classifications and different surgical approaches for removal of these lesions have been used by each author. In accordance with others (4,12,17,22,25,26), we found that total resection and hearing and FN function preservation was more difficult for premeatal than for retromeatal meningiomas. Overall, the total removal rate ranges from 82.9 to 94.6% (4,12,14,16,18,20,21). We achieved gross total tumor removal (Simpson Grades I–II) in 92.5% of patients.

Some authors stated that the probability of hearing preservation is higher for CPA meningiomas than for vestibular schwannomas because of the extraneural origin of meningiomas (26,27). We think that this assumption is true with PPFMs located posterior to the IAC. In accordance with Voss et al. (17), we attempt hearing preservation surgery when tumors arise posterior to the IAC, when there is minimal IAC involvement, and there is an absence of invasion of inner ear structures. In addition, we never attempt hearing preservation surgery in all cases of tumors with unserviceable hearing (independent of the size of the tumor) and in all cases of large tumors despite the presence of good hearing.

CONCLUSION

Total tumor removal remains our treatment of choice and takes priority over hearing preservation.

Subtotal resection is indicated for older and debilitated patients with giant lesions to relieve the tumor compression on the cerebellum and brainstem. We also preferred subtotal removal in the face of the absence of a plane of cleavage between the tumor and the brainstem, in the presence of encasement of vital neurovascular structures, and in elderly patients with tumors adherent to preoperatively normal facial or lower cranial nerves.

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