Olfactory Groove Schwannoma

—Case Report—

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Abstract

A 30-year-old man presented with a 2-year history of intermittent headache. No neurological deficit was detected. Computed tomography (CT) and magnetic resonance imaging showed a tumor with a diameter of 2.5 cm in the left anterior skull base associated with bone scalloping on three-dimensional CT. Angiography showed a hypovascular tumor. Craniotomy demonstrated a tumor in the region of the left olfactory groove attached to the anterior part of the cribriform plate. The histological diagnosis was schwannoma. Schwannoma arising from near the olfactory groove is rare, with only 13 other cases reported. The precise origin of these tumors is not well understood, but the tumor in this case probably arose from the fila olfactoria, because the olfactory bulb was involved in the tumor, whereas the olfactory tract remained intact.

Key words: olfactory groove, schwannoma

Introduction

Schwannomas are benign, slowly growing nerve sheath tumors which can arise from any peripheral nerve containing Schwann cells including distal portions of the cranial nerves. However, the optic and olfactory nerves do not have a Schwann cell layer and so schwannoma cannot develop. Solitary schwannomas arising from around the olfactory groove are rare with only 13 reported cases,^{1-4,6-11, 14-16)} although some cases are associated with von Recklinghausen disease.¹²⁾ We report a case of a young male with a schwannoma incidentally detected after complaints of slight headache, and present the characteristic radiological findings with discussion of the tumor origin.

Case Report

A 30-year-old man was admitted to our hospital on March 13, 2003, complaining of intermittent headache persisting for 2 years. There was no family history of note, in particular no history of von Recklinghausen disease. His medical history included hypertension. Magnetic resonance (MR) imaging, which was performed to investigate the persistent

Fig. 1 T₁-weighted magnetic resonance images with gadolinium (A: axial section, B: sagittal section) demonstrating a subfrontal tumor with homogeneous enhancement in the left anterior cranial fossa.

slight headache at the Department of Internal Medicine, disclosed an extra-axial mass with a diameter of 2.5 cm in the left subfrontal region (Fig. 1).

On admission to our department, neurological examination was entirely normal including anosmia. Angiography of the left internal and external carotid arteries showed a hypovascular lesion without the typical signs of meningioma such as sun-burst appearance (Fig. 2). Three-dimensional computed tomography (3DCT) of the skull demon-

strated erosion of the left cribriform plate (Fig. 3). The tentative radiological diagnosis was olfactory groove or falx meningioma.

A semi-coronal skin incision and left frontal craniotomy were performed. The intradural approach showed the tumor was closely attached to the

dura of the anterior part of the cribriform plate, but no attachment to the falx. The left olfactory bulb,

Fig. 2 Left internal carotid (A) and external carotid (B) angiograms showing a hypovascular tumor without typical signs of meningioma.

Fig. 3 Three-dimensional computed tomography scan of the skull base demonstrating erosion of the left cribriform plate.

Fig. 4 Photomicrographs of the tumor specimen. A, B: The tumor consisted of alternating areas of compact, elongated cells (A: Antoni A pattern) and less cellular, loosely textured tumor areas (B: Antoni B). Hemotoxylin and eosin stain, $\times 100$. C, D: Immunohistochemical examination showed the tumor cells strongly and diffusely expressed S-100 protein (C) and vimentin (D). $\times 400$.

Table 1 Summary of 14 cases of subfrontal schwannoma

Case No.	Author (Year)	Age (yrs)	Sex	Initial symptom/ preoperative duration	Chief complaint on admission	Bony erosion on radiological imaging	Attachment	Detection of intact olfactory nerve(s)
1	Sehrbunt et al. (1973) ¹¹	22	M	decreased visual acuity/3 mos	decreased visual acuity	—	n.d.	n.d.
2	Harano et al. (1974) ³¹	26	F	convulsion/—	convulsion	n.d.	anterior skull base	yes
3	Ulrich et al. (1978) ¹⁵	19	M	convulsion/5 yrs	decreased visual acuity	n.d.	olfactory groove	no
4	Vassilouthis and Richardson (1980) ¹⁶	17	M	diminishing ability at school/2 yrs	headache	+	falx	n.d.
5	Mauro et al. (1983) ⁶	44	F	amaurosis of the right eye/2 yrs	asthenia and reduction of short-term memory	+	crista galli	n.d.
6	Sato et al. (1985) ¹⁰	22	M	headache/3 yrs	convulsion	—	olfactory groove	no
7	Nagao et al. (1991) ⁷	63	F	recent memory disturbance/1 mo	recent memory disturbance	—	olfactory groove	yes
8	Bando et al. (1992) ²	55	F	hyposmia (1st operation at the age of 28)/n.d., defect of visual field (2nd operation at the age of 55)/n.d.	hyposmia, defect of visual field	n.d. +	n.d. not determined	n.d. no
9	Husain et al. (1992) ⁴	30	M	headache/18 mos	impaired vision	—	cribriform plate	no
10	Sabel and Teeppen (1995) ⁹	17	M	convulsion/—	convulsion	n.d.	anterior skull base	no
11	Praharaj et al. (1999) ⁸	45	M	headache/6 mos	convulsion	n.d.	cribriform plate	no
12	Timothy et al. (1999) ¹⁴	33	F	convulsion/5 yrs	convulsion	n.d.	crista galli	yes
13	Amador et al. (2002) ¹	24	F	hypesthesia on the left side of face/ 2 wks	impaired vision	+	olfactory groove	no
14	Present case	30	M	slight headache/ 2 yrs	slight headache	+	cribriform plate	no (olfactory bulb was not detected)

n.d.: not described.

which was involved with the tumor, could not be identified. The proximal side of left olfactory tract was intact, whereas the olfactory tract near the tumor was flat and continued to the tumor. The dural attachment was well coagulated after total resection of the tumor.

Postoperative MR imaging showed total excision of the lesion. Histological examination demonstrated that the tumor consisted of spindle-shaped cells with alternating areas of compact (Antoni A pattern) and less cellular, loosely textured tumor areas (Antoni B). Immunohistochemical studies revealed that the tumor cells were positive for S-100 protein and vimentin, and negative for CD34 and epithelial membrane antigen (Fig. 4). The final diagnosis was schwannoma.

Discussion

Only 13 cases of solitary schwannoma around the olfactory groove have been described in the English and Japanese literature (Table 1).^{1-4,6-11,14-16} Olfactory groove schwannomas may originate from either the olfactory bulb and nerve, or an intracranial 'peripheral' nerve such as the anterior ethmoid nerve, or the meningeal branches of the trigeminal nerve. The origin of the tumor in Cases 2, 7, and 12 was speculated as the anterior ethmoid nerve or the meningeal branches of the trigeminal nerve, since the intact olfactory nerve and bulb could be identified. In our case, the tumor was incidentally detected in a patient with a slight headache, and was so small that we could more easily detect the origin of the tumor. The small attachment of the dura at the cribriform plate and involvement of the olfactory

bulb by the tumor suggested that the origin of the tumor was the fila olfactoria. The fila olfactoria is known to acquire a Schwann cell sheath approximately 0.5 mm beyond the olfactory bulb.¹³⁾

Meningioma may be the most likely candidate in the differential diagnosis of an extra-axial anterior fossa tumor. In our case, angiography of the left external carotid artery demonstrated a hypovascular tumor associated with bone erosion but no sclerotic changes of the cribriform plate on skull 3DCT. Radiography showed bone erosion in four of the 13 previous cases (Cases 4, 5, 8, and 13), whereas the anterior skull fossa was not affected in four cases (Cases 1, 6, 7, and 9). Radiography can detect erosion of the skull only in the case of a large tumor, whereas skull 3DCT can detect trivial changes in the skull such as the scalloping that had occurred in our case. If 3DCT had been performed in the latter four cases, bone erosion might have been demonstrated.

The age and sex distribution of these 14 subfrontal schwannomas are characteristic. The mean age at presentation of the 14 cases, including our case, was 31.9 ± 14.5 years (Table 1), which is younger than that of schwannoma at other common sites. Patients of all ages are affected by schwannoma, but generally there is a peak incidence in the fourth to sixth decades.⁵⁾ Furthermore, eight were male and six were female among these 14 patients, whereas there is a female:male ratio of 2:1 for intracranial schwannoma.⁵⁾ The cause of these clinical characteristics remains uncertain, but these clinical features and the radiological findings of skull erosion and lower vascularity may facilitate the preoperative diagnosis of schwannoma in the differential diagnosis of meningioma.

References

- 1) Amador AR, Santonja C, Del Pozo JM, Ortiz L: Olfactory schwannoma. *Eur Radiol* 12: 742-744, 2002
- 2) Bando K, Obayashi M, Tsuneharu F: [A case of subfrontal schwannoma]. *No Shinkei Geka* 20: 1189-1194, 1992 (Jpn, with Eng abstract)
- 3) Harano H, Hori S, Kamata K, Shinohara T, Toyama K, Nemoto H, Nakayama K: [A case report of subfrontal schwannoma]. *No Shinkei Geka* 2: 643-647, 1974 (Jpn, with Eng abstract)
- 4) Husain M, Mishra UK, Newton G, Husain N: Isolated olfactory groove neurilemmoma. *Surg Neurol* 37: 115-117, 1992
- 5) Kleihues P, Cavenee WK (eds): *Pathology and Genetics of Tumours of the Nervous System*. Lyon, International Agency for Research on Cancer, 2000, pp 163-166
- 6) Mauro A, Sciolla R, Sicuro L, Ponzio R: Solitary neurinoma of the anterior cranial fossa. *J Neurosurg Sci* 27: 45-49, 1983
- 7) Nagao S, Aoki T, Kondo S, Gi H, Matsunaga M, Fujita Y: [Subfrontal schwannoma: a case report]. *No Shinkei Geka* 19: 47-51, 1991 (Jpn, with Eng abstract)
- 8) Prahraj SS, Vajramani GV, Santosh V, Shankar SK, Kolluri S: Solitary olfactory groove schwannoma: case report with review of the literature. *Clin Neurol Neurosurg* 101: 26-28, 1999
- 9) Sabel LHW, Teepen LJLM: The enigmatic origin of olfactory schwannoma. *Clin Neurol Neurosurg* 97: 187-191, 1995
- 10) Sato S, Toya S, Nakamura T, Ohtani M, Imanishi T, Kodaki K, Nakamura Y: [Subfrontal schwannoma: report of a case]. *No Shinkei Geka* 13: 883-887, 1985 (Jpn, with Eng abstract)
- 11) Sehrbunt V, Pau A, Turtas S: Olfactory groove neurinomas. *J Neurosurg Sci* 17: 193-196, 1973
- 12) Spiller WG, Hendrickson WF: A report of two cases of multiple sarcomatosis of the central nervous system and of one case of intramedullary primary sarcoma of the spinal cord. *Am J Med Sci* 126: 10-33, 1903
- 13) Tarlov IM: Structure of the nerve root. II. Differentiation of sensory from motor roots; observations on identification of functions in roots of mixed cranial nerves. *Arch Neurol Psychiatry* 37: 338-355, 1937
- 14) Timothy J, Chakrabarty A, Rice A, Marks P: Olfactory groove schwannoma revisited. *Acta Neurochir (Wien)* 141: 671-672, 1999
- 15) Ulrich J, Levy A, Pfister C: Schwannoma of the olfactory groove. Case report and review of previous cases. *Acta Neurochir (Wien)* 40: 315-321, 1978
- 16) Vassilouthis J, Richardson AE: Subfrontal schwannoma. Report of a case. *Acta Neurochir (Wien)* 53: 259-266, 1980

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