Neurol Med Chir (Tokyo) 44, 591～594, 2004

Subfrontal Schwannoma Without Hyposmia

—Case Report—

Hiroki SANO, Yutaka HAYASHI, Mitsuhiro HASEGAWA, and Junkoh YAMASHITA

Department of Neurosurgery, Kanazawa University Hospital, Kanazawa

Abstract

A 44-year-old man presented with a rare subfrontal schwannoma with headache. He had undergone radiation therapy for a pineal lesion 30 years previously, but the histology was not verified. On admission, neurological examination revealed no focal deficits including hyposmia. Computed tomography demonstrated a mass measuring 5 × 3 cm in the right anterior cranial fossa. Magnetic resonance imaging revealed a heterogeneously enhanced mass with multiple cysts. The tumor, which was clearly separable from the surrounding normal brain, was totally resected through a right frontal craniotomy. There was no adhesion between the tumor and the olfactory groove or cribriform plate. The frontal base dura was suspected to be the tumor attachment. The patient was discharged without hyposmia. Histological examination revealed a typical pattern of schwannoma consisting of Antoni type A and type B. Immunohistochemical staining was positive for S-100 protein but negative for epithelial membrane antigen. Subfrontal schwannoma not associated with the olfactory groove or cribriform plate is extremely rare. The operative findings and absence of hyposmia suggest that the meningeal branch of the trigeminal nerve was the origin of the tumor. However, the possibility of radiation-induced reactive Schwann cells cannot be excluded.

Key words: subfrontal schwannoma, hyposmia, irradiation

Introduction

Schwannomas usually arise from the vestibular nerve, and rarely from the trigeminal nerve, facial nerve, and lower cranial nerves.[12,14,19] Intracranial schwannomas comprise 6% to 8% of intracranial tumors, and are extremely rare not associated with any cranial nerve. Only 18 cases of subfrontal schwannoma have been reported usually presenting with hyposmia preoperatively.[1–3,5–8,10–12,14,16,18–21] Only three cases were unassociated with the olfactory groove or cribriform plate.[1,6,8] Several investigators suggested these schwannomas may have originated from Schwann cells normally present on the meningeal branches of the trigeminal nerve in the subfrontal dura, hamartomatous Schwann cells, and aberrant Schwann cells arising from multipotential mesenchymal pial cells in pathological conditions.[1,4,6,13] We report a case of subfrontal schwannoma not associated with olfactory groove or cribriform plate in a 44-year-old man who had received local radiation therapy 30 years earlier.

Case Report

A 44-year-old man had undergone suboccipital craniotomy 30 years previously for a suspected tumor in the pineal region, but no definitive lesion was found. Ventriculoperitoneal shunting for hydrocephalus and irradiation (44 Gy) of a 5 cm × 5 cm area covering the pineal region were then performed. He presented to our hospital in 2002 with a complaint of frontalgia. Neurological examination revealed no remarkable deficits, and olfactometry and intravenous olfaction testing were within the normal limits. Computed tomography revealed an isodense to hypodense lesion measuring 5 cm × 3 cm in the right anterior cranial fossa (Fig. 1A). Magnetic resonance imaging revealed a heterogeneously enhanced mass (Fig. 1B, C). The lesion partly overlapped with the irradiation field performed 30 years earlier (Fig. 1C). Internal carotid angiography revealed a shift of the anterior cerebral artery from the right to the left. Internal and external carotid angiography revealed no feeding artery or tumor

Received September 16, 2003; Accepted May 21, 2004
Author's present address: Y. Hayashi, M.D., Department of Neurosurgery, Toyama City Hospital, Toyama, Japan.

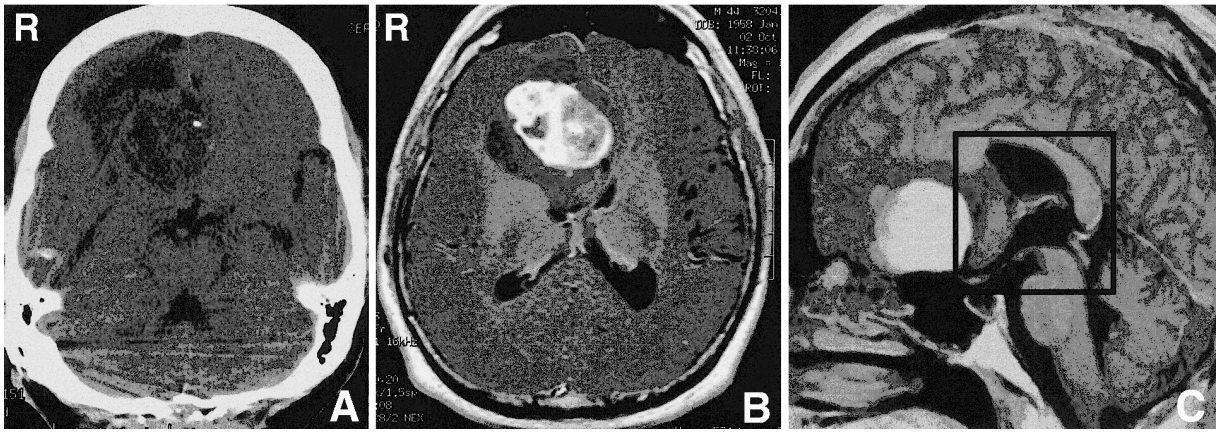

Fig. 1 Preoperative computed tomography scan (A) and T_1-weighted magnetic resonance images with gadolinium (B, C) demonstrating the subfrontal mass, and the previous radiation field (*square*) (C).

stain.

The patient underwent right frontal craniotomy, and the tumor was totally resected. The tumor was yellowish-white in color and easily separable from the surrounding normal brain. Attachment to the dura of the frontal base was suspected, but no adhesions to the olfactory groove or cribriform plate were recognized. Intraoperatively, the tumor was difficult to distinguish from meningioma. The patient did well postoperatively, with no neurological deficits or decreased sense of smell.

Histological examination revealed that the tumor consisted of a highly cellular part consisting of spindle cells with elongated oval nuclei, and a poorly cellular part consisting of an unstructured meshwork of loosely disposed cells. Immunohistochemical staining was negative for epithelial membrane antigen and positive for S-100 protein. Reticulin silver staining showed dense patterns of fine reticular fibers around individual cells (Fig. 2). The histological diagnosis was schwannoma.[9,15,17,22]

Discussion

Only three previous cases of subfrontal schwannoma were unassociated with the olfactory groove or cribriform plate (Table 1).[1,6,8] Several hypotheses have been proposed to explain the origin of intracranial schwannomas not arising from cranial nerves: Schwann cell hyperplasia, i.e., Schwann cells localized within the perivascular nerve plexuses,[13] the meningeal branch of the trigeminal nerve in the anterior cranial fossa, or the anterior ethmoidal nerve around the cribriform plate[21]; schwannosis, i.e., a hamartomatous lesion consisting of Schwann cells as a result of displaced neural crest, usually occurring in young males, and often associated with von Recklinghausen's disease[14,20]; reactive changes after injury, i.e., Schwann cells reactively arising from multipotential mesenchymal cells after injury in a patient with a pathological condition such as multiple sclerosis or cerebral infarction.[1,4,6,13] Candidate tumor origins were suggested in two of the three reported cases of subfrontal schwannomas not associated with the olfactory groove or cribriform plate (Table 1).

Our patient was middle-aged and unaffiliated by von Recklinghausen's neurofibromatosis, so the tumor origin was less likely to be a hamartomatous lesion of central schwannosis. The tumor was attached to the dura of the frontal base, so we concluded that the most likely tumor origin was the meningeal branch of the trigeminal nerve in the frontal base. However, since the tumor partly overlapped the previously irradiated field, we could not rule out the possibility that the tumor arose from Schwann cells reactively generated arising as a result of cell injury by the irradiation.

Subfrontal schwannomas unassociated with the olfactory groove or cribriform plate are extremely rare. The origin of the tumor was probably the meningeal branch of the trigeminal nerve in the dura of the frontal base, but involvement of the previous irradiation could not be excluded. More cases are required to speculate on the origin of such schwannomas.

Acknowledgment

We thank Ms. A. Imamura for her skillful technical assistance.

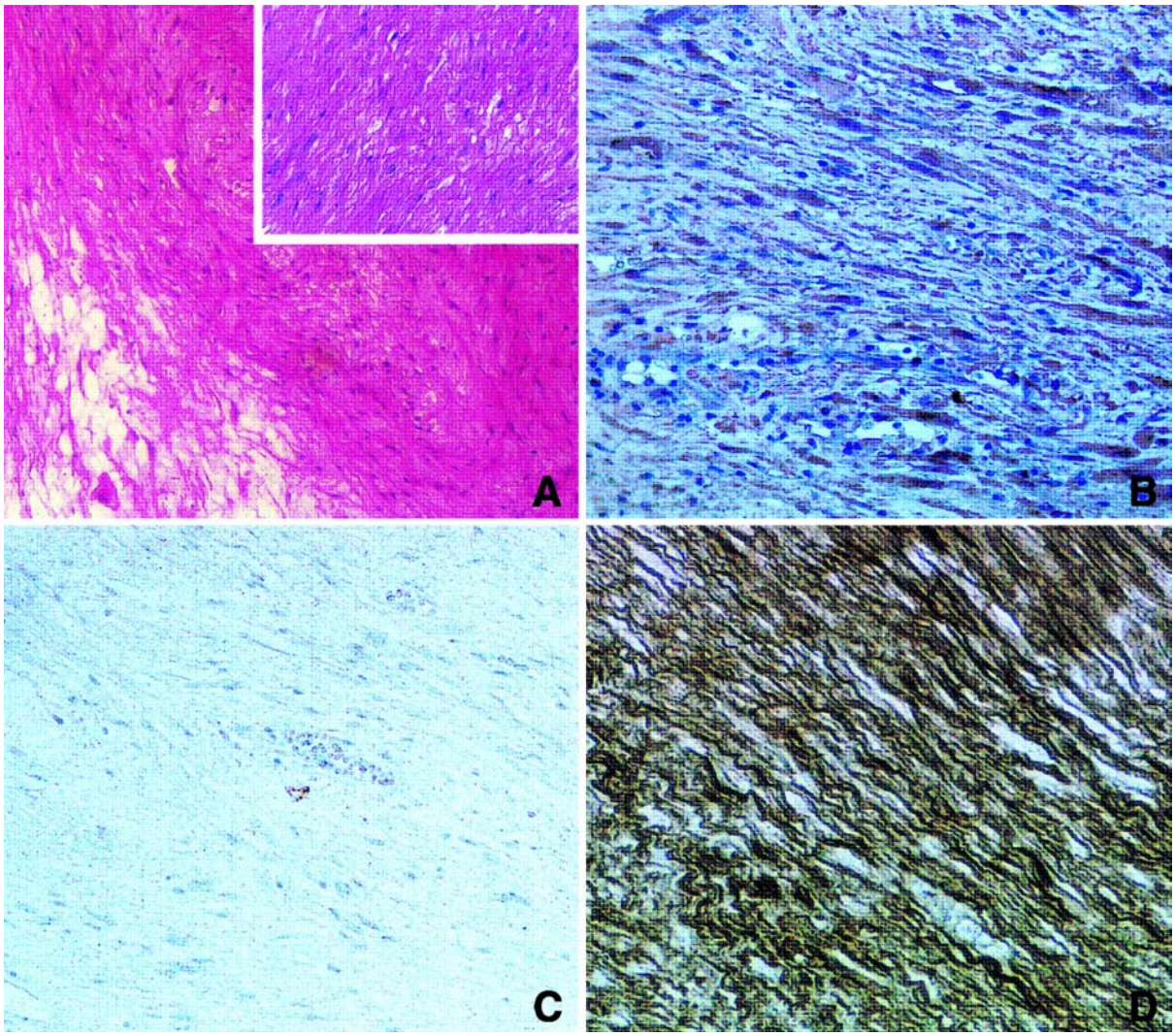

Fig. 2 Photomicrographs showing the highly cellular part of the tumor consisting of spindle cells with elongated oval nuclei (*inset*) intermingled with a looser pattern (A: hematoxylin and eosin stain, ×100; *inset*, ×200). The tumor was positive for S-100 protein (B: ×200), and negative for epithelial membrane antigen (C: ×200). Reticulin silver staining showed fine reticular fibers around individual cells (D: ×100).

Table 1 Reported cases of subfrontal schwannoma without hyposmia

Author (Year)	Age/ Sex	Symptoms	Remarks on origin
Auer et al. (1982)[1]	15/M	headache, nausea	schwannosis
Harano et al. (1974)[6]	26/F	headache, convulsion	meningeal branch
Huang et al. (1997)[8]	33/M	headache, lethargy, decreased vision	not described
Present case	44/M	headache	meningeal branch (trigeminal nerve)/ radiation

References

1) Auer KN, Budny J, Drake CG, Ball MJ: Frontal lobe perivascular schwannoma. *J Neurosurg* 56: 154–157, 1982
2) Bando K, Obayashi M, Tsuneharu F: [A case of subfrontal schwannoma]. *No Shinkei Geka* 20: 1189–1194, 1992 (Jpn, with Eng abstract)
3) Chiristin E, Naville F: A propos de neurofibromatoses centrals. *Ann Médecino* 8: 31–50, 1920
4) Feigin I, Ogata J: Schwann cells and peripheral myelin within human central nervous tissues: the mesenchymal character of Schwann cells. *J Neuropathol Exp Neurol* 30: 603–612, 1971

5) Harada T, Kawauchi M, Watanabe M, Kyoshima K, Kobayashi S: Subfrontal schwannoma: Case report. *Neurol Med Chir* (*Tokyo*) 32: 957–960, 1992
6) Harano H, Hori S, Kamata K, Shinohara T, Toyama K: [A case report of subfrontal schwannoma]. *No Shinkei Geka* 2: 643–647, 1974 (Jpn, with Eng abstract)
7) Hirano A, Zimmerman HM, Levine S: Electron microscopic observations of peripheral myelin in a central nervous system lesion. *Acta Neuropathol* (*Berl*) 12: 348–365, 1969
8) Huang P, Zagzag D, Benjamin V: Intracranial schwannoma presenting as a subfrontal tumor. *Neurosurgery* 40: 194–197, 1997
9) Louw D, Sutherland G, Halliday W, Kanfuraun J: Meningioma mimicking cerebral schwannoma. *J Neurosurg* 73: 715–719, 1990
10) Mauro A, Sciolla R, Sicuro L, Ponzio R: Solitary neurinoma of the anterior cranial fossa: Case report. *J Neurosurg Sci* 27: 45–49, 1983
11) 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)
12) Nakayama K, Nakayama T, Matsuoka Y, Kono K: Supratentorial convexity leptomeningeal schwannoma. *Neurosurgery* 51: 1295–1298, 2002
13) Nelson E, Rennels M: Innervation of intracranial arteries. *Brain* 93: 475–490, 1970
14) New PFJ: Intracerebral schwannoma. Case report. *J Neurosurg* 36: 795–797, 1972
15) Russell DS, Rubinstein DS: Schwannomas, *in* Russell DS, Rubinstein LJ (*eds*): *Russell and Rubinstein's Pathology of Tumors of the Nervous System, ed 5*. London, Arnold, 1989, pp 535–560
16) 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)
17) Schnitt SJ, Vogel H: Meningiomas: Diagnostic value of immunoperoxidase staining for epithelial membrane antigen. *Am J Surg Pathol* 10: 640–649, 1986
18) Tan TC, Ho LC, Chiu HM, Leung SC: Subfrontal schwannoma masquerading as meningioma. *Singapore Med J* 42: 275–277, 2001
19) Tsai YD, Lui CC, Eng HL, Liang CL, Chen HJ: Intracranial subfrontal schwannoma. *Acta Neurochir* (*Wien*) 143: 313–314, 2001
20) Ulrich J, Levy A, Pfister C: Schwannoma of the olfactory groove. *Acta Neurochir* (*Wien*) 40: 315–321, 1978
21) Viale ES, Pau A, Turtas S: Olfactory groove neurinomas. *J Neurosurg Sci* 17: 193–196, 1973
22) Winek RR, Scheithauer BW, Wick MR: Meningioma, meningeal hemangiopericytoma (angioblastic meningioma), peripheral hemangiopericytoma, and acoustic schwannoma: A comparative immunohistochemical study. *Am J Surg Pathol* 13: 251–261, 1989

Address reprint requests to: Y. Hayashi, M.D., Department of Neurosurgery, Toyama City Hospital, 2–1 Imaizumihokubu–machi, Toyama 939–8511, Japan.
e-mail: yuh@tch.toyama.toyama.jp