Surgical Management of PICA Aneurysm and Incidental Facial Nerve Schwannoma: Case Report

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ABSTRACT

We report a patient with a posterior inferior cerebellar artery (PICA) aneurysm and an incidental facial nerve schwannoma at the cerebellopontine angle (CPA). A 46-year-old woman presented with the sudden onset of a severe headache, nausea, and vomiting. She had no other abnormal neurological symptoms and signs. Computed tomography (CT) showed hemorrhage in the fourth ventricle. Cerebral angiography demonstrated an aneurysm arising from the tonsillomedullary segment of the left PICA. A facial nerve schwannoma was incidentally found as the aneurysm was being clipped. The aneurysm was clipped via a left transcondylar approach. Subsequently, the schwannoma ($2 \times 3 \times 2$ mm) was resected from the facial nerve fascicles, and the facial nerve was preserved. Postoperatively, the patient developed mild to moderate dysfunction of the facial nerve (House-Brackmann grade III [H-B III]) but her hearing was intact. Both a facial nerve schwannoma involving the CPA and an aneurysm involving the PICA can be managed through the transcondylar approach. An asymptomatic facial nerve schwannoma can be resected safely with minimal facial nerve dysfunction.

KEYWORDS: Facial nerve schwannoma, PICA, aneurysm, transcondylar approach

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Aneurysms arising from the posterior inferior cerebellar artery (PICA) are uncommon. Their reported incidence ranges from 0.49 to 3% of all intracranial aneurysms.^{1,2} Patients presenting with hemorrhage, in whom an aneurysm is the only pathological condition identified, should be treated urgently.

Facial nerve schwannomas are rare tumors^{3,4} that usually involve the vertical portion of the facial nerve. Tumors arising from Schwann cells of the facial nerve sheath account for fewer than 1% of all intrapetrous mass lesions.^{3,4} Furthermore, facial nerve schwannomas located at the cerebellopontine angle (CPA) are even less common, accounting for about 1% of all CPA tumors.⁵ Removal of facial nerve schwannomas usually causes severe facial paralysis despite placement of a facial nerve graft after the facial nerve is sacrificed.⁶ Therefore, early diagnosis and treatment are crucial to preserve facial function.⁷

We report a patient who harbored both a PICA aneurysm and an incidental facial nerve schwannoma. We discuss the surgical approach and postoperative outcome of these two pathologies.

CASE ILLUSTRATION

A 46-year-old woman developed a severe headache of sudden onset, nausea, and vomiting that had

persisted for 7 hours before she was admitted to the hospital. She had experienced intermittent mild headache and nausea for several months without underlying hypertensive disease. Neurological examination demonstrated an awake and cooperative patient complaining of a stiff neck (Hunt and Hess grade II, Glasgow Coma Scale 15). She had no other neurological deficits and all her cranial nerves were intact. Cranial computed tomography (CT) showed an intraventricular hemorrhage, predominantly in the fourth ventricle (Fig. 1A). Cerebral angiography revealed an aneurysm arising from the tonsillomedullary segment of the left PICA (Fig. 1B).

After the aneurysm was diagnosed, the patient underwent surgical clipping of the aneurysm via a transcondylar approach with electrophysiological monitoring of brainstem acoustic potential and the facial nerve. The patient was placed in the lateral park bench position. The muscle and craniotomy were dissected as reported previously.⁸ After the arachnoid membrane was opened and the cerebellum was retracted slightly, the cerebellomedullary fissure was dissected. The aneurysm dome projected laterally and inferiorly. No vessels originated from the vicinity of the aneurysm, which was clipped successfully (Fig. 1C).

After the aneurysm was occluded (Fig. 2A), the surgeon (BLG) noticed a tumor arising from the facial nerve. The tumor was near the internal

Figure 1 (A) Computed tomographic scan shows the fourth ventricular hemorrhage. (B) Cerebral angiography shows the PICA aneurysm located at the tonsillomedullary segment of the left PICA. (C) Postoperative angiogram confirms complete occlusion of the aneurysm.

auditory canal and between cranial nerves VII and VIII (Fig. 2B). The $2 \times 3 \times 2$ mm lesion was gray, relatively soft, and avascular. There was no well-defined plane between the tumor and facial nerve. The tumor was resected piecemeal from the facial nerve fascicles. Total removal of the tumor and anatomical preservation of the facial nerve were achieved (Fig. 2C).

Postoperative cerebral angiography confirmed the complete clipping of the aneurysm (Fig. 1C). Histopathological examination showed tumor cells aggregating in a loose-textured pattern of tissue. The tumor was diagnosed as a mixed type (Antoni A/B) predominant schwannoma (Fig. 3). The patient made a good recovery, with mild to moderate facial nerve dysfunction (House-Brackmann [H-B] grade III) (Fig. 2D). Her hearing was intact. Six months after surgery, her left facial nerve function recovered to H-B grade I.

DISCUSSION

PICA Aneurysms

The frequency of hemorrhage from PICA aneurysms is higher than from aneurysms originating from the circle of Willis.⁹ The hemorrhagic pattern of a PICA aneurysm is always associated with the fourth ventricle.^{10,11} Our case also presented with fourth ventricular hemorrhage. Focal pathological neurological signs, such as bilateral palsy of the abducent nerve, truncal ataxia, mild hemiparesis, focal neck discomfort, or quadriparesis, have also been associated with PICA aneurysm.^{12–15}

The management of a PICA aneurysm usually includes surgery and endovascular treatment, each of which has advantages and disadvantages.^{16–22} After discussion with a neuroendovascular therapist, we decided to pursue surgery because the distal location of the PICA aneurysm rendered an endovascular technique infeasible. Either a bilateral midline suboccipital craniotomy or a transcondylar approach can be

used to clip aneurysms arising within transitional or distal segments.^{9,23} Although the PICA aneurysm was located at the transitional segment in our patient, we selected the suboccipital transcondylar approach to minimize retraction of the cerebellum, because the aneurysm was small and its dome projected laterally and inferiorly (Fig. 2A). The transcondylar approach not only provides exposure of an aneurysm, but also offers visualization of cranial nerves VII, VIII, IX, and X. Consequently, coexisting incidental pathology (such as an AVM [arteriovenous malformation]) might be discovered,⁹ like the incidental facial nerve schwannoma found in our patient. Although two coexisting pathological lesions may be unusual in this vicinity, we believe it is worthwhile for the surgeon to inspect the lower cranial nerves after clipping a PICA aneurysm.

Facial Nerve Schwannoma

Since Schmidt reported the first case of a facial nerve schwannoma in 1931,²⁴ more than 600 cases of facial nerve schwannoma (or neuroma) have been reported in the literature worldwide.⁷ Schwannomas at the CPA account for 17.8% of all facial nerve schwannomas and about 1% of all CPA tumors.^{5,6} Facial palsy is typically regarded as the most common presentation of facial nerve schwannomas. However, at the CPA a unique subset of facial nerve schwannomas have characteristics that vary greatly from those of facial nerve schwannomas at other locations. Symptoms attributed to acoustic neuromas (e.g., tinnitus, hearing loss, and vertigo) are often associated with facial nerve schwannomas involving the CPA.^{3,6} Therefore, clinically, they are indistinguishable from acoustic neuromas.²⁵ Our case was clearly diagnosed as a CPA facial nerve schwannoma based on the tumor's clear origin (Fig. 2B).

Recently, Kubota and colleagues reviewed 28 cases of facial nerve schwannomas without facial palsy, including many rather small tumors.²⁶ Among these cases, the most common symptom

Figure 2 (A) Microscopic view shows the aneurysm (1), cranial nerve IX (2), cranial nerve X (3), and PICA (4). (B) Microscopic view shows the tumor located between cranial nerves VII and VIII and its adhesion to the seventh cranial nerve. (C) Intraoperative photograph shows the preserved anatomical course of the facial nerve after complete resection of the tumor. (D) Postoperatively, the patient had mild facial nerve dysfunction (House-Brackmann grade II). The facial nerve (5), tumor (6), acoustic nerve (7), and aneurysm clip (8) are also shown.

was sensorineural or conductive hearing loss (75%, 21 cases), and the most common site involved was the CPA (67%, 19 cases).²⁶ At the CPA, a facial nerve schwannoma can easily compress the cochlear nerve in the narrow internal auditory meatus. The reason for the absence of facial palsy might be neuronal tolerance induced by the extremely slow growth of the tumor, abundant tumor blood flow supporting the facial nerve, or the location of the tumor. Moreover, motor nerves such as the facial nerve have a thicker myelin sheath than sensory

nerves and consequently are more resistant to compression.^{27,28}

In patients with progressive or recurrent abrupt facial paresis, facial spasm, and/or ear pain, the neurosurgeon should suspect a facial nerve schwannoma.^{4,5,8,13,14,29–32} These patients should undergo MRI with and without gadolinium. Our patient underwent only CT because her presenting symptoms and signs indicated the diagnosis of a ruptured aneurysm and the patient's facial and acoustic nerve function was intact. Therefore, the

Figure 3 A microscopic photograph shows the mixed type of schwannoma with (A) Antoni A and (B) Antoni B structures (original magnification $\times 20$).

patient did not undergo MRI and her facial nerve schwannoma was not diagnosed preoperatively.

Histopathologically, our patient's asymptomatic facial nerve schwannoma was a predominant Antoni A/B type of schwannoma (Fig. 3), which was similar to the report of Kwiek and associates.³² Interestingly, this pathological observation contrasts with the finding of Antoni B type pathology in symptomatic facial nerve schwannomas.³²

Treatment of facial nerve schwannoma is controversial because facial paralysis is inevitable after surgical resection. Complete surgical resection and facial nerve reconstruction is the most recommended modality.³³ Some authors advise observation rather than surgical excision because facial nerve schwannomas are benign tumors that typically grow slowly, and many patients do not become symptomatic with significant facial paralysis. Proponents advocate delaying surgery until the patient exhibits at least an H-B grade III facial nerve paralysis. During this time, the tumor can be followed by radiologic imaging.^{34,35} Another conservative treatment is decompression surgery if the patient has normal facial function. Angeli and Brackmann treated four patients with decompression who only achieved H-B grade I and II facial nerve function postoperatively.³⁶ However, Ulku et al demonstrated that early diagnosis and treatment are required to optimize postoperative facial

nerve function.³⁷ Consequently, although our patient had an incidental asymptomatic facial nerve schwannoma, we considered that it should be removed during clipping of the PICA aneurysm through one incision and a one-stage operation.

Although we were able to remove the facial nerve schwannoma and preserve the facial nerve, this good outcome may reflect the early diagnosis and small size of the tumor. Even if a facial nerve schwannoma is often encapsulated, an obvious plane of separation between the schwannoma and the perineurium of the facial nerve is often lacking.⁵ This might clarify why our patient had mild facial nerve dysfunction after the procedure.

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Commentary

The authors present an unusual case report of a coincidental occurrence of a ruptured peripheral PICA aneurysm on the same side as an incidental small schwannoma arising on the cisternal segment of the facial nerve. The aneurysm was clipped

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appropriately through the transcondylar approach. Given that PICA was not the origin of the aneurysm, it also could have been approached through the so-called paracondylar approach. However, I see no harm in using the approach that the authors selected.

I would have been hesitant to resect the incidentally discovered facial nerve schwannoma in the absence of intraoperative facial nerve and auditory nerve monitoring, which I assume were not available given that the planned surgery was aneurysmal clipping rather than a schwannoma resection. However, I cannot argue with a final outcome of normal facial nerve function after a temporary grade III House-Brackmann paresis. Nonetheless, it is also conceivable that the outcome may not have been as favorable.

Furthermore, it seems that both unusual pathologies must be assumed to have been related coincidentally rather than etiologically.

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Commentary

Bian and colleagues present an interesting case of coincidental ruptured PICA aneurysm and facial nerve schwannoma. The aneurysm was treated successfully with direct clipping, preserving the distal blood flow in PICA. The schwannoma was noticed during the dissection and successfully resected with minimal postoperative facial nerve dysfunction. The authors applied standard surgical techniques but demonstrated that the wide exposure of a skull base approach enables inspection of surrounding anatomy. Early detection of tumors like facial nerve schwannomas when they are still small can facilitate resection and lead to good surgical results. When the tumors are large, symptomatic, and further along in their progression, good surgical outcomes may be more difficult to achieve.

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