

Case Report

Malignant Transformation of an Epidermoid Cyst in the Cerebellopontine Angle

Kyu-Hyon Chon, M.D., Jong-Myong Lee, M.D., Eun-Jung Koh, M.D., Ha-Young Choi, M.D.

Department of Neurosurgery, Chonbuk National University Hospital and Medical School, Jeonju, Korea

Intracranial squamous cell carcinoma is extremely rare, with most of the cases arising from malignant transformation of an epidermoid or a dermoid cyst. The patient presented with facial weakness. Initial magnetic resonance imaging revealed a mass in the right cerebellopontine angle. A subtotal resection was performed via right retrosigmoid suboccipital approach. Histopathological findings were consistent with an epidermoid tumor. Five months later, the patient underwent gamma knife radiosurgery due to highly probable recurrent epidermoid tumor. Two years after, the patient's neurological deficit had been newly developed, and follow-up magnetic resonance imaging demonstrated a large contrast-enhancing tumor in the left cerebellopontine angle, which compressed the brainstem. After resection of the tumor, histopathological examinations revealed a squamous cell carcinoma probably arising from an underlying epidermoid cyst. We report a case of an epidermoid tumor in the cerebellopontine angle that transformed into a squamous cell carcinoma.

Key Words : Epidermoid cyst · Malignancy.

INTRODUCTION

Intracranial epidermoid cysts represent approximately 1% of all brain tumors and 7% of cerebellopontine angle (CPA) tumors, and generally regarded as slow growing brain tumors⁸⁾. Intracranial squamous cell carcinoma is a rare complication of epidermoid cysts^{9,11,15,17)}. The clinical and radiological course of malignant transformation is more aggressive than epidermoid cysts, and their prognosis remains quite poor^{9,11,15)}. Treatment of such malignancies can be problematic, particularly if there is extensive brainstem involvement. We report a case of the CPA epidermoid tumor that transformed into a squamous cell carcinoma. The imaging and clinical features of this case focus attention on the efficacy of radiosurgery in the management of this unusual malignancy.

CASE REPORT

A 43-year-old man visited our clinics in February of 2009 due to the weakness of the right facial expression (House-Brackmann grade III). T2-weighted magnetic resonance image (MRI) showed a high signal intensity (SI) in the CPA (Fig. 1A). A T1-

weighted gadolinium enhanced MRI showed a nonenhancing tumor in the right CPA, sized 58×38 mm (Fig. 1B). Diffusion-weighted (DW) MRI revealed a high signal intensity lesion in the right CPA (Fig. 1C). A right retrosigmoid suboccipital craniotomy was performed and the epidermoid tumor was resected. The capsule of the tumor adherent to the brainstem and the low cranial nerves was not able to be removed. Cranial nerves V through XI were identified and preserved. Histopathological findings showed keratin debris and squamous epithelium, consistent with an epidermoid cyst (Fig. 1D). In July 2009, follow-up brain MRI showed focal enhanced mass on the right cerebellar hemisphere, there is outside operation field (Fig. 2A). Because the patient refused reoperation, he underwent gamma knife radiosurgery (GKRS) for treatment of the small enhanced tumor on right cerebellar hemisphere in July of 2009 due to the small enhanced tumor which is highly probable malignant transformation. The tumor was covered with a 50% iso-dose gradient and the dose delivered to the tumor margin was 15 Gy; the maximum dose was 25 Gy. Annual radiological surveillance showed no change in residual tumor. In January 2011, follow-up contrast-enhanced axial T1-weighted image shows that there is no enhanced tumor (Fig. 2B). In April 2011, he present-

• Received : December 29, 2011 • Revised : May 24, 2012 • Accepted : August 17, 2012

• Address for reprints : Jong-Myong Lee, M.D.

Department of Neurosurgery, Chonbuk National University Hospital & Medical School, 20 Geonji-ro, Deokjin-gu, Jeonju 561-712, Korea
Tel : +82-63-250-1870, Fax : +82-63-277-3273, E-mail : nsjmlee@gmail.com

• This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

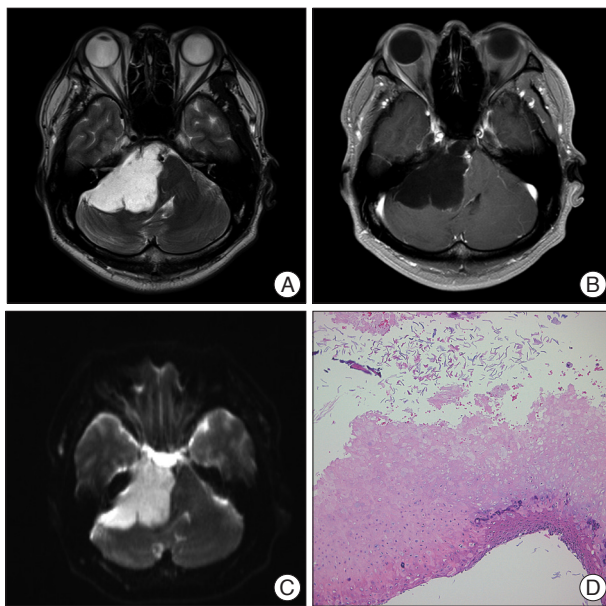


Fig. 1. A : T2-weighted image shows a high signal mass in the right CPA. B : Contrast-enhanced T1-weighted image shows nonenhancing huge mass. C : Diffusion weighted image shows very high signal intensity mass in the right CPA suggestive of an epidermoid cyst. D : The cyst is lined by keratinizing squamous epithelium and filled with lamellated keratinous debris (Hematoxylin-Eosin stain, $\times 100$). CPA : cerebellopontine angle.

ed again with facial numbness on the left side and swallowing difficulty. MRI showed a large tumor in the left CPA. T2-weighted MRI showed an iso SI in the CPA (Fig. 3A). Contrast-enhanced T1-weighted images showed strong enhancement of the nodular lesion sized 30×15 mm (Fig. 3B, C). These MRI findings were suggestive of the malignant transformation of epidermoid cyst or the benign meningioma. A left retrosigmoid suboccipital approach was done. However, the tumor could not be removed totally due to the highly adherent to the pons, cerebellum, and lower cranial nerves. The immunohistochemistry showed pan-cytokeratin, thereby proving an epithelial cell origin. These histopathological and immunohistochemical features were consistent with a diagnosis of squamous cell carcinoma (Fig. 3D). To rule out the possibility of the intracranial metastasis of a squamous cell carcinoma, systemic workup was necessary, which yielded negative results. He underwent GKRS for treatment of the remnant malignant tumor. The tumor was covered with a 60% iso-dose gradient and the dose delivered to the tumor margin was 15 Gy; the maximum dose was 25 Gy. Thirteen months later, however, the enhanced volume had again enlarged. He underwent a second GKRS procedure with a marginal dose of 12 Gy; the maximum dose was 20 Gy. The adjacent brain stem tissue showed no evidence of adverse effects of radiation.

DISCUSSION

An epidermoid tumor is a congenital lesion that arises from

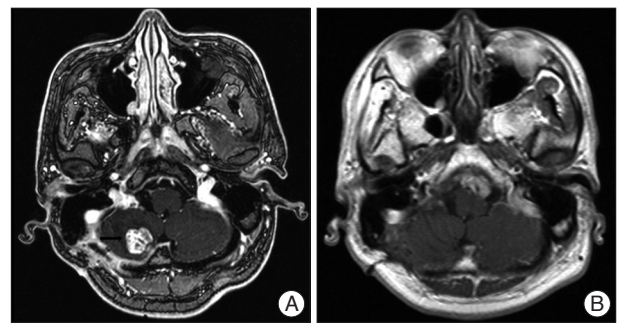


Fig. 2. A : In July 2009, contrast-enhanced axial T1-weighted image shows strong enhancement of the small nodular lesion (black arrow) in the right cerebellar hemisphere. The patient received GKRS in this lesion. B : In January 2011, follow-up contrast-enhanced axial T1-weighted image shows that there is no enhanced tumor. GKRS : gamma knife radiosurgery.

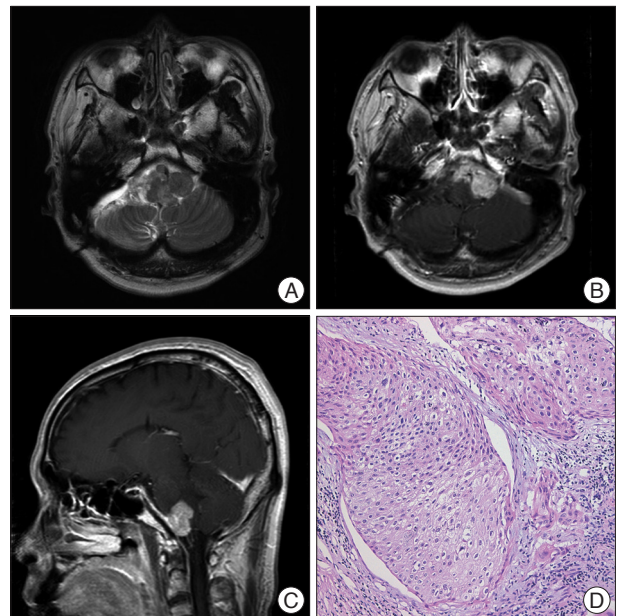


Fig. 3. A : T2-weighted image shows isodense signal intensity mass in the left CPA. B : Contrast-enhanced axial T1-weighted image shows strong enhancement of the nodular lesion in the left CPA. C : Contrast-enhanced sagittal T1-weighted image shows strong enhancement. D : The specimen contains high cellular area with enlarged pleomorphic and hyperchromatic nuclei, which is a component of poorly differentiated squamous cell carcinoma (Hematoxylin-Eosin stain, $\times 200$). CPA : cerebellopontine angle.

inclusion of ectodermal epithelial elements⁸). Epidermoid cysts are benign and slow growing lesions representing about 1% of all intracranial tumors⁷⁻⁹). The CPA is the most common site of occurrence of intracranial epidermoid tumors, accounting for 7% of tumors in this region⁸). Grossly, epidermoid tumors are typically well defined lesions with an irregular nodular outer surface and a shiny “mother of pearl” appearance^{8,9}). Microscopically, the wall of the epidermoid cyst consists of a layer of stratified squamous epithelium without vascularity. The cyst content is derived from desquamated epithelial cells composed mainly of keratin in concentric layers and cholesterol in a solid

crystalline state⁶. Five months later, follow-up brain MRI showed focal enhanced mass on the right cerebellar hemisphere, there is outside operation field in our case. This finding was atypical. The small enhanced tumor was highly suggested malignant transformation. We performed a retrospective review of the initial pathological specimen did not uncover any evidence of squamous cell carcinoma. We recommended reoperation, but patient refused. Kida et al.¹⁰ reported that GKRS has also been used to treat recurrent benign epidermoids with reported shrinkage of the tumor and resolution of the patient's symptoms. Patient underwent GKRS. In cases of previously resected epidermoids when new contrast-enhancing lesions are seen, surgical exploration is necessary to document malignant transformation before adjuvant therapy is considered.

Their complication by squamous cell carcinoma is an unusual occurrence. Primary intracranial squamous cell carcinoma shares a rare but well-described association with benign intracranial epidermoid cysts^{7,9}. These mechanisms of such transformation remain unclear. Malignant change in the epithelium-lining cyst is well documented. An *'in situ'* carcinoma has been observed in an epidermoid cyst^{12,16}. Concerning the mechanisms of malignant transformation of benign epidermoid cysts, some authors have suggested that introduction of a foreign material intraoperatively in combination with the inflammation-inducing contents of the epidermoid cyst, may be a cause of cellular atypia leading to neoplasia^{1,13}.

Malignant transformation of intracranial epithelial cysts has been classified into five groups. These five groups include an initial malignant transformation of an epidermoid cyst, malignant transformation from a remnant epidermoid cyst, malignant transformation with leptomeningeal carcinomatosis, squamous cell carcinoma from other benign cysts, and other malignancies arising from the benign cysts⁹. According to Hamlat's classification, our case can be classified as malignant transformation from a remnant epidermoid cyst.

On MRI, epidermoid tumors typically have low signal intensity on T1-weighted images, high signal intensity on T2-weighted images that is similar to that of cerebrospinal fluid, and no enhancement on gadolinium-enhanced images^{6,11}. In echo-planar DW imaging, all epidermoid tumors appeared sharply hyperintense relative to the brain and CSF³. DW imaging could differentiate epidermoid tumors from other cystic lesions, in that the apparent diffusion coefficient (ADC) of epidermoid tumors were similar to that of brain tissue whereas the ADCs of cystic lesions were similar to that of CSF³. Fast fluid-attenuated inversion recovery (fast-FLAIR) imaging of epidermoid tumors is featured by the increased signal intensity of surrounding CSF in the subarachnoid cisterns and ventricles³. In previous reports, characteristic MRI findings of malignant transformation of epidermoid cysts include a focal enhancing part within the mass and leptomeningeal metastasis^{7,9}. The diagnosis of malignant transformation is still remained controversial, because of atypical features^{2,4,5,8}. In the present case, MRI can show an en-

hanced part with associated vasogenic edema in the cerebellum and pons adjacent to the enhancing nodule. These findings were suggestive of malignant transformation of epidermoid cyst. Therefore, ongoing clinical and neuroimaging follow-up at yearly intervals is necessary for previous subtotal resection of the epidermoid cysts.

The treatment options are controversial. Only short-term follow up was available but the results were encouraging. Patients with subtotal resection should be followed up for the identification of recurrence and malignant transformation. In case suggesting malignant transformation, surgical exploration is necessary to confirm diagnosis. Unfortunately, the complete surgical resection of malignant transformation is usually limited to partial removal because the tumor firmly adheres to the neurovascular structures, as was the case with our case¹⁷. Surgery alone is not curative and limited. Radiation therapy (external-beam radiation or GKRS) after surgical treatment may offer better control of an intracranial squamous cell carcinoma. Tamura et al.¹⁷ performed a meta-analysis for the survival of intracranial squamous cell carcinomas arising in epidermoid cysts. They are compared among different treatment modalities (surgery alone, surgery plus external-beam radiation, and surgery plus GKRS)¹⁷. They suggested that GKRS appears to offer the best survival benefits on patients with intracranial squamous cell carcinomas¹⁷. Surgery plus GKRS is recommended for residual squamous cell carcinoma^{11,17}. Most recently, Nagasawa et al.¹⁴ suggest that when determining the management for malignant transformation of epidermoid tumors, the combination of surgical resection and radiotherapy may be associated with improved short-term survival. Further investigation is necessary to obtain a beneficial treatment strategy against malignant transformation of epidermoid cysts.

CONCLUSION

We report a case of an epidermoid tumor in the CPA that transformed into a squamous cell carcinoma after resective surgery and GKRS. Malignant transformation is a rare cause of enhancement on MR images, as is progressive neurological deficit in a patient with an epidermoid cyst. The presence of contrast enhancement or progressive clinical symptoms within a typical epidermoid cyst along with rapid growth should alert the physician to the possibility of malignant transformation. GKRS has also been used to treat malignant transformation of epidermoids with reported shrinkage of the tumor and resolution of the patient's symptoms, however, only short-term follow up was available. Further investigation is necessary to obtain a beneficial treatment strategy against malignant transformation of epidermoid cysts.

References

1. Abramson RC, Morawetz RB, Schlitt M : Multiple complications from an intracranial epidermoid cyst : case report and literature review. Neu-

- rosurgery 24 : 574-578, 1989
2. Chen S, Ikawa F, Kurisu K, Arita K, Takaba J, Kanou Y : Quantitative MR evaluation of intracranial epidermoid tumors by fast fluid-attenuated inversion recovery imaging and echo-planar diffusion-weighted imaging. *AJNR Am J Neuroradiol* 22 : 1089-1096, 2001
 3. Cheng MH, Lin JW : Intracranial meningioma with intratumoral hemorrhage. *J Formos Med Assoc* 96 : 116-120, 1997
 4. deSouza CE, deSouza R, da Costa S, Sperling N, Yoon TH, Abdelhamid MM, et al. : Cerebellopontine angle epidermoid cysts : a report on 30 cases. *J Neurol Neurosurg Psychiatry* 52 : 986-990, 1989
 5. Dunn RC Jr, Archer CA, Rappaport RL 2nd, Looi LM : Unusual CT-dense posterior fossa epidermoid cyst : case report. *J Neurosurg* 55 : 654-656, 1981
 6. Gao PY, Osborn AG, Smirniotopoulos JG, Harris CP : Radiologic-pathologic correlation. Epidermoid tumor of the cerebellopontine angle. *AJNR Am J Neuroradiol* 13 : 863-872, 1992
 7. Garcia CA, McGarry PA, Rodriguez F : Primary intracranial squamous cell carcinoma of the right cerebellopontine angle. *J Neurosurg* 54 : 824-828, 1981
 8. Guidetti B, Gagliardi FM : Epidermoid and dermoid cysts. Clinical evaluation and late surgical results. *J Neurosurg* 47 : 12-18, 1977
 9. Hamlat A, Hua ZF, Saikali S, Laurent JF, Gedouin D, Ben-Hassel M, et al. : Malignant transformation of intra-cranial epithelial cysts : systematic article review. *J Neurooncol* 74 : 187-194, 2005
 10. Kida Y, Yoshimoto M, Hasegawa T, Fujitani S : [Radiosurgery of epidermoid tumors with gamma knife : possibility of radiosurgical nerve decompression]. *No Shinkei Geka* 34 : 375-381, 2006
 11. Link MJ, Cohen PL, Breneman JC, Tew JM Jr : Malignant squamous degeneration of a cerebellopontine angle epidermoid tumor. Case report. *J Neurosurg* 97 : 1237-1243, 2002
 12. Mayayo Vicente MS, Fernández Arjona M, Gascón Veguín JP, Jiménez Sánchez F, Puig Rullan AM, Cortés Aróngués I : [Prostatic epidermoid carcinoma : report of a new case an review of the literature]. *Arch Esp Urol* 56 : 939-943, 2003
 13. Mori Y, Suzuki Y, Tanasawa T, Yoshida J, Wakabayashi T, Kobayashi T : [A case report of epidermoid carcinoma in the cerebello-pontine angle]. *No Shinkei Geka* 23 : 905-909, 1995
 14. Nagasawa D, Yew A, Spasic M, Choy W, Gopen Q, Yang I : Survival outcomes for radiotherapy treatment of epidermoid tumors with malignant transformation. *J Clin Neurosci* 19 : 21-26, 2012
 15. Sawan B, Vital A, Loiseau H, Dousset V, Strub D, Vital C : Squamous cell carcinoma developing in an intracranial prepontine epidermoid cyst. *Ann Pathol* 20 : 258-260, 2000
 16. Steffey DJ, De Filipp GJ, Spera T, Gabrielsen TO : MR imaging of primary epidermoid tumors. *J Comput Assist Tomogr* 12 : 438-440, 1988
 17. Tamura K, Aoyagi M, Wakimoto H, Tamaki M, Yamamoto K, Yamamoto M, et al. : Malignant transformation eight years after removal of a benign epidermoid cyst : a case report. *J Neurooncol* 79 : 67-72, 2006