



Case Report

Cerebellopontine angle ependymoma presenting as isolated hearing loss in an elderly patient: A case report and literature review

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ABSTRACT

Background: Ependymoma is an uncommon tumor accounting for approximately 1.9% of all adult central nervous system tumors. Ependymomas at the cerebellopontine angle (CPA) are even more rare and only previously described in isolated case reports. Typically, acoustic neuromas and meningiomas represent the bulk of adult CPA tumors. Diagnosis can be challenging, as ependymomas have clinical findings and imaging characteristics that overlap with more common tumor histologies at the CPA.

Case Description: We present the case of a 70-year-old male patient with progressive, isolated left-sided hearing loss found to have a World Health Organization (WHO) Grade II CPA ependymoma, representing one of the oldest recorded patients presenting with this primarily pediatric malignancy in this unique location. The patient presentation with isolated hearing loss was particularly unusual. When associated with neurologic deficits, CPA ependymomas more characteristically result in facial nerve impairment with fully preserved hearing, while vestibular schwannomas tend to present with isolated hearing loss. The standard of care for pediatric ependymomas is maximal safe resection with adjuvant radiotherapy, but treatment paradigms in adult CPA ependymoma are not well defined particularly for WHO Grade II disease. After resection, he received adjuvant radiation to decrease the risk of local recurrence. Twenty-nine months after resection, the patient remains free of treatment-related toxicity or disease recurrence.

Conclusion: We review this patient's clinical course in the context of the literature to highlight the challenges associated with timely diagnosis of this rare tumor and the controversial role of adjuvant therapy in preventing local recurrence in these patients.

Keywords: Adjuvant therapy, Adult ependymoma, Cerebellopontine angle ependymoma, Ependymoma, Radiation therapy

INTRODUCTION

Ependymoma is an uncommon tumor accounting for approximately 1.9% of all adult central nervous system (CNS) tumors.^[20] Ependymomas at the cerebellopontine angle (CPA) in adults are rarer and

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Table 1: Literature review documenting previously reported cases of adult cerebellopontine angle ependymoma, organized by patient age at presentation.

Author	Age/Sex	Size (cm)	Extent of resection	Grade	Adjuvant therapy	Outcome
Cosgrove ^[7] (1985)	78/male	3.0×3.0	GTR	NA	None	NED after 36 mos
Our patient	70/male	2.5×2.5	GTR	II	RT	NED after 28 mos
Fukui <i>et al.</i> ^[12] (1997)	68/male	2.5×1.5	NA	NA	RT	NED at 30 mos
Sun and Thomas ^[25] (2001)	66/male	NA	STR	NA	None	Unrelated death at 2 mos
Cunha <i>et al.</i> ^[8] (2011)	57/male	3.6×3.4	GTR	I	None	NA
Kasliwal <i>et al.</i> ^[15] (2007)	50/female	NA	GTR	II	RT	NA
Zhao <i>et al.</i> ^[31] (2015)	50/male	NA	GTR	II	chemoRT	Spinal metastasis
Gill <i>et al.</i> ^[13] (2015)	48/male	NA	STR	II	None	NA
Sayyahmelli <i>et al.</i> ^[23] (2018)	46/male	NA	NA	II	RT	NED
Salunke <i>et al.</i> ^[21] (2011)	43/female	7.2×5.9	GTR	II	RT	NED at 6 mos
Sayyahmelhi and Baskaya ^[22] (2019)	38/female	NA	GTR	III	RT	NED
Ueyama <i>et al.</i> ^[27] (1997)	38/male	NA	STR	“low”	RT (not completed)	Died at 6 weeks
Ebrahimi <i>et al.</i> ^[11] (2020)	36/female	NA	GTR	II	RT	NED at 1 year
Yang <i>et al.</i> ^[29] (2014)	35/male	4.2×3.5	GTR	II	None	LR at 4 mos
Torun <i>et al.</i> ^[26] (2005)	31/male	4.5×3.5	GTR	NA	RT	NA
Sparaco <i>et al.</i> ^[24] (2009)	30/male	NA	NA	I	None	NED at 12 mos
Goto <i>et al.</i> ^[14] (2003)	29/male	5.0×4.0	GTR	NA	None	NED at 9 mos
Lan <i>et al.</i> ^[16] (2019)	28/male	3.7×3.2	GTR	II	RT	NED at 24 mos
Donich <i>et al.</i> ^[10] (1999)	22/female	4.0×3.0	GTR	NA	RT	NED at 18 mos

GTR: Gross total resection, LR: Local recurrence, NA: Not available, Mos: Months, NED: No evidence of disease, STR: Subtotal resection, RT: Radiation therapy

only previously described in isolated case reports [Table 1].^[7,8,10-16,21-27,31] Vestibular schwannoma and meningiomas represent the bulk of adult CPA tumors,^[4] but CPA ependymomas, although uncommon, are important to include in the differential diagnosis. Ependymomas typically appear hypointense on T1-weighted magnetic resonance imaging (MRI) sequences, hyperintense on T2-weighted imaging, and heterogeneously enhance with contrast.^[4,29] Standard of care for pediatric ependymomas is maximal safe resection with adjuvant radiotherapy,^[18] but treatment paradigms in adult CPA ependymoma are not well defined. We present the case of a 70-year-old patient with progressive, isolated left-sided hearing loss found to have an ependymoma after resection and treated with adjuvant radiation, representing one of the oldest recorded patients presenting with this primarily pediatric malignancy in this unique location. We review this patient's clinical course in the context of the literature to highlight the challenges associated with timely diagnosis of this rare tumor and the controversial role of adjuvant therapy in preventing local recurrence in these patients. Informed consent for this report was obtained from this patient.

CASE DESCRIPTION

A 70-year-old male presented to our institution with progressive left-sided hearing deficit over several years with accelerated loss in the immediately preceding months. He

denied headache, weakness, numbness, nausea, vomiting, dysphagia, speech issues, dizziness, vertigo, and difficulty walking. Physical examination including detailed neurologic exam was unremarkable except for significant left-sided hearing loss confirmed by audiogram; the facial nerve was intact. MRI of the brain with contrast revealed a 2.5 cm heterogeneously enhancing, extra-axial, well-defined mass with cystic components in the left CPA causing mild to moderate mass effect on the left-sided pons, anterior cerebellar hemisphere, and middle ear cerebellar peduncle [Figure 1]. Radiographically, the mass appeared to involve the proximal cranial nerve (CN) VII and VIII without extension into the internal auditory canal. A presumptive diagnosis of schwannoma was considered due to the radiographic findings with associated hearing loss in the absence of other neurologic deficits. Meningioma was also considered but deemed to be less likely due to the CN VIII deficit. The patient underwent left retrosigmoid craniotomy with left CN VII intraoperative neuromonitoring. Intra-operative findings were notable for a tumor appearing to originate from the dura at the CPA with left CN VII, VIII, IX, X, and brainstem compression but not involvement. It did not extend to CN V. Because the CNs were compressed but not involved, gross total resection was achieved without introduction of iatrogenic deficits. Postoperative MRI showed no definitive radiographic evidence of residual disease.

Surgical pathology was significant for cells arranged in perivascular pseudorosette formations.

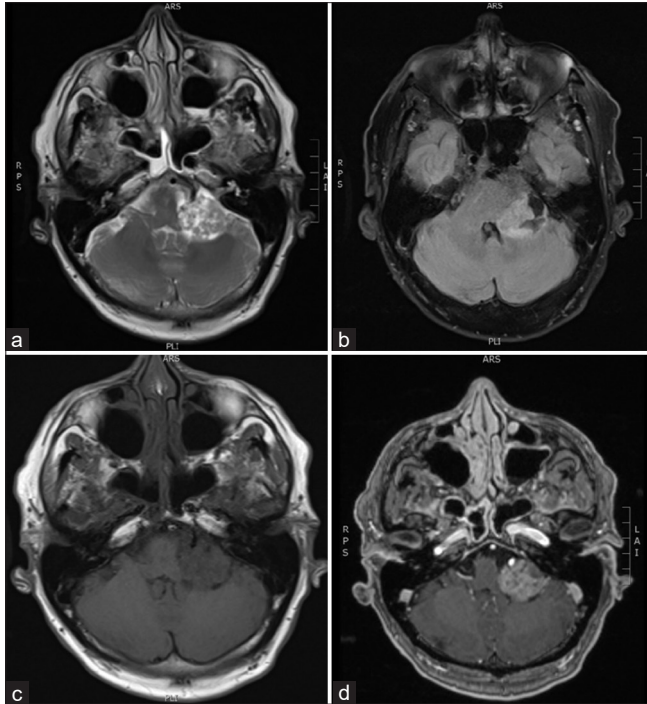


Figure 1: MRI Brain with contrast revealed a mass adjacent to the brainstem at the level of the medulla hypointense on axial T1-weighted sequences (a) with heterogeneous enhancement on the post-contrast sequence (b) and edema noted on T2 enhancing (c) and FLAIR (d) sequences.

Immunohistochemistry revealed tumor cells diffusely positive for glial fibrillary acidic protein and S100 with scattered positivity for Olig2 and epithelial membrane antigen (dot-like perinuclear), and a Ki-67 proliferation index highlighted up to 15% of tumor cell nuclei [Figure 2]. Areas of tuncytic features were noted. The samples were negative for NeuN and neurofilament. Tumors such as meningioma, glioma, atypical teratoid/rhabdoid, and choroid plexus papilloma/carcinoma were on the differential but not consistent with the morphology and other histopathologic features. Due to the S100 positivity, schwannoma was a possibility but was inconsistent with the arrangement of cells in perivascular pseudorosette formations, which was highly consistent with ependymoma. Thus, the diagnosis of World Health Organization (WHO) Grade II ependymoma was established based on the histopathology and morphology including the presence of tuncytic features. MRI imaging of the cervical, thoracic, and lumbar spine to complete staging was unremarkable.

The role of post-operative radiotherapy in patients with ependymoma WHO grade II undergoing gross tumor resection remains controversial. Because this patient was >59 years at presentation, male sex, and had a rare site of presentation with unknown molecular subgroup, radiotherapy for improved local control was offered after

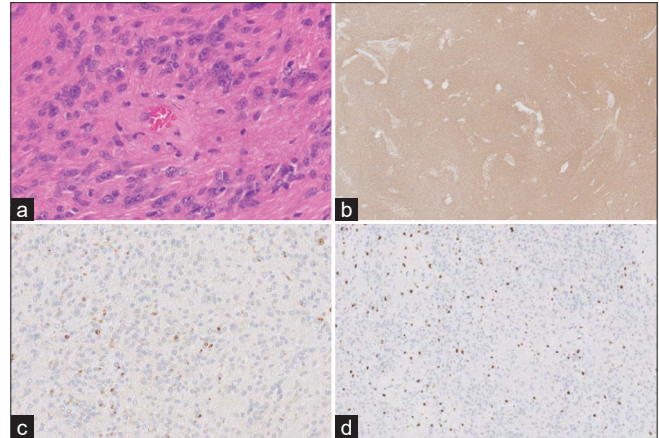


Figure 2: Hematoxylin and eosin-stained sections from surgical pathology revealed a non-infiltrating glial neoplasm with round to ovoid cells arranged in perivascular pseudorosette formations (a, $\times 40$). Tumor cells were diffusely positive for glial fibrillary acidic protein (b, $\times 20$) and epithelial membrane antigen in a scattered, dot-like perinuclear distribution (c, $\times 20$). A Ki-67 proliferation index highlighted up to 15% of tumor cell nuclei (d, $\times 10$). Based on these findings, a diagnosis of WHO Grade II ependymoma was made.

discussion at multidisciplinary tumor board. A dose of 5400 cGy in 30 daily fractions was prescribed to the planning target volume which consisted of the resection cavity plus a 3 mm margin as identified on the T1 post-contrast MRI sequence [Figure 3]. Radiation therapy was delivered on a linear accelerator using a 3-arc volumetric modulated arc therapy plan with 6 MV photons. Twenty-nine months after resection, the patient has had no clinical or radiographic evidence of treatment related toxicity or recurrent disease [Figure 4]. Besides baseline left sided hearing loss, he has no other neurological complaints.

DISCUSSION

We present nearly the oldest recorded case of a patient presenting with CPA ependymoma, which presented significant challenges for diagnosis and management due to the uniqueness of this histology in a patient of this age and the paucity of literature guiding adjuvant therapy. Nearly every previously reported case of CPA ependymoma occurred in the fifth decade or earlier [Table 1]. Ependymomas arise from cells lining the ventricular system and most commonly originate in the fourth ventricle in children and spinal canal in adults. Ependymomas typically appear heterogeneously hypointense on T1, hyperintense on T2, and exhibit contrast enhancement on T1-weighted MRI imaging. Because schwannomas share these imaging characteristics, CPA ependymomas in adults are difficult to distinguish from this more common histology.^[4,29] However, it has been estimated that 50% of ependymomas exhibit calcification on

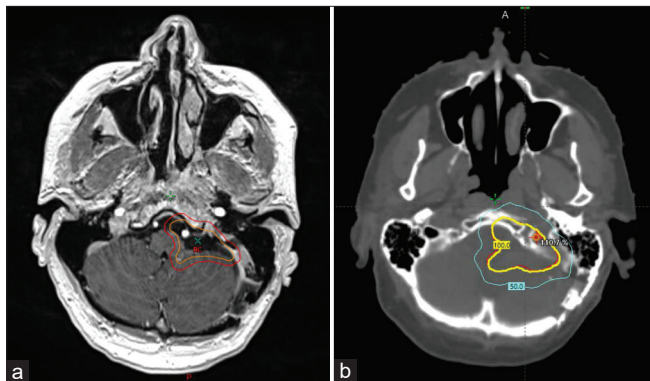


Figure 3: The planning target volume (PTV) consisted of the resection cavity (outlined in orange) plus a 3 mm margin (outlined in red) as identified on the T1 post-contrast sequence (a). 100% of the dose was prescribed to this volume. A 3-arc volumetric modulated arc therapy technique with 6-MV photons was used to cover the volume with the 100% isodose line (5400 cGy) (in yellow) covering the PTV target (resection cavity + 3 mm margin) (in red) on the planning CT head (b).

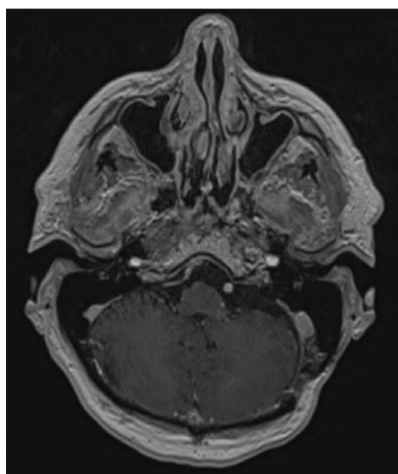


Figure 4: Axial T1-weighted post contrast MRI sequence at the level of the brainstem 24 months after resection demonstrated no residual or recurrent gross disease.

computed tomography (CT) imaging, a feature that would make a diagnosis of schwannoma less likely,^[30] although calcifications are noted to be common in choroid plexus papillomas and 20% of meningiomas.^[5,6] Other distinguishing features for ependymomas include markedly heterogeneous enhancement reflecting hemorrhage, cystic elements, or necrosis. Schwannomas typically have strong homogenous enhancement, especially when <2.5 cm.^[5] Furthermore, ependymomas have a characteristically lobulated architecture and are much less likely to involve the internal acoustic canal. A CT scan may help identify calcifications often seen in ependymoma, widening of the porus acousticus favoring vestibular schwannoma,^[9] or hyperostosis consistent with meningioma. Preservation of hearing would also suggest a

diagnosis of ependymoma, whereas vestibular schwannomas are associated with tinnitus as well as hearing deficit in 94% of patients.^[9] Our patient, however, had significant hearing loss that complicated initial diagnosis. Headache or facial weakness may suggest ependymoma as they are less commonly associated with vestibular schwannomas; however, our patient displayed neither symptom.^[17]

Given the rarity of CPA ependymoma, there is only limited retrospective data to help identify patients most likely to benefit from adjuvant treatment. Poor prognostic factors identified in adults include advanced age >68, anaplastic histology, high E3 ubiquitin ligase MIB-1 labeling index, and the extent of resection.^[1-3] Adjuvant radiotherapy may improve local control and progression free survival, potentially decreasing long-term morbidity.^[19,28] In this context, to maximize local control, adjuvant radiotherapy to 5400 cGy in 30 daily fractions was offered after multidisciplinary neuro-oncology tumor board discussion. Twenty-nine months after resection and adjuvant radiation therapy, the patient demonstrates no clinical or radiographic evidence of disease.

CONCLUSION

In summary, we present nearly the oldest recorded case of a patient presenting with CPA ependymoma, which demonstrates that diagnosing CPA ependymoma in elderly adults based on imaging and symptoms alone can be challenging due to overlapping characteristics with tumors more commonly seen at this location including vestibular schwannoma. Although surgery, when feasible, is first line therapy for every tumor in the differential diagnosis, improving the odds of an accurate clinical diagnosis is essential to providing accurate upfront prognostic information to guide patient expectations. With limited evidence to guide therapy, the role of adjuvant therapy remains uncertain particularly for patients with the WHO Grade II disease, although groups at higher risk of recurrence have increasingly been identified. Further investigations into the role and potential benefit of adjuvant radiotherapy for patients with CPA ependymoma are warranted.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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