Clinical Case Report

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Cerebellar pilocytic astrocytomas with spontaneous intratumoral hemorrhage in the elderly

A case report and review of the literature

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Abstract

Rationale: Pilocytic astrocytoma (PA) is the most common pediatric central nervous system glial tumor. Adult occurrence is rare, especially in elderly adults. How to manage the pilocytic astrocytoma with spontaneous intratumoral hemorrhage in the elderly is still unfamiliar with clinician.

Patient concerns: Reports of tumors with intratumoral hemorrhage in elderly adults are extremely rare. We report a case of a 62-year-old male diagnosed with cerebellar pilocytic astrocytomas with spontaneous intratumoral hemorrhage. Informed consent was obtained from the patient.

Diagnoses: Histological examination of the specimens revealed pilocytic astrocytomas, including a hemorrhagic portion.

Interventions: The patient underwent the radical resections of tumour and was given the regular follow-up.

Outcomes: 12 months later, he recovered without evidence of disease.

Lessons: Cerebellar pilocytic astrocytomas associated with hemorrhages occur over the age of 60 is extremely rare. Removing the tumor and hematoma completely is the best treatment options. Long term follow-up is very necessary for this tumor.

Abbreviations: CNS = central nervous system, CT = computed tomography, EMA = epithelial membrane antigen, GFAP = glial fibrillary acidic protein, MRI = magnetic resonance imaging, PA = pilocytic astrocytoma, SWI = susceptibility weighted imaging.

Keywords: cerebellar, elderly, intratumoral hemorrhage, pilocytic astrocytomas

1. Introduction

Pilocytic astrocytoma (PA) is a slow-growing neuroglioma, commonly found among children and adolescents but rarely occurs in elderly adults.[1] The cerebellum is the primary site for PA occurrence, followed by diencephalon, brain stem, and the visual pathway. Occasionally, patients with pilocytic astrocytomas (PAs) may present with a spontaneous intratumoral hemorrhage.[2] Although there have been few reported cases of spontaneous intracerebral hemorrhage in pediatric cerebellar PAs, such occurrence is extremely rare among elderly patients (Table 1). Here, we report a case of an elderly male who presented with cerebellar PAs and spontaneous intratumoral hemorrhage. In addition, we review the relevant literature and discuss the diagnosis and treatment for elderly patients with both PAs and spontaneous intratumoral hemorrhage.

2. Case report

A 62-year-old man was presented with unstable walking and a headache lasting for 10 days. Upon neurological examination, the results of both cerebellar ataxia test and right finger-to-nose test were positive, while a negative result for the left finger-to-nose test. Meanwhile, the muscle strength and tension were normal in the patient's limbs. Preoperative brain magnetic resonance imaging (MRI) revealed a cerebellar mass with mixed iso- and high-signal intensity on T1-weighted axial image (Fig. 1A). The mass indicated a central mixed-signal intensity and peripheral low-signal intensity on T2-weighted axial image (Fig. 1B). A well-circumscribed, heterogeneous enhancement and less enhanced periphery was presented on gadolinium-enhanced T1-weighted image (Fig. 1D). Brain susceptibility-weighted imaging (SWI) detected the cerebellar mass with hemorrhage (Fig. 1C).

Midline posterior suboccipital craniotomy was performed under general anesthesia. The dura mater was opened to release the cerebrospinal fluid and expose the cerebellar hemisphere. A

Editor: N/A.

SS and HZ contributed equally to this work.

Consent for publication: The patient gave consent for publication of this case report and images.

Funding/support: The case report was funded by the High Level Talent Project of Jiangsu (2017WSW-166).

The authors have no conflicts of interest to disclose.

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Medicine (2018) 97:31(e11329)

Received: 28 March 2018 / Accepted: 5 June 2018

http://dx.doi.org/10.1097/MD.0000000000011329

Table 1

Previous case reports on cerebellar pilocytic astrocytomas with hemorrhage.

Author and ref	Age/gender	Tumor location	Hemorrhage Location	Pathology	Outcome
Mauersberger et al[3]	10 yrs/F	Cerebellum	ITB	Spongioblastoma	Alive
	10 yrs/M	Cerebellum	ITB	Spongioblastoma	Dead
Vincent et al[4]	14 yrs/F	Cerebellum	ITB	Pilocytic	Alive
Fogelson et al[5]	9 yrs/M	Cerebellum	ITB	Pilocytic	Alive
Specht et al[6]	8 yrs/M	Cerebellum	ITB	Mixed pilocytic/ Oligodendroglioma	Dead
Mesiwala et al[7]	13 yrs/M	Cerebellum	ITB	Pilocytic	Alive
Frassanito et al[8]	7 yrs/F	Cerebellum	ITB,SAH	Pilocytic	Alive
Lee et al[9]	15 mos/M	Cerebellum	ITB, SAH, SDH	Pilocytic	Alive
Kumar et al[10]	16 yrs/F	Cerebellum	ITB	Pilocytic	Alive
Kim et al[11]	37 yrs/F	Cerebellum	ITB	Pilocytic	Alive
	53 yrs/M	Cerebellum	ITB	Pilocytic	Alive
Wilson et al[12]	12 yrs/M	Cerebellum	ITB	Pilocytic	Dead
	5 yrs/F	Cerebellum	ITB, SAH	Pilocytic	Dead
Present case	62 yrs/M	Cerebellum	ITB	Pilocytic	Alive

F = female, ITB = intratumoral hemorrhage, M = male, mos = months, Ref = references, SAH = subarachnoid hemorrhage, SDH = subdural hemorrhage, yrs = years.

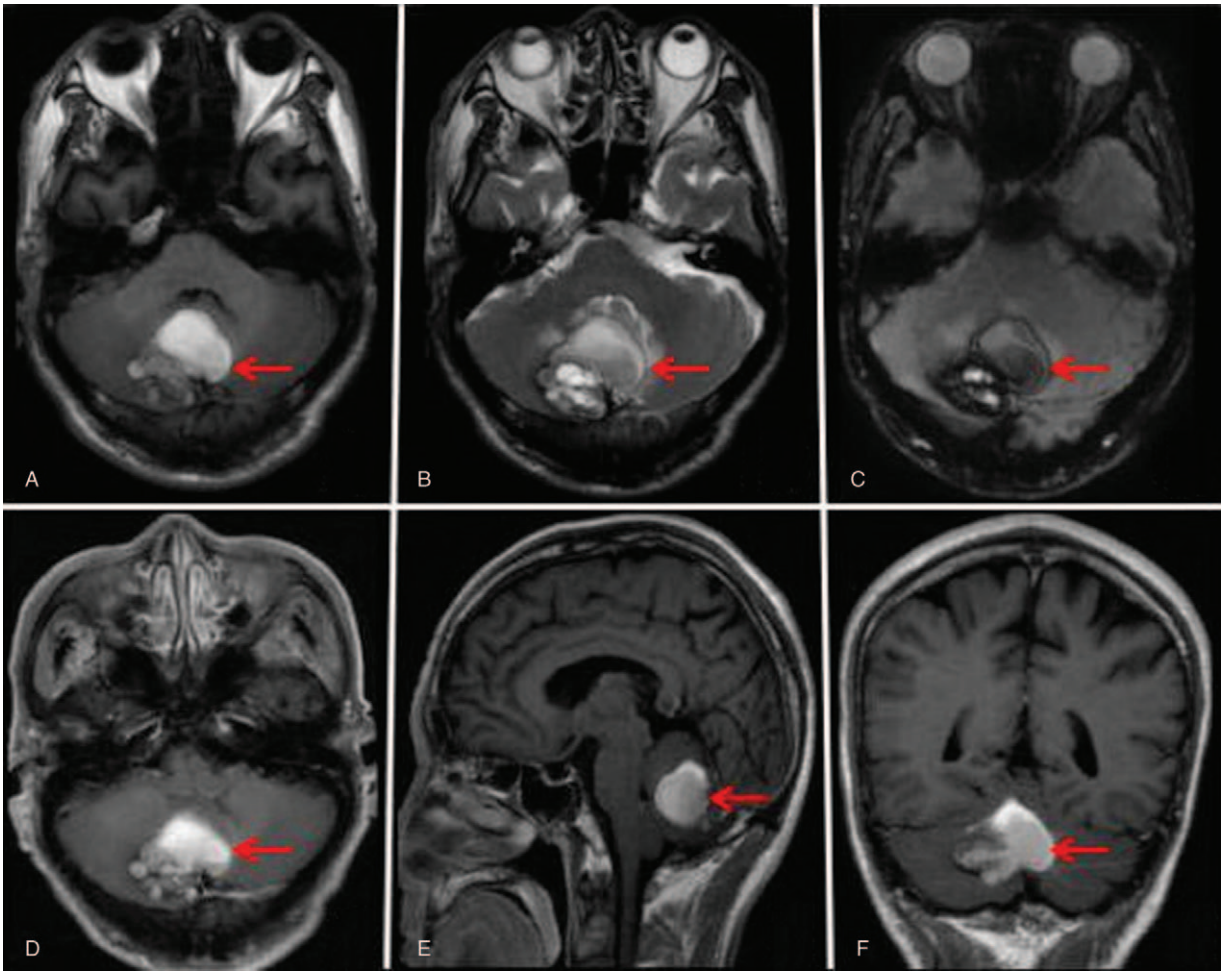

Figure 1. (A) Preoperative T1-weighted brain magnetic resonance imaging (MRI) axial scan showing a cerebellar mass adjacent to the vermis cerebelli. The mass shows mixed-signal intensity (iso and high). (B) T2-weighted axial scans showing the mass with central mixed-signal intensity and peripheral low-signal intensity. (C) Susceptibility-weighted imaging (SWI) demonstrating the mass in the vermis cerebelli, with the low-signal intensity corresponding to the hemorrhage. (D–F) The mass shows circumscribed, heterogeneous enhancement, though the peripheral has less enhancement in the gadolinium-enhanced T1-weighted image. SWI = susceptibility-weighted imaging.

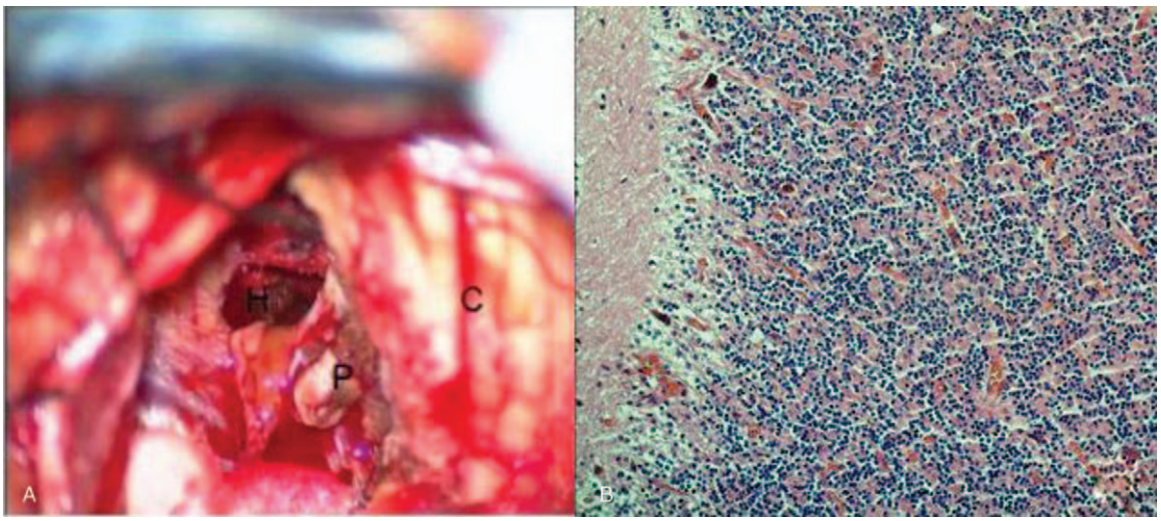

Figure 2. (A) The picture during the surgery shows the tumor (P), hemorrhage (H), and the right hemisphere of the cerebellum (C). (B) Histopathological examination showing neoplastic astrocytes in the glial fibrillary background, with numerous Rosenthal fibers (H&E staining, ×200). The immunohistochemistry revealed GFAP (+++), S-100 (+++), EMA (−), PR (−), and Ki-67 (1%+).

tumor was found to be located at the upper pole of right cerebellum, with a purple intratumoral hematoma and a clear demarcation toward surrounding normal tissue (Fig. 2A). The tumor with intratumoral hemorrhage was removed completely.

Postoperatively, histopathological examination of the specimen revealed a typical PA (WHO Grade I), while the expressions of glial fibrillary acidic protein (GFAP) (+++), S-100 (+++) and epithelial membrane antigen (EMA) (−) were detected by immunohistochemical staining (Fig. 2B). MRI performed 3 months after surgery demonstrated a complete resection of tumor (Fig. 3). The patient recovered well over the 12-month follow-up period.

3. Discussion

PA is a histological subtype of astrocytomas, which accounted for approximately 15% of central nervous system (CNS) tumors. PAs are considered World Health Organization (WHO) grade I tumors, which have distinct histological appearance and clear boundaries.[13,14] The annual incidence of PAs is 2.9 to 4.8 cases per million in all age groups, with a much higher prevalence among children and adolescents. The most common sites of PAs origin are cerebellum, optic chiasma, hypothalamus, and to a lesser extent, cerebral hemispheres, brain stem and spinal cord. In pediatric patients, 67% of PAs occurred in the cerebellum, whereas 55% of PAs occurred supratentorially in adults.[15] The majority of glial tumors, such as high-grade astrocytomas, oligodendrocytes, and mixed astrocytomas, are susceptible to intratumoral bleeding. However, intratumoral hemorrhage is very rare among patients with PAs, with only 8% found in the cerebellum.[11]

Age is strongly correlated with the development of PAs. The most common age group for PAs is 5 to 14 years, followed by the age group ranges 0 to 4 years and 15 to 19 years; however, PAs rarely occur after age 60 years.[1] This case study involved a 62-year-old male patient, and a relatively limited body of literature is available on PAs in older age group. Besides, there are no gender differences in the occurrence of this disease. It has been reported

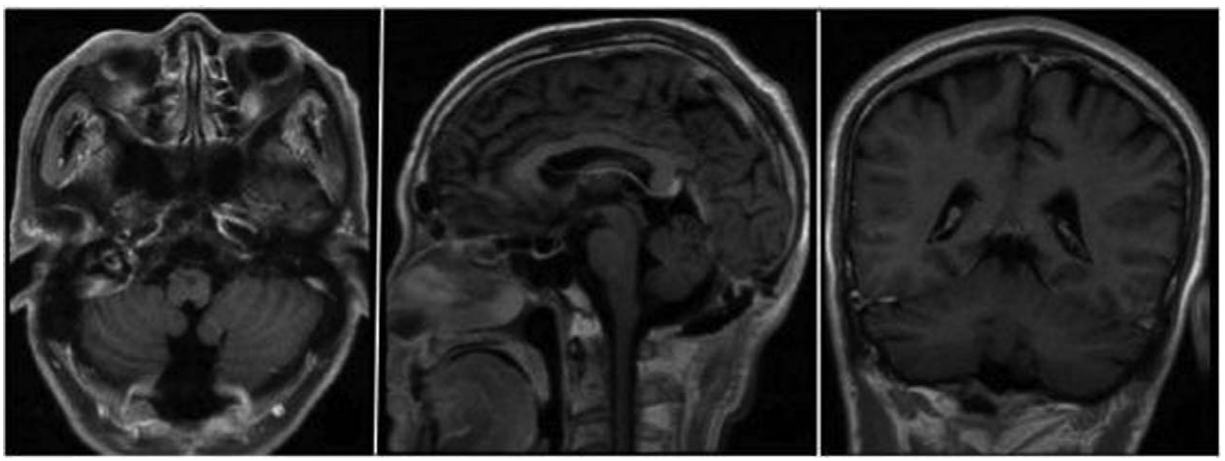

Figure 3. Gadolinium-enhanced T1-weighted MRI obtained 3 months after the operation showing that the tumor was completely resected. MRI = magnetic resonance imaging.

that children with neurofibromatosis type I disease are susceptible to the development of PAs.[13,16] Furthermore, the clinical manifestations of cerebellar PA with hemorrhage are generally divided into 2 main types. The first set comprises the symptoms and signs of cerebellar dysfunction that may persist for weeks or months and can sometimes mimic other diseases, while another type is the acute symptom of intracranial hypertension,[12,17] which is more common and potentially life-threatening. Our patient exhibited the typical symptoms of intracranial hypertension and cerebellar dysfunction, including severe headache, gait disturbances, nausea and vomiting. Moreover, the patients were positive for both cerebellar ataxia and right finger-to-nose tests. These clinical and laboratory findings are in consistent with those reported in the literature.

PA is a localized tumor and often associated with cysts, which is distinguished from other tumors by its imaging features. PAs are detected on CT scans as well-demarcated tumors with both solid and cystic components. MRI has been used routinely to characterize the cystic and solid lesions with better accuracy than CT in many instances. These lesions often appeared as hypointense to isointense on T1-weighted images and sometimes present as hyperdense if the cyst fluid is enriched and contains secreted proteins from tumor cells. On T2-weighted images, the tumor may show high signal intensity. Peritumoral edema is seldom observed in patients with PAs, but can become increasingly noticeable in the presence of hemorrhage.[17–19] In our case study, the results of preoperative brain MRI revealed a cerebellar mass with mixed iso- and high-signal intensity on T1-weighted axial image. These findings are consistent with the previous literature. However, the mass demonstrated a central mixed-signal intensity and peripheral low-signal intensity on the T2-weighted axial image, which is in contrast to previous study. The histopathological features of PAs are very obvious, but not for peritumoral edema. PAs are often characterized by gray, solid, and soft nodules with cysts, in which chronic lesions may contain either hemosiderin or calcification. Microscopic examination shows a well-circumscribed biphasic pattern consisting of dense and loose regions. The loose glial tissues are composed of protoplasmic astrocytes mixed with eosinophilic granular bodies, microcapsules and giant capsules, while the dense hair tissues contain bipolar cells and Rosenthal fibers. In addition, PAs may display a positive GFAP staining, as well as perivascular hyalinization, diffuse growth, necrosis, etc. Other visible features include hardening of blood vessels, angiogenesis, calcification and chronic inflammation, while nuclear pleomorphism, mitosis and necrosis are extremely rare.[17–20] In our case study, the histopathological examination and immunohistochemical analysis indicated that neoplastic astrocytes exhibited fibrillary background, with numerous Rosenthal fibers, and were immunohistochemically positive for GFAP. Indeed, these are the clinical and laboratory evidence to support the diagnosis of PAs in elderly patients.

The rate of PAs with spontaneous bleeding is approximately 8%, with a high occurrence in children than in adults. The signs and symptoms of cerebellar dysfunction are the most common clinical manifestations of cerebellar PAs with spontaneous intratumoral hemorrhage. The symptoms can last for several weeks or months and is frequently misdiagnosed and mistreated. Occasionally, those PAs patients with intracranial hypertension may require emergency neurosurgical care. Although vascular necrosis and tumor invasion are the primary causes of bleeding in high-grade gliomas, the mechanisms underlying low-grade gliomas remain unclear.[2] Previous studies have demonstrated that spontaneous bleeding in PAs is due to interaction of different factors, which can be attributed to the specific pathological changes in vascular structures of tumor, such as interstitial degeneration, hyaline degeneration and proliferation of vascular endothelial cells. For instance, the vascular histology of bleeding tumor indicated a poorly developed capillary bed and thin vessel walls. These blood vessels, although rich in collagen, have fewer elastic fibers and poor compliance, which can increase the chances of tumor rupture. The association between tumor capillary type and bleeding tendency has been reported previously, in which the reticular vessels are more prone to rupture.[11] In addition, intratumoral bleeding is associated with tumor growth, intratumoral vascular invasion, rupture of an encased aneurysm and hemostatic abnormalities. Notably, higher arterial pressure and acute intracranial hypertension are often the predisposing factors. Approximately 27% of patients with bleeding have calcification, suggesting that calcification may contribute to intratumoral bleeding. A recent study has found that the spontaneous bleeding of PAs is significantly associated with tumor VEGF expression.[12] The patient in our case study developed spontaneous intratumoral hemorrhage, but the cause of bleeding is still unclear. Therefore, we speculate that intratumoral bleeding may be related to vascular abnormalities in the tumor.

Surgery is the preferred the treatment for PAs with hemorrhage, which allows for simultaneous removal of tumor and hematoma. Tumors that occurred in the brain stem or visual pathway usually cannot be completely removed by surgery, though the residual tumors may cease to grow, or grow slowly, or even regress. Therefore, a complete oncologic resection is the cure for this disease. In this case study, a midline posterior suboccipital craniotomy under general anesthesia was performed to completely remove the tumor lesion and intratumoral hematoma. Furthermore, long-term follow-up is required for patients with complete and partial resection. Rare sequelae can be observed in some patients, including postoperative posterior fossa silent syndrome (<5%). Moreover, PAs patients may experience symptoms such as movement disorder balance and gait problems at the time of diagnosis, but most of these symptoms are transient and do not affect their daily life.[18] The patients treated with subtotal resection may be required for additional chemotherapy and radiotherapy after surgery, but is still a matter of debate. The prognosis of patients with PAs is generally good, with the 5-year survival rate of 86% to 100%. The location of the tumor and the extent of the resection can play an important role in the prognosis of PAs patients. For example, the proliferation index of Ki-67 is related to the prognosis of PAs, and patients with complete resection may have a higher survival rate. Age is another important risk factor for death among PAs patients. The 5-year survival rate is reported to be 96.5% for pediatric patients range 5 to 19 years old, and declined to 52.9% for elderly patients over the age of 60 years. Reoperation may remain the first choice for most patients with recurrent PAs. Patients who underwent partial resection surgery can have a higher risk of recurrence after PAs.[17] In our case, the postoperative brain MRI indicated that the tumor was completely resected. During the 12 months follow-up period, the patient was found to be fully recovered. Nevertheless, according to the literature, a longer follow-up period is necessary for PAs patients with intratumoral hemorrhage.

4. Conclusions

Based on the combined results from the current clinical experience and other related studies, we suggest that cerebellar

PAs with spontaneous intratumoral hemorrhage is extremely rare, especially in elderly patients over the age of 60 years. Surgery is probably the most effective treatment options to completely remove the tumor and hematoma. Long-term follow-up after surgical treatment of PAs and intratumoral hemorrhage is essential to reduce the risk of recurrence.

Author contributions

Data curation: Zhao-Zheng Ding.
Writing – original draft: Hui Zhou.
Writing – review & editing: Shuo Sun, Hui Shi.

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