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Intratumoral Hemorrhage within a Petrous Meningioma

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ABSTRACT

Introduction: Intracranial hemorrhage stemming from a benign intracranial lesion is much less commonly seen than from malignant tumors such as gliomas or metastases. Cerebellopontine angle (CPA) lesions rarely present with hemorrhage.

Case presentation: We describe the case of a 49-year-old male with a recurrent right CPA meningioma arising from the petrous bone that was previously treated with a subtotal resection and postsurgical radiosurgery, presenting with acute left-sided hemiparesis secondary to intratumoral hemorrhage. Although surgical evacuation and decompression was recommended, the patient declined operative intervention and was managed medically.

Discussion: Meningiomas can cause subarachnoid, intraparenchymal, and rarely intratumoral hemorrhage. Symptomatic hemorrhage can worsen the prognosis, with increased morbidity and mortality. Several etiologies have been proposed for this phenomenon, including rupture of aberrant vasculature, intratumoral necrosis, and tearing of stretched bridging veins.

Conclusion: Only two prior cases of CPA meningioma have been reported in the literature. Recognition of CPA meningioma hemorrhage as a clinical entity can help in future diagnoses and management.

INTRODUCTION

Intratumoral hemorrhage into a malignant brain tumor such as a glioma or metastasis is a well-documented event. Conversely, benign lesions – other than pituitary adenomas – rarely present with extensive hemorrhage.^{1,6,10} Though rare, there have been several cases of cerebellopontine angle (CPA) lesions presenting with hemorrhage.^{3,12} We present a case of a patient with recurrent CPA meningioma that was previously treated with a subtotal resection and postsurgical radiosurgery, presenting with neurological decline due to intratumoral hemorrhage.

CASE PRESENTATION

We present the case of a 49-year-old male with a history of medulloblastoma resected as a child, who underwent chemo- and radiation therapy at that time. Due to surgical clips placed at the time of his posterior fossa craniotomy, he was unable to receive magnetic resonance imaging and was instead followed with cranial contrasted computed tomography (CT) studies. Subsequently, in adulthood, he developed multiple radiation-induced extra-axial lesions, including a right 2.7 x 1.9 cm homogeneously enhancing extra-axial dural-based mass, arising from the petrous bone, extending through the ambient and cerebellontine cisterns and down to the CPA. He underwent a subtotal resection of this lesion thirteen years earlier through a retrosigmoid approach at another facility, with a resultant right facial palsy and complete hearing loss post-operatively. Pathology was consistent with a WHO grade I meningioma. Radiologic reports described approximately 50% of the tumor remaining postoperatively. He underwent fractionated conformal proton therapy to the residual tumor shortly thereafter, receiving 54 Gy in 30 fractions.

After being lost to clinical and radiographic followup for seven years, an updated cranial CT was eventually obtained twelve years after the meningioma resection for unrelated symptoms. This demonstrated enlargement of the previously treated residual tumor as well as communicating hydrocephalus (Figure 1), and he was referred to us for evaluation. As he had experienced progressive gait disturbance over the previous year, a high volume lumbar puncture was performed, yielding transient but significant improvement in his ambulation. Therefore, a left occipital ventriculoperitoneal shunt with a Medtronic Strata valve set at 1.5 – correlating to a standing opening pressure of 8.5 cm H₂O – was placed with plans for repeat surgical resection after his recovery from that procedure. Routine postoperative imaging showed a small amount of intraventricular hemorrhage as well as a small new hyperdensity within the posterior fossa meningioma consistent with intratumoral hemorrhage (Figure 2). The patient was asymptomatic from both of these findings and was discharged to home on postoperative day. He experienced a very satisfactory improvement in his gait and cognitive abilities over the next few months.

He returned to the emergency department four months after placement of the shunt with progressively worsening headache and left-sided weakness. Imaging revealed intratumoral hemorrhage into the meningioma (Figure 3A), with extension into the pons and pre-pontine cistern (Figure 3B).

After lengthy discussion with the patient and his family, surgery was offered for hematoma evacuation and maximal safe tumor resection for brainstem decompression. However, the patient refused, stating that he did not want any additional surgery and opted for medical management instead. His left hemiparesis improved to a Modified Rankin Score of 3 and he ultimately required a percutaneous gastrostomy tube for dysphagia. The patient was eventually discharged to a rehabilitation facility and has had significant improvements in his strength on the

left side during this time. At the time of his last followup 6 months postoperatively, he has had significant improvements, and is now at a mRS of 2, and independent with many activities of daily living. He continues to refuse any further imaging or further surgical intervention.

DISCUSSION

Meningiomas are the most commonly encountered benign intracranial lesion, accounting for roughly one quarter of all primary intracranial lesions. While the incidence of hemorrhage into brain tumors is noted to be close to 4% – mostly in gliomas and metastatic tumors – the incidence in meningiomas is much lower, roughly 1.3%.^{6,7,11} Hemorrhage arising from a meningioma can manifest in several ways, including subarachnoid, intracerebral, and least commonly intratumoral hemorrhage.⁶ Rarely, subdural hematoma may also be seen.⁷ However, clinically symptomatic hemorrhages are less common.^{5,11} Notably, the morbidity and mortality rates for meningiomas presenting with symptomatic hemorrhage appears to be higher than lesions that have not bled.^{4,9}

A small number of factors have been associated with an increased risk of hemorrhage, including age (those older than 70 or younger than 30 years of age), pathology (more common with fibrous, malignant, and angioblastic varieties), and location. There appears to be an increased propensity for bleeding observed in convexity and intraventricular meningiomas, with convexity meningiomas having a roughly three-fold higher rate of hemorrhage than those occurring elsewhere intracranially.^{2,5,9} Surprisingly, a review of the literature found that a history of prior radiotherapy – as in the currently presented case – did not appear to increase the risk of hemorrhage.⁸ Literature review did not reveal any known risk for hemorrhage in recurrent meningiomas.

So far, only two cases of CPA meningioma presenting with hemorrhage have been reported.^{5,12} Both of these patients were presented by Yasargil et al. in 1976. One was a 50-year-old female who presented with right hemiparesis, and underwent surgical resection of a left CPA meningioma with significant improvement in her symptoms. The other was a 47-year-old lady who presented with subarachnoid hemorrhage from intratumoral hemorrhage, and after neurologically declining while under observation, underwent surgical resection; her course was more difficult, ultimately requiring a tracheostomy and feeding tube, with residual neurological deficits despite maximal surgical and medical therapies.

Several theories exist in the literature regarding the etiology of meningioma-associated bleeding. This includes rupture of abnormal vasculature, intratumoral necrosis, and stretching (due to growth) and subsequent hemorrhage of bridging veins. Coagulopathy, trauma, seizure, tumor infarction, malignant transformation, peritumoral edema, hypertension, and venous hypertension have also been proposed as possible mechanisms.^{2,4,6,9} There does not appear to be a consensus, and different causes may exist for hemorrhage in different patients.

In our described patient, alteration of cerebrospinal fluid flow and resultant decrease in intracranial pressure after ventriculoperitoneal resulted in an asymptomatic intratumoral hemorrhage prior to his representation. Therefore, we postulate based on this initial finding that changing the transmural pressure of the tumor may support the theory of hemorrhage from the injury to the tumor's bridging veins. Being aware of this potential risk for hemorrhage as a consequence of transmural pressure alterations may aid in decision making for similar cases in the future. There are a number of reports of intratumoral hemorrhage following VPS placement, many of which report disastrous if not fatal outcomes (Matsumoto, Kasliwal), especially in posterior fossa tumors (Sanathanam, El-Gaidi). Recognizing the potential for CSF drainage to

cause intratumoral hemorrhage in posterior fossa tumors may help in determining a proper setting for the shunt valve, potentially in choosing a higher setting in the setting of previous radiosurgery.

CONCLUSION

Hemorrhage is a rare presentation of cerebellopontine angle lesions, especially meningiomas. Review of meningioma as a possible etiology for hemorrhage in the posterior fossa can help aid in diagnosis. Recognizing the risk for intratumoral hemorrhage following VPS may help in managing hydrocephalus secondary to posterior fossa tumors. Symptomatic hemorrhage can worsen outcomes, and discussion with the patient and their family is critical in treatment planning.

FIGURE LEGEND

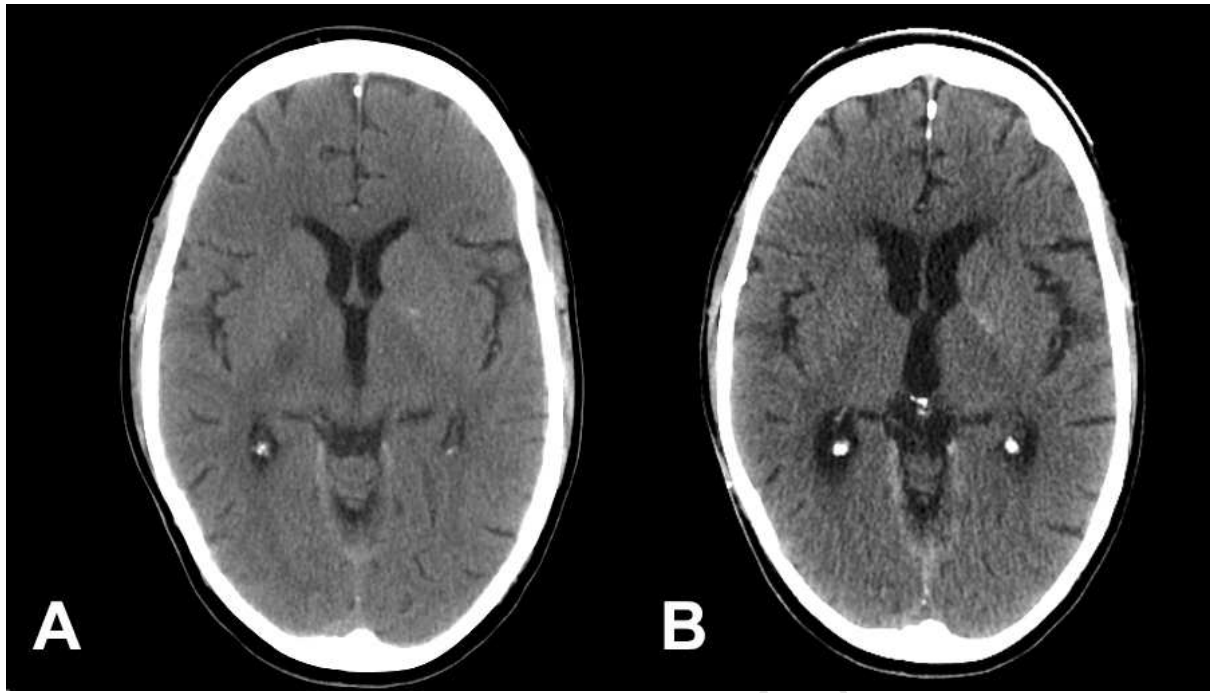
FIGURE 1: Patient's ventricular caliber on **A)** post-operative/post-radiation imaging compared to **B)** presentation for re-evaluation following imaging obtained after being lost to followup for several years.

FIGURE 2: Routing post-operative imaging following ventriculoperitoneal shunt placement showing both **A)** intratumoral and **B)** intraventricular hemorrhage.

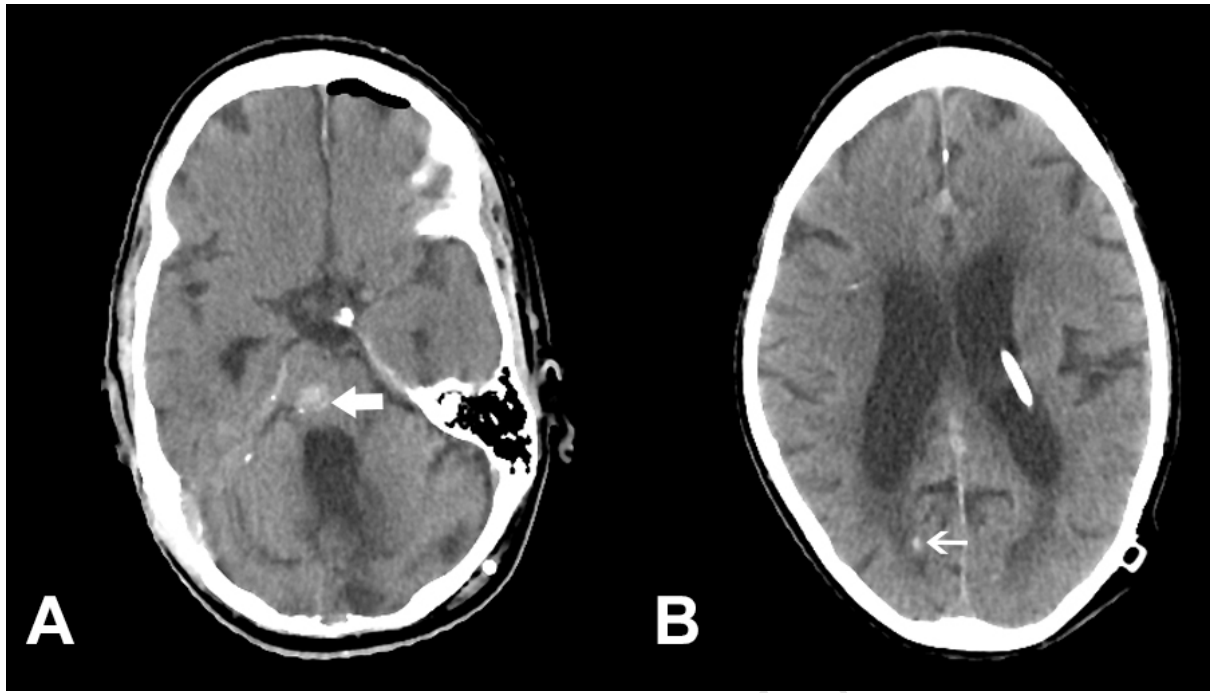
FIGURE 3: **A)** Intratumoral hemorrhage into the enlarging meningioma **B)** with extension into the pons and pre-pontine cistern.

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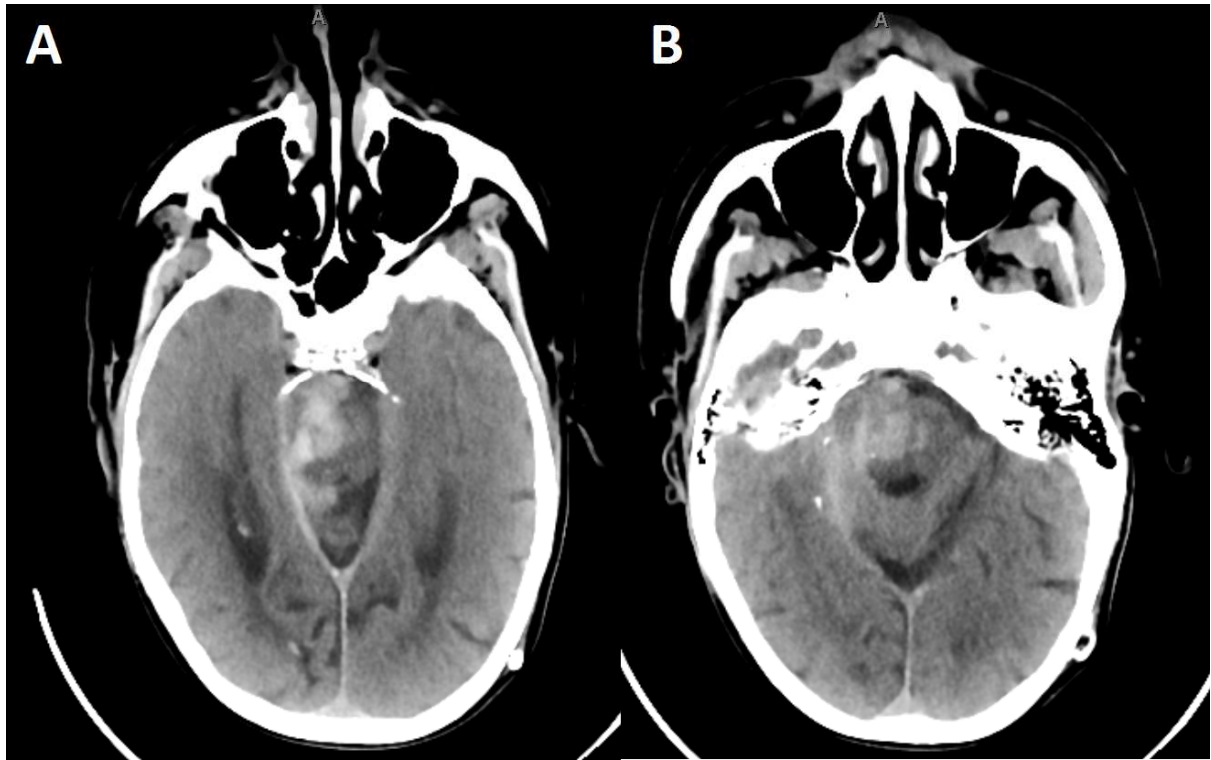
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HIGHLIGHTS

- Intracranial hemorrhage stemming from a benign intracranial lesion is much less common than from malignant tumors.
- Meningiomas can cause subarachnoid, intraparenchymal, and rarely intratumoral hemorrhage.
- Cerebellopontine angle meningiomas can present as an exceedingly rare cause of posterior fossa hemorrhage.
- Changes in transmural pressure due to cerebrospinal fluid diversion may cause these lesions to hemorrhage.

ABBREVIATIONS

Cerebellopontine Angle – CPA

Computed tomography - CT

Modified Rankin Score - mRS

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