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## Introduction

- Vestibular schwannomas (VS) are benign tumors of the vestibular portion of 8th cranial nerve, representing 8% of all intracranial neoplasms and >80% of cerebellopontine angle (CPA) and internal auditory canal (IAC) tumors.<sup>1,2</sup>
- Symptoms: sensorineural hearing loss, tinnitus, imbalance, facial numbness or pain, and, rarely, facial weakness.<sup>1</sup>
- Managed with microsurgical resection, and/or stereotactic radiosurgery (SRS).<sup>2</sup>
- Intratumoral hemorrhage (ITH) in VS has been reported as a rare complication of SRS, with a cumulative incidence of 0.26%.<sup>3</sup>

We present a case of VS treated initially with microsurgery followed by CyberKnife radiosurgery, in which the patient developed sudden-onset complete unilateral facial paralysis due to intratumoral hemorrhage 12 years after SRS.

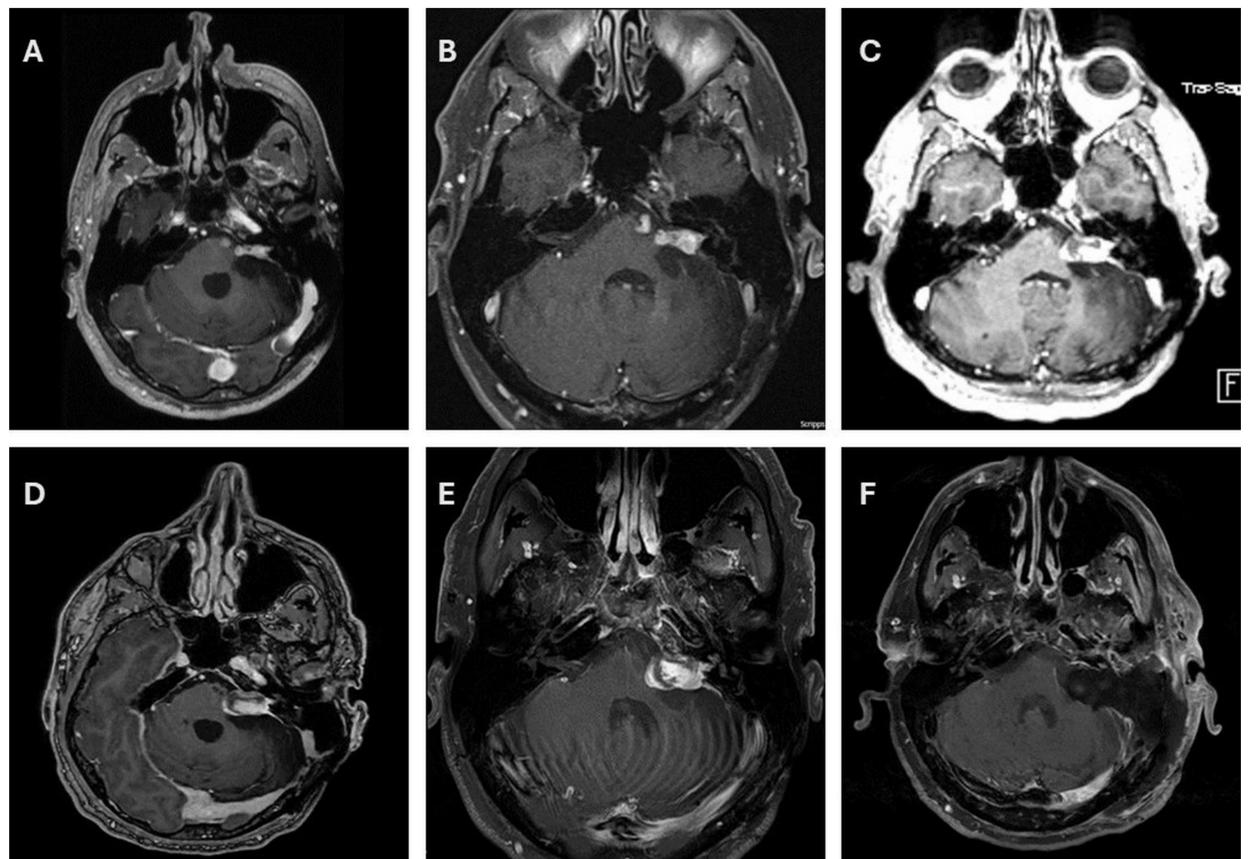
## Case Report

- A 51-year-old male presented to our emergency department due to one month of acute-onset left-sided facial paralysis (House-Brackmann VI) and facial pain.
- He had a history of left-sided VS, treated 12 years prior to presentation with retrosigmoid craniotomy with partial tumor resection, followed by Cyberknife radiosurgery. He also had a history of multiple cavernous malformations, which were entirely stable and without any symptomatic hemorrhages.
- His treatment course had resulted in left-sided deafness and facial numbness, but intact facial motor function. Most recent MRI, three years prior, showed a 2.0 × 1.0 cm non-cystic residual tumor with homogeneous enhancement (**Figure 1**).
- One month before presentation, he developed a spontaneous left-sided facial droop, facial pain, and altered gait. MRI demonstrated a 2.5 × 1.3 × 1.9 cm left CPA mass expanding into the IAC, with new signs of hemorrhage (**Figure 1**).
- Translabyrinthine resection was performed, and gross total resection was achieved. Final pathology confirmed schwannoma with organizing hemorrhage and features of radiation-induced vasculopathy, negative for malignancy.
- Facial palsy remained stable up to four months post-surgery. He was encouraged to follow up for continued MRI surveillance.

## Discussion

- Several risk factors have been associated with ITH development in VS tumors, including antiplatelet or anticoagulant therapy, hypertension, pregnancy, trauma, larger tumor size, and rapid tumor growth. History of radiosurgery has also been implicated.<sup>2</sup> The only identifiable risk factor in our case was prior SRS.
- Data on hemorrhagic events following radiosurgery for VS remain limited. ITH incidence after SRS in VS tumors has been reported as 0.26% with the interval time between SRS and ITH ranging from 2 to 130 months.<sup>3,4</sup>
- Rapid tumor expansion and stretching of facial nerve in the setting of clinically significant ITH can result in facial palsy, which is reported more frequently in hemorrhagic VS compared with typical VS (47% vs. 6%).<sup>1</sup>
- Vascular abnormalities and hypervascularity have been proposed as potential mechanisms underlying ITH in VS, which is consistent with radiation-induced vasculopathy, histopathologically observed in our case.<sup>4</sup>
- No radiologic or pathologic evidence to suggest that patient's cavernous malformations were involved in the pathogenesis of the patient's ITH or facial palsy.
- Management of ITH depends on accompanying neurologic signs and symptoms. In cases with neurologic symptoms such as ours, surgery is preferred. Facial nerve function often fails to improve after resection.<sup>1,5</sup>

**Figure 1.** Pre- and postoperative contrast enhanced T1-weighted MRI. An enhancing homogeneous residual mass of the right CPA that extends into the right IAC measuring (A) 20 × 8 mm, 8 years post-CyberKnife radiosurgery, and (B) 20 × 10 mm, 9 years post-CyberKnife radiosurgery. Serial MRI after symptom onset demonstrating heterogeneous enhancing mass with hemorrhagic changes measuring (C) 25 × 13 mm, (D) 25 × 13 mm, and (E) 28 × 13 mm. (F) Postoperative MRI showing postsurgical changes and no enhancement.



## Conclusions

Intratumoral hemorrhage can occur many years after radiosurgery for vestibular schwannoma, even in stable tumors. This complication has the potential to cause cranial nerve deficits, among other neurologic sequelae. Long-term follow-up with regular MRI surveillance is essential for early detection and intervention.

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## References

1. Mathkour M, Helbig B, McCormack E, Amenta PS. Acute Presentation of Vestibular Schwannoma Secondary to Intratumoral Hemorrhage: A Case Report and Literature Review. *World Neurosurg*. 2019 Sep;129:157-163. <https://doi.org/10.1016/j.wneu.2019.05.075>
2. Thombre B, Sadashiva N, Krishnan JB, et al. Symptomatic Post-Radiosurgery Intratumoral Hemorrhage in a Case of Vestibular Schwannoma: A Case Report and Review of the Literature. *Stereotact Funct Neurosurg*. 2019;97(5-6):399-403. <https://doi.org/10.1159/000504264>
3. Bin-Alamer O, Abou-Al-Shaar H, Mallela AN, et al. Intratumoral Hemorrhage in Vestibular Schwannomas After Stereotactic Radiosurgery: Multi-Institutional Study. *Neurosurgery*. 2024 Feb 1;94(2):289-296. <https://doi.org/10.1227/neu.0000000000002627>
4. Bin-Alamer O, Fogg D, Wei Z, et al. Intratumoral hemorrhage in vestibular schwannomas after stereotactic radiosurgery. *J Neurosurg*. 2022 Jun 24;138(2):413-419. <https://doi.org/10.3171/2022.5.JNS22935>
5. Rao P, Thibodeau R, Jafroodifar A, Mangla R. Hypervascular vestibular schwannoma: A case report and review of the literature. *Radiol Case Rep*. 2021 Aug 1;16(10):2841-2846. <https://doi.org/10.1016/j.radcr.2021.06.082>