CASE REPORT

A schwannoma at the lower cerebellopontine angle mimicking a brainstem glioma on neuroimaging: case report

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Abstract

This study reports the case of a schwannoma in the inferior cerebellopontine angle (CPA) that mimicked a brainstem glioma in imaging. The patient was a 35-year-old male, who presented in February 2023 with dizziness that had persisted for six months and exacerbated on moving the neck. Imaging examinations, specifically cranial magnetic resonance imaging (MRI), revealed a mass in the left brainstem and cerebellar region, measuring approximately 3.7 × 2.6 × 3.8 cm. The mass was irregular in shape, showing slightly long T1 and mixed T2 signals. It locally compressed the fourth ventricle, and after contrast-enhanced scanning, significant heterogeneous enhancement was observed. Magnetic resonance spectroscopy (MRS) indicated that the peak heights of N-acetylaspartate (NAA) and choline complex in the lesion were approximately 0.049 and 0.524, respectively. Due to the extremely similar imaging features to those of a brainstem glioma, it was initially misdiagnosed as glioma. Total surgical resection was performed, and post-operative pathology confirmed it to be a schwannoma. The patient recovered well after the operation, the symptoms disappeared and no neurological deficits remained. This type of schwannoma is extremely rare and is highly likely to be misdiagnosed as a brainstem glioma due to its imaging manifestations. This case emphasises the importance of cautious diagnostic evaluation and surgical management of such rare tumours, providing valuable reference for clinical practice.

Keywords: Schwannoma, Brainstem glioma, Neuroimaging, Persistent dizziness, Surgery, Tumour..

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Introduction

Schwannomas are benign tumours of the spinal and cranial nerves originating in the Schwann cell sheath of the peripheral nerves. The auditory and trigeminal nerves are common sites; however, the glossopharyngeal, vagus, and hypoglossal nerves can also be affected.[1] Brain stem schwannomas are exceptionally rare[2] and usually occur in children and young adults, with the age of onset being 12–48 years. Clinical manifestations depend on tumour location and ventricular compression, including dizziness, headaches, vomiting, limb weakness, sensory disturbances, and dysphagia.[3,4] We hereby report a case of schwannoma that mimicked brainstem glioma in imaging manifestations. The case was confirmed by surgery, and the lesion was located in the inferior cerebellopontine angle. This case provides valuable insights into understanding the diagnostic and treatment challenges caused by atypical neuroimaging features.

Case Report

A 35-year-old man was admitted to the Department of Neurosurgery, Second Affiliated Hospital of Kunming Medical University, Yunnan, China, with persistent dizziness for six months. In September 2022, he developed dizziness, which often worsened with neck rotation and bending and was occasionally accompanied by distending pain behind the occipital region. The symptoms persisted and worsened; the patient was admitted to our institute in February 2023. Physical examination revealed normal consciousness and clear speech, with no hoarseness or dysphagia, bilateral equal pupils with intact light reflexes, and bilateral normal hearing. The neck was supple and the limbs moved easily, whereas gait disturbance was observed; no other neurological alterations were noted; the body weight was unaltered. Cranial computed tomography (CT) scan revealed a mass-like slightly low-density shadow in the left pontocerebellar peduncle area (Figure 1A). Cranial magnetic resonance imaging (MRI) demonstrated a 3.7 × 2.6 × 3.8 cm mass in the left brainstem and cerebellar with an irregular, slightly long T1-mixed-T2 signal (Figures 1B, C) and localised compression of the fourth ventricle, with uneven and obvious intensification after enhancement scanning (Figures 1D–F). Pre-operative tumour marker levels (HGH, Free-PSA, PSA, NSE, CA125, ferritin, CA19-9, AFP, CEA, CA242, beta-HCG, and CA15-3) were normal. On magnetic resonance spectroscopy (MRS), the peak heights of nitrogen-acetylaspartate (NAA) and choline complexes in the lesion were approximately 0.049 and

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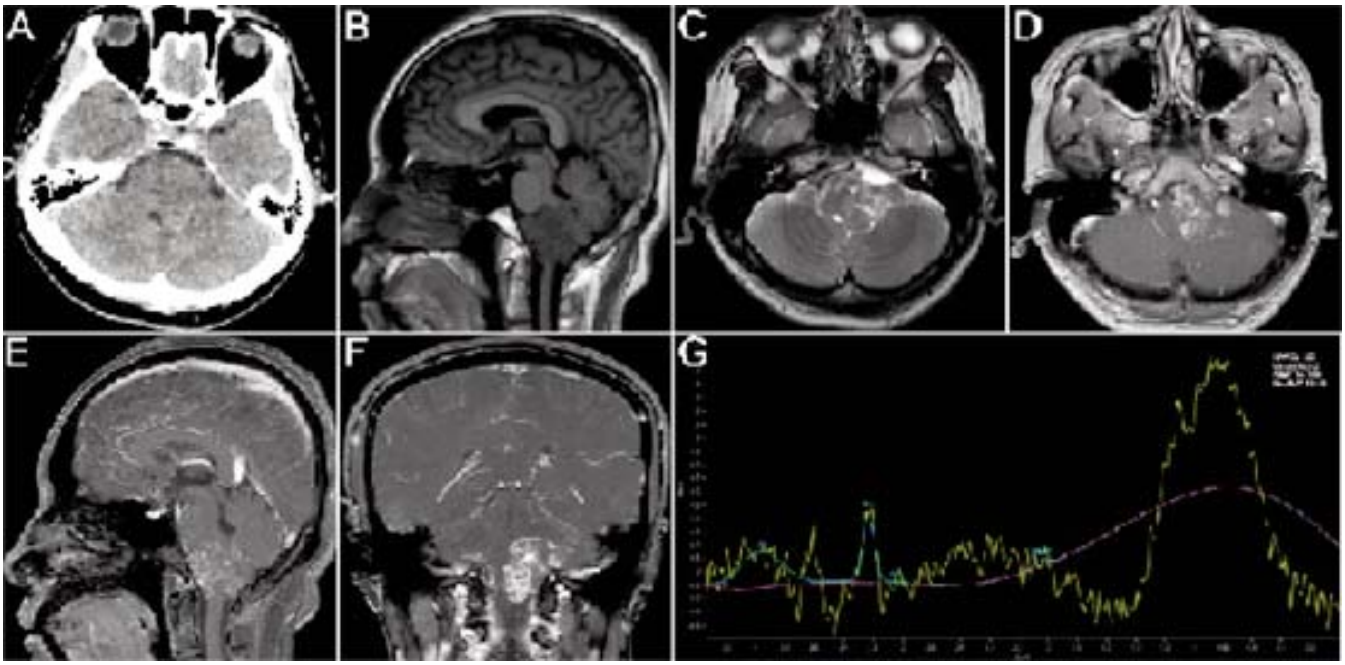

Figure-1: Pre-operative cranial imaging. (A) Computed tomography suggests a left cerebellar mass with a slightly low-density shadow poorly demarcated from the adjacent brainstem. (B, C) Cranial magnetic resonance imaging (MRI) shows an irregular, slightly long T1-mixed-T2 signal mass in the brainstem, and segmentation is observed within the mass. (D–F) An enhanced cranial magnetic field scan shows uneven enhancement of the mass; a glioma is suspected. (G) Magnetic resonance spectroscopy shows slightly elevated choline complex levels.

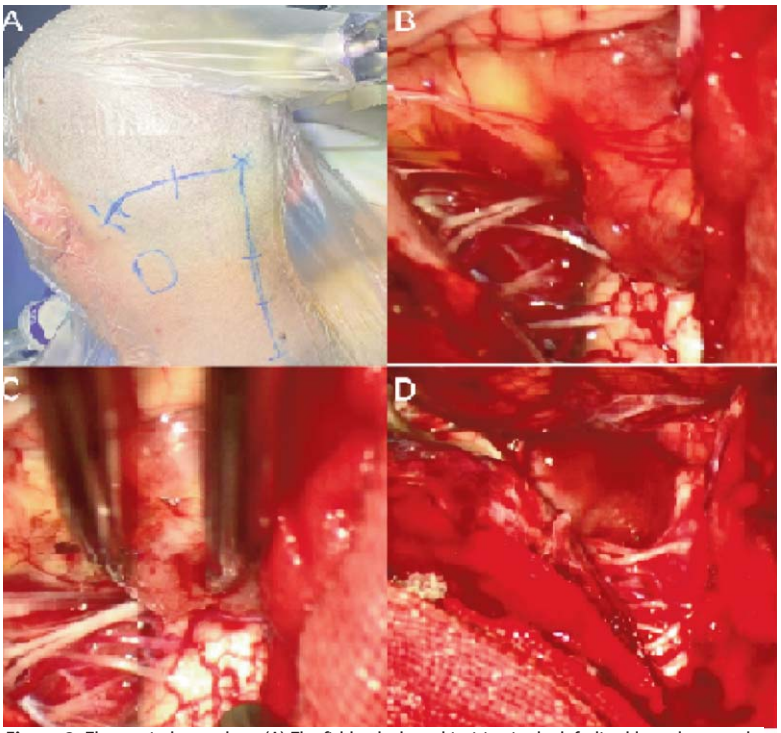

Figure-2: The surgical procedure. (A) The fishhook-shaped incision in the left distal lateral approach. (B) After the dura is opened, the tumour is observed at the lower edge of the foramen magnum: it is greyish-red in colour, with a complete envelope and medium texture. (C) The posterior group of the cranial nerves is compressed by the tumour, becoming thin and pale, and the tumour is completely resected. (D) Total macroscopic excision of the tumour and cranial nerve preservation.

0.524, respectively (Figure 1G). These imaging features, particularly the irregular shape of the mass, the slightly long T1 and mixed T2 signals, as well as the heterogeneous enhancement, led to the pre-operative diagnosis of brainstem glioma.

Craniotomy and tumour resection were performed in March 2023, employing a fishhook-shaped incision in a left far lateral approach (Figure 2A). The occipital and neck skin and muscles were incised layer by layer to fully expose the squamous portion of the occipital bone and the left atlas and axis posterior arches. The posterior arches were opened approximately 3 cm, exposing the posterior cranial fossa and the Foramen Magnum. The atlanto-occipital fascia was resected and the dura mater was incised in a "+" shape to expose the tumour. The tumour was located at the inferior edge of the foramen magnum (Figure 2B). It was greyish-red in colour, encapsulated, and of medium texture. The tumour was compressing the cervical nerve roots. Crucially, the tumour was noted to be exogenous, compressing rather than originating endogenously from the brainstem, and was clearly separated from the medulla oblongata. The mass was resected from its lower edge,

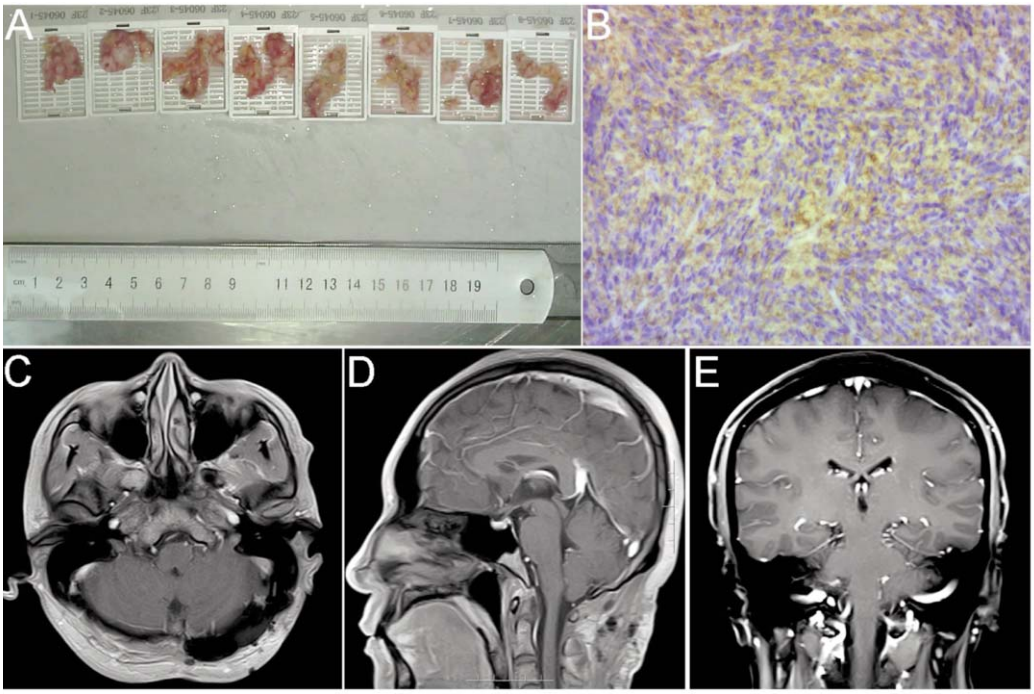

Figure-3: Post-operative pathological and imaging findings. (A) The tumour tissue is removed during surgery. (B) Pathological results suggest a nerve sheath tumour. (C–E) Cranial magnetic resonance imaging performed three months later shows that the tumour has been completely removed without a remnant.

which showed that the base of the tumour was attached to the jugular foramen and the lower group of cranial nerves were compressed, becoming thin and pale (Figure 2C). The lower cranial nerves and the tumour were carefully separated, showing that the mass grew anteriorly and posteriorly across the medulla oblongata. The tumour was resected upward and laterally, and the facial-auditory nerve and left vertebral and basilar arteries were revealed; the mass was finally completely resected (Figure 2D). Post-operative pathological examination led to a diagnosis of nerve sheath tumour (Figures 3A, B).

The patient recovered well after the operation, with resolution of the dizziness, normal consciousness level and cognition during physical examination, answering to questions, no cranial nerve damage, and good limb movements. He was discharged from the hospital two weeks post-operatively after removal of the head dressing. MRI repeated three months later revealed a completely resected tumour without remnants (Figures 3C–E). Notably, the compressed medulla oblongata returned to normal, and there was no surgical cavity that is usually left after the resection of intrinsic brainstem lesions.

Discussion

Brainstem schwannomas have a low prevalence. With the continuous improvement of medical imaging, MRI has been applied to diagnose and treat various diseases. MRI provides high diagnostic accuracy and superior image resolution, offering additional advantages. Magnetic resonance spectroscopy analysis is the use of nuclear magnetic resonance phenomena and chemical shift effects to identify the biochemical and metabolic changes of intracranial tumours, including NAA, Creatinine (Cr), Choline (Cho), lipids, and lactic acid.[5] In the present case, glioma was initially considered based on pre-operative imaging. However, the post-operative pathology confirmed that the tumour was a schwannoma. The reason for the misdiagnosis in this case stemmed from the atypical MRI imaging findings. Schwannomas typically exhibit high or isointense signals on T2-weighted images and usually show homogeneous enhancement after contrast-enhanced scanning. Nevertheless, the patient's tumour presented as hypointense on T2-weighted images and non-homogeneous enhancement. Considering its location in the brainstem-cerebellar region, it strongly suggested the possibility of an intrinsic brainstem lesion, such as glioma, especially when taking into account the magnetic resonance spectroscopy (MRS) findings. These pieces of information were highly likely to lead to misdiagnosis.

This case highlights a significant pitfall in the process of neuroimaging diagnosis, that is, atypical signal characteristics are likely to mislead doctors' judgment, causing them to deviate from the correct diagnostic direction. This also reminds us that during the clinical diagnosis process, we cannot rely solely on a single imaging feature. Instead, we need to comprehensively analyse information from multiple aspects to avoid misdiagnosis.

Brainstem schwannomas are benign tumours that expand into the medullary mass and compress the fibre

bundles and nerve nuclei, resulting in clinical symptoms. These can be cured with surgical resection. The surgical goal is to remove as much tumorous tissue as possible while preserving nerve function, relieving brain stem pressure, restoring the cerebrospinal fluid circulation pathway to relieve the increased intracranial pressure, and providing better conditions for radiotherapy. An appropriate surgical approach should be selected according to the tumour location. Available modalities include the far lateral, posterior midline and frontotemporal approaches. In the present case, the tumour presented on the left side; therefore, the left far lateral approach was employed. All operations should be performed using a microscope with extreme caution. The tumour centre should be excised first, followed by capsular decompression and excision of the tumour periphery. Unlike gliomas, which have no defined boundary, schwannomas are well-defined and have the consequent potential for total resection. In the present case, the poorly vascularised and well-defined tumour, which was medium-textured, greyish-red, well encapsulated, and located posteriorly to the medulla oblongata, allowed for its complete resection. Although completely resecting the tumour is not easy in some cases, subtotal resection can also yield good results. The complete surgical resection of the tumour is possible mainly depends on its location. Moreover, the efficacy of chemoradiotherapy for schwannomas is uncertain. Stereotactic radiosurgery has been reported for cases in which the tumour could not be completely resected but may result in temporary tumour growth.[6] Therefore, the use of such therapy should be carefully considered in tumours located in important functional sites, such as the medulla oblongata. Notably, brainstem operations should be done cautiously to avoid reactive brain oedema caused by excessive traction. Additionally, blood infiltration or using low-output bipolar electrocoagulation can achieve haemostasis. Additionally, for patients with pre-operative hydrocephalus, cerebromedullary cistern puncture should be performed to release the cerebrospinal fluid, reduce intracranial pressure, and facilitate tumour exposure and resection. The brainstem serves as the 'life centre', comprising a dense anatomical structure with complex physiological function and possessing multiple life nuclei, the down and up conduction bundles of motion and sensation, the ascending reticular activating system, and other network structures. Moreover, the brainstem is attached to the complex skull base bone below the anterior cranial fossa, cerebellum, and important cerebral blood vessels and is surrounded posteriorly and laterally by cranial nerves.[7] Despite continuous breakthroughs in imaging and microsurgical techniques, neurosurgery still requires great caution—even a slight pull on the brain stem can lead to a sharp drop in heart rate. Therefore, the patient's blood pressure and heart rate should be closely monitored intra-operatively, in close coordination with the anaesthesiologist, and the brainstem should never be pulled during the procedure. Additionally, for tumours strongly adherent to the cranial nerves and vertebral artery posteriorly, careless resection may result in cranial nerve injury or vertebral artery rupture with massive haemorrhage. The tumour should be carefully separated along the direction of the cranial nerves and vertebral artery in partial resections. Low-power bipolar electrocoagulation can be employed for local haemostasis to avoid unnecessary heat conduction to the brainstem and cranial nerve damage. For vertebral artery protection, pre-operative CT angiography or digital subtraction angiography can aid in understanding the direction of the vertebral artery and guide the surgical plan.[8] In the present case, the principles of maximum tumour resection and maximum possible neurovascular protection were adhered to, and the patient recovered well after surgery, without serious sequelae, and achieved a satisfactory cure.

Conclusion

In conclusion, neurilemmomas that resemble brainstem gliomas in imaging manifestations are highly prone to misdiagnosis due to their unique and misleading imaging features. To achieve the goal of radical treatment, the key lies in comprehensively integrating multi-dimensional information, conducting a comprehensive analysis, and thus achieving an accurate pre-operative diagnosis. This case provides valuable reference experience for the diagnosis and treatment of related diseases. Looking to the future, there is a need to further strengthen research efforts on rare tumours, constantly explore and innovate, so as to improve the overall diagnosis and treatment level of such diseases.

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References

1. Chiasson-MacKenzie C, Vitte J, Liu CH, Wright EA, Flynn EA, Stott SL, et al. Cellular mechanisms of heterogeneity in NF2-mutant schwannoma. Nat Commun 2023;14:1559. doi: 10.1038/s41467-023-37226-0.
2. Chang HC, You WC, Shen CC, Chen YJ, Sun MH, Sheu ML, et al. Using the deformity index of vital structures to predict outcome of patients with large vestibular schwannomas after Gamma Knife

radiosurgery. J Neurooncol 2023;162:179-89. doi: 10.1007/s11060-023-04280-z.
3. Sharma AK, Savardekar AR, Nandeesh BN, Arivazhagan A, Rao MB. Intrinsic brainstem schwannoma - A rare clinical entity and a histological enigma. J Neurosci Rural Pract 2016;7:302-4. doi: 10.4103/0976-3147.176190.
4. Barrett TF, Patel B, Khan SM, Mullins RDZ, Yim AKY, Pugazenthi S, et al. Single-cell multi-omic analysis of the vestibular schwannoma ecosystem uncovers a nerve injury-like state. Nat Commun 2024;15:478. doi: 10.1038/s41467-023-42762-w.
5. Vlashi R, Sun F, Zheng C, Zhang X, Liu J, Chen G. The molecular biology of NF2/Merlin on tumorigenesis and development. Faseb J 2024;38:e23809. doi:.10.1096/fj.202400019RR.
6. Moutsatsos A, Pantelis E. A simple plan strategy to optimize the biological effective dose delivered in robotic radiosurgery of vestibular schwannomas. Phys Med Biol 2025;70. doi: 10.1088/1361-6560/adaf72.
7. Shigekawa S, Inoue A, Nakamura Y, Kohno D, Tagawa M, Kunieda T. A rare case of spinal dural arteriovenous fistula mimicking malignant glioma of the medulla oblongata: Significance of cerebral angiography for accurate diagnosis of brain stem region. Surg Neurol Int 2020;11:287. doi: 10.25259/SNI_437_2020.
8. Hou K, Qu L, Yu J. Therapeutic dilemmas regarding giant aneurysms of the intracranial vertebral artery causing medulla oblongata compression. Neuroradiol J 2022;35:137-51. doi: 10.1177/19714009211042881.

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