



**ORIGINAL RESEARCH PAPER**

**Radio-Diagnosis**

**CASE REPORT: PETROCLIVAL MENINGIOMA PRESENTING WITH DIPLOPIA**

**KEY WORDS:** Petroclival meningioma, Diplopia, Headache, Abducens nerve displacemen

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**ABSTRACT**

Petroclival meningiomas are rare, comprising approximately 0.15% of all intracranial tumors, and are particularly challenging due to their location at the skull base near critical neurovascular structures. This case report discusses a 32-year-old female who presented with a one-month history of diplopia, blurring of vision, and left frontal headache. An MRI revealed a small, well-defined, extra-axial lesion in the left petroclival region, consistent with a meningioma. Given the lesion's size and the mild nature of the symptoms, a conservative management approach was chosen, involving regular imaging and clinical follow-up. The differential diagnosis included other dural-based lesions, but the imaging characteristics, particularly homogenous, avid post-contrast enhancement and the "dural tail" sign, strongly supported a diagnosis of meningioma. The patient's symptoms remained stable over the follow-up period, with no significant tumor growth observed on subsequent MRIs. Management strategies for petroclival meningiomas vary based on tumor size and symptomatology.

**INTRODUCTION**

Petroclival meningiomas represent a rare and challenging subset of meningiomas, accounting for approximately 0.15% of all intracranial tumors. These tumors originate at the junction of the petrous bone and clivus, located at the skull base, making surgical access and complete resection particularly difficult [1]. The petroclival region's complex anatomy, proximity to critical neurovascular structures, and the tumor's potential to invade surrounding areas contribute to a high degree of surgical complexity and risk of complications.

Clinically, petroclival meningiomas tend to present insidiously, with symptoms that may initially be vague or subtle, often leading to delays in diagnosis. Common presenting symptoms include cranial nerve deficits, such as diplopia due to abducens nerve involvement, facial numbness from trigeminal nerve compression, and headaches related to increased intracranial pressure or direct tumor effects [2]. In many cases, the diagnosis is only considered after these symptoms progress or become more pronounced, underscoring the importance of early and accurate imaging.

The demographic profile of patients with petroclival meningiomas shows a clear female predominance, with a female-to-male ratio ranging from 3:1 to 5.7:1, and the average age at diagnosis typically falls between 47 and 55 years [3]. However, cases presenting at a younger age, such as the patient discussed in this report, are less common and highlight the variability in presentation.

Despite advances in surgical techniques and adjuvant therapies, the management of petroclival meningiomas remains a significant challenge. Complete surgical resection, while ideal, is often difficult due to the tumor's location and its adherence to critical structures such as cranial nerves and the brainstem. As a result, subtotal resection followed by radiotherapy is a common strategy, aiming to balance tumor control with the preservation of neurological function [4].

presented with diplopia and headaches, ultimately diagnosed with a petroclival meningioma. This case emphasizes the critical role of detailed imaging in the diagnosis and management of such tumors, as well as the importance of considering petroclival meningiomas in the differential diagnosis of patients presenting with cranial nerve deficits and headaches.

**Case Report:**

- **Demographic Information:** The patient is a 32-year-old female.
- **Primary Concerns and Symptoms:** The patient presented with a one-month history of diplopia, blurring of vision, and left frontal headache.
- **Medical, Family, and Psychosocial History:** The patient has no significant medical or family history of neurological disorders. There is no history of prior surgical interventions or chronic illnesses. The patient leads an active lifestyle with no known psychosocial stressors.
- **Relevant Past Interventions with Outcomes:** No relevant past medical interventions were reported prior to the current presentation.

**Clinical Findings:**

On physical examination, the patient, a 32-year-old female, exhibited signs consistent with cranial nerve involvement. Notably, there was evidence of abducens nerve palsy, manifesting as diplopia and impaired lateral eye movement. The patient also reported persistent left frontal headaches, which she described as throbbing and worsening with eye movements. There was no evidence of facial weakness, sensory deficits, or other cranial neuropathies on examination. General physical and neurological examinations were otherwise unremarkable.

The patient's symptoms were suggestive of a lesion impacting the cranial nerves at the skull base, prompting further imaging studies to evaluate the underlying cause.

**Timeline:**

Date	Event
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This case report presents a 32-year-old female patient who

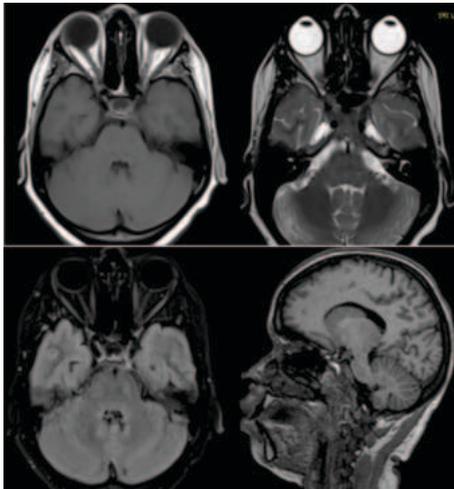
March 2024	Onset of diplopia, blurring of vision, and left frontal headache.
Early April 2024	Patient seeks medical attention; initial examination reveals abducens nerve palsy.
April 20, 2024	MRI brain with contrast performed, revealing a small, well-defined extra-axial lesion in the left petroclival area, suggestive of a meningioma.
Early May 2024	Further clinical correlation and discussion of management options.

**Diagnostic Assessment**

**Imaging Findings:** The patient underwent an MRI of the brain with contrast on April 20, 2024, due to the clinical presentation of diplopia and persistent headaches. The MRI revealed a well-defined small extra-axial lesion in the left petroclival region. The lesion measured approximately 6.5 x 5.8 x 5.6 mm and was noted to be isointense on T1 and T2-weighted images, with homogenous and avid enhancement post-contrast with presence of a "dural tail", a characteristic finding commonly associated with meningiomas.

The lesion was closely abutting the cisternal portion of the left abducent nerve, causing mild lateral displacement of the nerve. There was no evidence of restriction diffusion or blooming artifact on SWI sequence, which might suggest hemorrhage or calcification. The adjacent pontine region appeared normal, with no abnormal signal intensity or evidence of brainstem involvement. Additionally, the bilateral cavernous sinuses and the rest of the cranial nerves, including the optic nerves, appeared grossly normal on imaging.

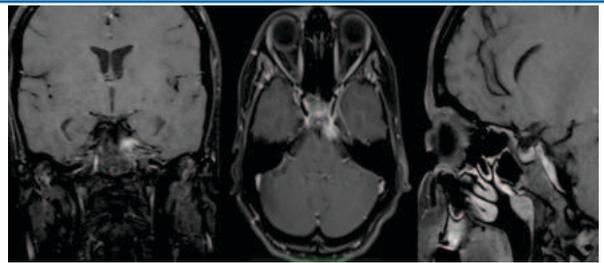
**Figures**



**Figure 1.** Left PCM on axial T1, T2, FLAIR, T1 Sagittal sequence, the lesion appears isointense on T1 and T2-weighted images.



**Figure 2.** Lesion causing compression of abducent nerve on axial T2 CISS sequence



**Figure 3.** Left PCM on axial and sagittal T1 post contrast sequence with homogenous and avid enhancement post-contrast with presence of a "dural tail", a characteristic finding commonly associated with meningiomas.

**Differential Diagnosis:** Given the imaging characteristics and location of the lesion, the differential diagnosis primarily included petroclival meningioma. Other considerations, though less likely, included schwannoma or other dural-based lesions such as a hemangiopericytoma. The absence of significant edema, brainstem adherence, or pial invasion suggested a meningioma rather than more aggressive pathologies.

**Diagnostic Challenges:** The primary challenge in this case was ensuring accurate differentiation between a benign meningioma and other potential dural-based lesions, particularly given the lesion's proximity to critical neurovascular structures. However, the lesion's imaging characteristics, particularly the dural tail sign and homogenous enhancement, strongly supported the diagnosis of a meningioma. Furthermore, the lack of significant brainstem involvement or abnormal signal intensity in adjacent structures minimized the need for more invasive diagnostic procedures, such as biopsy, at this stage.

Given the lesion's small size and the relatively mild clinical symptoms, the decision was made to proceed with close monitoring and consider surgical intervention only if symptoms progressed or the lesion showed significant growth on follow-up imaging.

**Therapeutic Intervention**

**Initial Management Plan:** Given the patient's clinical presentation and the imaging findings of a small, well-defined petroclival meningioma, the initial management strategy was conservative. Considering the tumor's size, lack of significant brainstem involvement, and the patient's relatively mild symptoms, the medical team decided to adopt a "watchful waiting" approach with regular follow-up imaging. This decision was based on the current understanding that many small petroclival meningiomas may remain stable for extended periods without requiring immediate intervention.

**Surgical Consideration:** Despite the decision to monitor, the option of surgical resection was discussed with the patient. Surgical intervention would typically be considered if the tumor demonstrated significant growth, or if the patient developed worsening symptoms, particularly those related to cranial nerve deficits, which could impact her quality of life. The risks associated with surgery, including the potential for cranial nerve damage, cerebrospinal fluid leakage, and other complications, were carefully weighed against the benefits of tumor removal.

**Radiotherapy:** In cases where surgery might be deemed too risky due to the tumor's location and the patient's condition, stereotactic radiosurgery (SRS) was considered as a non-invasive alternative. This option would be particularly relevant if the tumor showed signs of progression on follow-up imaging but remained surgically inaccessible due to its proximity to critical neurovascular structures. SRS offers the advantage of targeting the tumor with high precision, minimizing damage to surrounding tissues, and has been

shown to be effective in controlling the growth of small meningiomas.

**Outcome:**

At this stage, the patient was advised to undergo regular MRI scans every 6 to 12 months to monitor the tumor's size and growth characteristics. If significant changes were observed, surgical resection or SRS would be reconsidered. The patient was counselled on the signs and symptoms that would necessitate immediate medical attention, such as worsening vision, new onset of facial numbness, or increased headaches, and was encouraged to maintain close follow-up with her healthcare providers.

**DISCUSSION**

This case highlights imaging characteristics of petroclival meningioma as well as their closest imaging differentials. This case also highlights complexities involved in managing petroclival meningiomas, particularly when the tumor is small, and symptoms are relatively mild. The decision to pursue a conservative approach, including regular monitoring rather than immediate surgical intervention, reflects a thoughtful balance between the risks and benefits. The primary strength of this approach lies in its ability to avoid the potential complications associated with surgical resection, especially given the challenging location of the tumor at the skull base, near critical neurovascular structures. However, the conservative approach also has its limitations. The main concern is the possibility of tumor growth over time, which could lead to further cranial nerve involvement or other complications, potentially necessitating more aggressive intervention at a later stage. Additionally, while the patient's symptoms have remained stable, there is a risk that they could worsen, impacting her quality of life. This case emphasizes the need for careful patient selection when opting for a conservative approach and underscores the importance of thorough patient education and regular follow-up.

The management of petroclival meningiomas is a subject of ongoing debate in the neurosurgical community. Traditionally, the goal of treatment has been complete surgical resection, given the potential for these tumors to grow and cause significant morbidity due to their location. However, complete resection is often difficult due to the tumor's proximity to critical structures, leading to high rates of surgical morbidity. Studies have shown that subtotal resection, followed by adjuvant radiotherapy, can offer good long-term control with lower morbidity compared to more aggressive surgical approaches [1,2,4].

This case aligns with current literature suggesting that small, asymptomatic, or minimally symptomatic petroclival meningiomas can be managed conservatively with regular imaging and clinical follow-up [3,5]. This approach is supported by studies that have shown that many of these tumors grow slowly, if at all, and that the risks of intervention may outweigh the benefits in certain cases [6]. The literature also emphasizes the role of patient preferences and quality of life considerations in decision-making, which were integral to the management of this patient.

**Findings from Similar Cases**

**1. Imaging Characteristics:**

- **Common Findings:** Petroclival meningiomas typically present as extra-axial, dural-based masses with characteristic imaging features. On MRI, they often appear isointense or hypointense on T1-weighted images and isointense to hyperintense on T2-weighted images. Post-contrast enhancement is typically homogenous with "dural tail" sign is frequently observed, which is highly suggestive of meningioma.
- **Tumor Size And Location:** Similar cases have reported tumor sizes ranging from small (<1 cm) to large (>3 cm) masses. The proximity to critical structures like the

brainstem, cranial nerves (especially CN III, IV, V, and VI), and major arteries (e.g., the basilar and carotid arteries) significantly influences both the symptoms and management decisions [4,5].

- **Neurological Involvement:** In many cases, cranial nerve involvement is common, particularly with the abducens nerve, leading to diplopia, as well as trigeminal nerve involvement causing facial numbness. The extent of nerve compression and displacement correlates with symptom severity [2].
- 2. Management Strategies:**
  - **Conservative Management:** In cases where the tumor is small and the patient is either asymptomatic or presents with mild symptoms, conservative management with regular MRI monitoring is often chosen. Studies indicate that many small petroclival meningiomas may remain stable for years, with minimal growth or symptom progression. This approach minimizes surgical risks, particularly in older patients or those with comorbidities [3].
  - **Surgical Intervention:** Larger tumors or those causing significant symptoms are often managed surgically. The choice of surgical approach (e.g., retrosigmoid, transpetrosal, or combined approaches) depends on the tumor's size, extent, and relationship to surrounding structures. The aim is typically maximal safe resection while preserving neurological function. However, complete resection is challenging and not always possible due to the tumor's location [1,6].
  - **Radiosurgery:** Stereotactic radiosurgery (SRS) is commonly used for small, residual, or inoperable tumors. It offers a non-invasive option with good control rates, particularly for tumors that are less accessible surgically or for patients who are not good surgical candidates. Radiosurgery is often preferred in cases where the tumor demonstrates slow growth or in cases of subtotal resection [7].
- 3. Outcomes:**
  - **Functional Outcomes:** Patients who undergo conservative management often maintain good functional status over the long term, provided the tumor does not grow significantly. In surgical cases, outcomes vary depending on the extent of resection and the patient's preoperative condition. Complete resection is associated with higher risks of cranial nerve deficits, while subtotal resection, followed by radiosurgery, tends to balance tumor control with preservation of function [8].
  - **Recurrence And Progression:** Recurrence rates are higher in cases of subtotal resection, necessitating adjuvant radiotherapy. Even in cases of complete resection, close follow-up is required due to the risk of recurrence, particularly in aggressive or atypical meningiomas [9].

**Main Take-away Lessons:** This case underscores several key lessons in the management of petroclival meningiomas:

1. **Importance of Regular Monitoring:** Regular follow-up with MRI and clinical assessments is essential in managing these patients, allowing for early detection of any changes in tumor size or symptoms that may necessitate a change in management strategy.
2. **Patient Selection for Conservative Management:** Not all petroclival meningiomas require immediate surgical intervention. Careful patient selection, based on tumor size, location, and symptomatology, is critical to ensuring a safe and effective conservative management plan.
3. **Patient Education and Involvement:** Educating the patient about the nature of the tumor, the rationale for conservative management, and the importance of adherence to follow-up is vital. Involving the patient in the decision-making process ensures that their preferences and quality of life are taken into account.

This case demonstrates that a conservative approach can be effective for managing small, minimally symptomatic petroclival meningiomas, provided that there is close monitoring and a clear plan for intervention if needed.

### CONCLUSION

This case report highlights the clinical presentation, diagnostic challenges, and management considerations in a patient with a small petroclival meningioma. Petroclival meningiomas, while rare, present significant challenges due to their location and potential impact on critical neurovascular structures. In this case, the patient presented with mild symptoms, including diplopia and headache, which prompted further investigation and led to the diagnosis. The decision to adopt a conservative management approach, with regular imaging and close clinical follow-up, was based on the tumor's small size, lack of significant brainstem involvement, and the stable nature of the patient's symptoms. This approach aligns with current evidence suggesting that many small petroclival meningiomas can be safely managed without immediate surgical intervention, thereby avoiding the risks associated with complex skull base surgery. In conclusion, this case emphasizes the importance of individualized treatment planning in managing petroclival meningiomas. While surgical resection remains the definitive treatment for symptomatic or larger tumors, conservative management with careful monitoring is a viable option for smaller, asymptomatic lesions. This approach requires a multidisciplinary team and informed patient involvement to ensure the best possible outcomes.

### REFERENCES

1. Clivus and apicopetroclivus meningiomas--report of 24 cases S Nishimura, A Hakuba, B J Jang, Y Inoue PMID: 2483855, DOI: 10.2176/nmc.29.1004
2. Bassiouni H, Asgari S, Stolke D. Petroclival meningiomas: functional outcome after microsurgery in 137 patients. *J Neurosurg.* 2009;110(4):875-81.
3. van Havenbergh T, Carvalho GA, Tatagiba M, Pitz S, Samii M. Natural history of petroclival meningiomas. *Neurosurgery.* 2003;52(1):55-64.
4. Natarajan SK, Sekhar LN, Schessel DA, Morita A. Petroclival meningiomas: multimodality treatment and outcomes at long-term follow-up. *Neurosurgery.* 2007;60(6):965-79.
5. Couldwell WT, Fukushima T, Giannotta SL, Weiss MH. Petroclival meningiomas: surgical experience in 109 cases. *J Neurosurg.* 1996;84(1):20-8.
6. Mathiesen T, Gerlich A, Kihlström L, Svensson M, Karlsson B. Effects of using combined transpetrosal surgical approaches to treat petroclival meningiomas. *Neurosurgery.* 2007;60(6):982-91.
7. Regis J, Roche PH, Dufour H, et al. Gamma knife surgery for cavernous sinus meningiomas. *J Neurosurg.* 2000;93 Suppl 3:68-73.
8. Samii M, Carvalho GA, Rassi-Neto A, et al. Surgical management of petroclival meningiomas: report of 24 cases. *Neurosurgery.* 1996;38(6):1247-53.
9. Surgery for Petroclival Meningiomas: A Comprehensive Review of Outcomes in the Skull Base Surgery Era. Pre published online 2010 Apr 27. doi: 10.1055/s-0030-1253581.