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Pre-rupture syndrome. Oculomotor nerve palsy in the case of an aneurysm of the posterior communicating artery

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ABSTRACT

Oculomotor nerve palsy can be a strong indicator of an internal carotid artery aneurysm, specifically of the posterior communicating artery, due to the anatomical positioning within the basal cisterns of the subarachnoid space, which allows for nerve compression. This condition can predict an acute subarachnoid haemorrhage, associated with a high mortality rate, often presenting with sudden, severe headaches, with or without deficits. The pathophysiology theories include direct mechanical compression by the aneurysmal sac, arterial pulsations, and nerve tissue oedema from venous obstruction. In cases of unruptured aneurysms, nerve irritation is less common. This palsy occurs in about one-third of cases.

Aneurysmal orientation can vary (lateral, superior, inferior, medial, posterior), and due to the nerve's anatomical position, aneurysms in the postero-lateral-inferior position are more likely to cause nerve damage. Treatment opinions vary from observation to intervention, with options including traditional neurosurgery and endovascular embolization. The latter is increasingly preferred due to its efficacy and lower risk profile.

A clinical case involves a 56-year-old female presenting with ptosis, diplopia, and ipsilateral mydriasis. Imaging confirmed a posterior communicating artery aneurysm with a maximum diameter of 5.3 mm and a 3 mm bleb. Endovascular coiling was performed successfully, excluding the aneurysm from circulation without complications. Post-treatment, the patient was discharged in good condition with recommendations for periodic monitoring.

In conclusion, while no single best treatment exists for posterior communicating artery aneurysms with oculomotor nerve palsy, early intervention (surgical or endovascular) and patient monitoring are crucial for preventing complications and ensuring quality of life.

1. INTRODUCTION

The pre-rupture syndrome associated with posterior communicating artery aneurysms represents a complex clinical entity characterized by neurological signs such as oculomotor nerve palsy. This syndrome

Keywords

oculomotor nerve palsy,
posterior communicating
artery aneurysm,
subarachnoid haemorrhage,
endovascular coiling,
aneurysm morphology



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holds significant importance in the diagnosis and management of cerebral aneurysms, bearing critical consequences for patient prognosis. In this context, identifying and understanding the pathophysiological mechanisms underlying this syndrome are essential for adopting an appropriate therapeutic approach and improving clinical outcomes.

Beginning with anatomical and pathophysiological aspects, this paper explores the complexity of the pre-rupture syndrome in the context of posterior communicating artery aneurysms. Aneurysms in this anatomical region pose an increased risk of oculomotor nerve palsy due to their proximity to this crucial neural structure.

Characterizing the orientation and dimensions of the aneurysm is of major importance in assessing the risk of nerve compression and determining the optimal treatment strategy.

With the advancement of medical technologies, multiple therapeutic options have been developed for managing cerebral aneurysms. From classical neurosurgical approaches to modern endovascular techniques, there is a diversity of methods available for treating these vascular lesions. However, the decision regarding the optimal treatment of aneurysms, especially in cases of pre-rupture syndrome associated with oculomotor nerve palsy, remains a subject of debate and controversy in the medical community.

Presenting a specific clinical case illustrates the importance of early diagnosis and appropriate management of posterior communicating artery aneurysms. In this case, a 56-year-old patient presented with characteristic symptoms of pre-rupture syndrome, such as eyelid ptosis and diplopia, with imaging and angiographic evidence confirming the presence of an aneurysm. Endovascular management of the aneurysm was associated with favorable clinical outcomes, highlighting the effectiveness and importance of this approach in preventing complications and improving patient prognosis.

The pre-rupture syndrome associated with posterior communicating artery aneurysms represents a complex clinical entity that requires a multidisciplinary and personalized approach. Early diagnosis, careful risk assessment, and selection of the most appropriate therapeutic strategy are crucial for the efficient management of these vascular lesions and for optimizing clinical outcomes.

2. MATERIALS AND METHODS

The study presents the case of a patient diagnosed with posterior communicating artery aneurysms and pre-rupture syndrome. The case manifested with oculomotor nerve palsy, confirmed through radiological imaging showing the presence of an aneurysm, and neurological examination findings consistent with pre-rupture syndrome. Diagnostic evaluation comprised MRI and cerebral angiography for anatomical visualization and aneurysm characterization. Endovascular treatment was administered under general anesthesia, involving femoral arterial access, catheterization to the internal carotid artery, and embolization using detachable coils. Follow-up angiography was conducted to assess treatment efficacy. Post-procedure, clinical outcomes were evaluated, with a focus on symptom resolution and complications. Descriptive statistics summarized patient demographics, procedural details, and outcomes. Ethical considerations were addressed with institutional review board approval and informed consent. Acknowledgment of limitations, such as the retrospective design, was made, with implications for future research highlighted.

3. CASE REPORT

3.1. Oculomotor Nerve Palsy as a pre-rupture sign

A 56-year-old female patient presented to our neurosurgery department with complaints of eyelid ptosis, diplopia, and ipsilateral mydriasis, which began several months ago and were completely resolved at the time of consultation. Upon neurological clinical examination at admission, the patient was conscious, cooperative, oriented, with a GCS score of 15, without signs of intracranial hypertension or meningeal irritation, with normal speech, cranial nerves within normal limits, and without sphincter disturbances. The brain MRI examination revealed the presence of a right posterior communicating artery aneurysm. The DSA confirmed the presence of the aneurysm, measuring 5.3 mm in maximum diameter, with a bleb in its postero-inferior portion measuring 3 mm. Considering the aneurysm's location, morphology (presence of a bleb), and the occurrence of right third nerve palsy episode, it can be inferred that the aneurysm exhibited a pre-rupture syndrome.

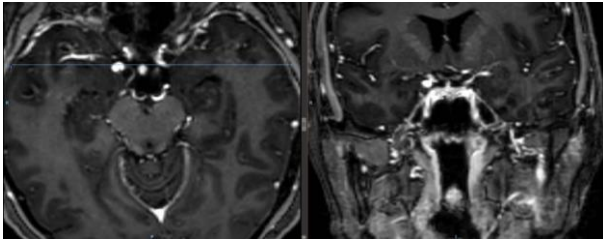


Figure 1. Native brain MRI TOF seg (a-b) right pCom aneurysm.

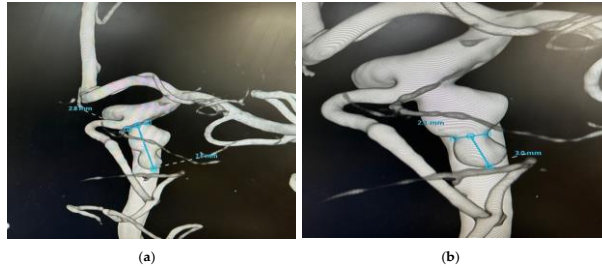


Figure 2. Digital subtraction angiogram (DSA) of the right internal carotid artery: (a-b) Giant posterior communicating saccular aneurysm with Bleb sac.

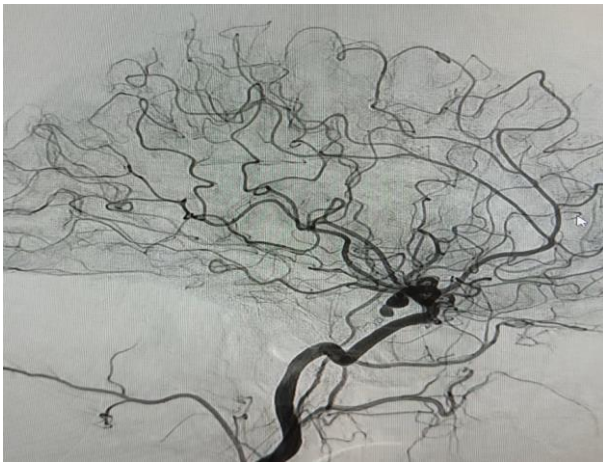


Figure 3. Digital subtraction angiogram (DSA) in lateral view of the right internal carotid artery: giant posterior communicating saccular aneurysm with Bleb sac.

3.2. Endovascular treatment

The patient was placed in the dorsal decubitus position and a right femoral arterial puncture was performed under general anesthesia. A 7F femoral introducer was inserted and connected for invasive blood pressure measurement. A BENCHMARK 6F, 071 catheter was advanced over a 5F SELECT vertebral catheter to the level of the right internal carotid artery for the acquisition of diagnostic angiographic series in anteroposterior, lateral, and 3D projections. Using coaxial technique, a Scepter 4/11 balloon was advanced to the cavernous segment level of the right internal carotid artery,

followed by an Echelon 14 microcatheter, pre-curved at 90 degrees, utilizing Transend14 guidewires. The distal tip of the microcatheter was positioned at the neck of the aneurysm. Embolization of the aneurysm was performed using coils sized 5/15, 4/8, 3/6, 2/4, 2/3, and 2/1. Control angiographic series were obtained in working projections, anterior-posterior, and lateral, with contrast injection through the catheter. At the end of the procedure, after angiographic control at the inguinal level, the femoral introducer was removed, and hemostasis was achieved at the puncture site by manual compression and compressive dressing. During the endovascular procedure, the following prophylactic antithrombotic medication was administered: Heparin bolus of 2500 IU and infusion of 1000 IU/h, and intravenous Aspirin 250 mg.

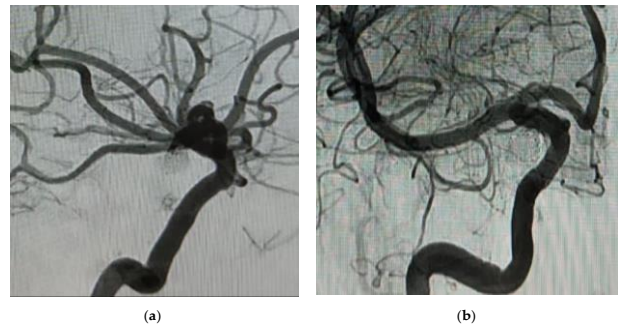


Figure 4. DSA of the right internal carotid artery - coiling session

3.3. Post-procedural result

Diagnostic series highlighted the posterior communicating artery aneurysm with a neck diameter of 2.95mm, maximum diameter of 5.34mm, and a small Bleb measuring 3.41mm. During the operation, aneurysm embolization was performed using simple coiling technique. Follow-up series demonstrated complete exclusion of the aneurysm without any embolic or hemorrhagic complications. The patient was discharged conscious, cooperative, with a GCS score of 15, afebrile, and advised for periodic monitoring and clinical and endovascular/neurosurgical imaging control.

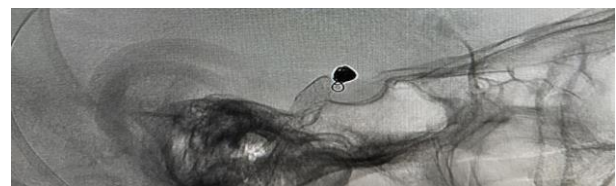




Figure 5. Control radiography highlighting the slipping of a coil loop into the aneurysm's bleb, ensuring better hemostasis at that level.

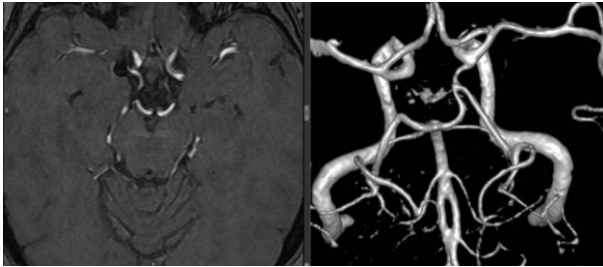


Figure 6. Postprocedural - brain MRI +TOF: exclusion from circulation of the posterior communicating artery as well as of the aneurysmal component.

4. DISCUSSION

The management of posterior communicating artery (PCOM) aneurysms, particularly those associated with oculomotor nerve palsy, requires a nuanced approach that balances immediate intervention with long-term care. A comprehensive comparative analysis of treatment options, including endovascular embolization and traditional neurosurgical approaches, is essential. This involves evaluating success rates, potential complications, recovery times, and long-term outcomes to determine the most beneficial approach for specific patient profiles.

Advancements in imaging techniques, such as 3D angiography and MRI, play a crucial role in the early detection and characterization of PCOM aneurysms. These technologies enhance diagnostic accuracy, aid in treatment planning, and enable precise monitoring of aneurysm progression or resolution. Understanding the various risk factors and predictive indicators of aneurysm rupture, such as patient demographics, genetic predispositions, and lifestyle factors, alongside clinical signs like sudden severe headaches or oculomotor nerve palsy, is vital for preventative care and timely intervention.

Delving into the pathophysiology of oculomotor nerve palsy reveals the complexities of the condition. Theories such as direct mechanical compression by

the aneurysmal sac, arterial pulsations, and nerve tissue edema from venous obstruction provide insights into the mechanisms at play. Analyzing specific patient case studies can highlight the variability in presentations, treatments, and outcomes, offering valuable lessons for clinical practice.

Long-term outcomes and the importance of regular follow-up care in patients treated for PCOM aneurysms cannot be overstated. Recommended follow-up schedules, imaging modalities for monitoring, and strategies for managing residual or recurrent aneurysms are crucial for ensuring patient safety and preventing future complications. An interdisciplinary approach to management, involving neurologists, neurosurgeons, and interventional radiologists, is essential for optimizing patient outcomes. Collaboration among specialists enhances treatment processes and ensures comprehensive care.

Innovations in endovascular techniques, including new coil materials and stent-assisted coiling, are revolutionizing the treatment of PCOM aneurysms. These advancements enhance the safety and efficacy of endovascular procedures, offering promising alternatives to traditional surgical methods. The impact of different treatment modalities on the quality of life and neurological function of patients post-treatment is another critical area of discussion. Understanding recovery experiences, long-term functional outcomes, and the psychological impact of living with or recovering from a PCOM aneurysm is vital for the patient care.

Finally, the emergency management of ruptured PCOM aneurysms requires well-defined protocols and strategies to minimize mortality and morbidity. Effective pre-hospital care, in-hospital emergency interventions, and rapid imaging and surgical responses are crucial for improving patient outcomes. Through these multifaceted discussions, the complexities of managing PCOM aneurysms can be better understood, ultimately leading to improved patient care and outcomes.

5. CONCLUSIONS

In conclusion, the management of posterior communicating artery (PCOM) aneurysms with associated oculomotor nerve palsy is complex and multifaceted. Early diagnosis is crucial due to the high risk of acute subarachnoid hemorrhage, which

significantly increases mortality. Imaging techniques such as cerebral angiography are vital for identifying aneurysm characteristics, including size and bleb formation, which guide treatment decisions. While traditional neurosurgical approaches remain effective, endovascular embolization is increasingly favored for its lower risk profile and comparable efficacy. The case study of a 56-year-old patient successfully treated with endovascular coiling highlights the potential for positive outcomes with this method. Nonetheless, regular monitoring and follow-up are essential to ensure ongoing patient safety and to promptly address any complications. Ultimately, individualized treatment plans that consider the aneurysm's morphology and patient-specific factors are key to optimizing outcomes and maintaining quality of life.

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Conflicts of Interest: The authors declare no conflict of interest.

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