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Dysplastic Saccular Aneurysm of the Internal Carotid Artery Cavernous Segment with Partial Thrombosis – Symptoms, Radiologic Findings, Solutions

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1. Abstract

Internal carotid artery cavernous segment (ICACS) aneurysms are uncommon but clinically significant, frequently resulting in symptoms due to nerve compression. Dysplastic aneurysms, characterized by irregular shapes and wall abnormalities, present challenges such as partial thrombosis and elevated thromboembolic risk. This case report presents the symptoms, radiological findings, and treatment approach for a dysplastic aneurysm of the cavernous internal carotid artery with partial thrombosis. A 64-year-old female patient experienced sudden, severe headaches, nausea, and vomiting during episodes of pain, accompanied by diplopia and periorbital discomfort. These symptoms suggested cranial nerve compression within the cavernous sinus. The clinical presentation raised suspicion of involvement of cranial nerve VI (abducens nerve), which is particularly vulnerable in this anatomical region and may result in lateral rectus palsy and horizontal double vision. Despite utilizing painkillers from various classes, her condition remained refractory. This case report underscores the paramount importance of comprehensive diagnostic procedures to prevent medical errors and elucidate the impact of an aneurysm in the internal carotid artery.

1.1. Conclusions

A partially thrombosed saccular aneurysm in the cavernous segment of the internal carotid artery was diagnosed using advanced imaging techniques. The patient's severe headaches, nausea, and vomiting, along with the absence of subarachnoid bleeding, made the initial diagnosis challenging. The aneurysm was successfully treated endovascularly with a cobalt-chromium flow-diverting stent.

2. Introduction

Internal carotid artery cavernous segment (ICACS) aneurysms are a distinct type of intracranial aneurysm that develops within the cavernous sinus, a region encompassed by cranial nerves and vascular structures. Unlike other aneurysms, these aneurysms rarely rupture but frequently cause symptoms by compressing adjacent nerves, re-sulting in ophthalmoplegia, facial pain, or diplopia [1]. Dysplastic aneurysms of the cavernous segment of ICA, frequently associated with wall abnormalities such as fibromuscular dysplasia, exhibit irregular shapes and can develop partial thrombosis, further complicating their clinical course and elevating the risk of distal thromboembolism [2]. This Clinical Case report describes a 64-year-old female with right sided cavernous segment aneurysm approximately 17x23x16mm, accompanied by partial thrombosis. The patient was hospitalized due to sudden onset of severe headaches and vomiting, additionallyright side ptosis and diplopia. The aneurysm's location within the cavernous segment of the internal carotid artery strongly indicates the potential for cranial nerve compression. The cavernous sinus houses cranial nerves III (oculomotor), IV (trochlear), V1 and V2 (ophthalmic and maxillary branches of the trigeminal nerve), and VI (abducens). Among these, cranial nerve VI is most susceptible due to its medial and unprotected position. Compression of the abducens nerve may result in lateral rectus muscle paralysis, leading to horizontal diplopia. Cranial nerve III involvement could cause

ptosis, mydriasis, and impaired eye movement, while compression of V1 or V2 may cause facial sensory disturbances. These findings remain significant considerations in aneurysms affecting the cavernous segment of the internal carotid artery. Despite the use of various painkillers, the pain persisted without relief. According to the patient, this type of pain was unlike anything she has experienced. She also reported nausea and vomiting during the pain episode. Initially in CT suspected to be a pituitary macroadenoma or cavernous segment meningioma, with less possible diagnosis of cerebral aneurysm in the MRI. The patient underwent a computed tomography angiography (CTA), which revealed a large saccular aneurysm of the ICA (at least 11 x 15 x 12mm) with an irregular shape and partial thrombosis. Following the diagnosis, the patient was transferred to the Interventional Radiology department for further examination and treatment planning.

3. Case

Patient with abruptly developing severe headaches was hospitalized in Riga East University Hospital Emergency Department. Despite the use of various painkillers, the condition persisted. According to the patient, this type of pain accompanied by nausea and vomiting she endured first time in her life.Upon evaluation at the Emergency Department, a computed tomography (CT) scan of the head revealed a new formation in the region of the sella turcica, suggesting infiltration of the cavernous sinuses and compression along the lower ventral edge of half the temporal lobe.Given the suspicion of pituitary macroadenoma, an MRI of the pituitary gland was performed. The most probable diagnosis was a cavernous sinus meningioma, with a lower probability of a pituitary macroadenoma or an aneurysm. Furthermore, blood tests did not reveal any indications of pituitary hormone dysfunction. The MRI was performed to rule out pituitary macroadenoma, rule out other lesions, and provide the indication for a Digital Subtraction Angiography (DSA).To further clarify the diagnosis, a Digital Subtraction Angiography (DSA) of the brain vessels was performed. This examination revealed a large right sided saccular aneurysm of irregular shape, measuring in rotational 3D angiography at least 11 x 15 x 12 millimeters. The aneurysm exhibited an uneven lateral and posterior contour.In response to these findings, the patient was administered Tramadol, which caused nausea. An interventional radiologist subsequently recommended endovascular treatment as surgical repair in this type of aneurysm was linked to high complication rate and difficulties to treat. However, considering the current hospitalization episode, the patient was discharged as an outpatient with instructions for further operative therapy.An endovascular embolization using flow-diverting stent of a giant saccular aneurysm of the cavernous segment of the internal carotid artery (ICA) was performed.

4. Discussion

The patient presented with severe, abrupt-onset headaches characterized by the most intense pain experienced in her life, accompanied by nausea and vomiting. These symptoms are indicative of intracranial vascular pathologies, particularly aneurysms, especially those with rupture or in exceptional casespartial thrombosis. Headaches caused by partially thrombosed aneurysms are believed to result from the aneurysmal mass effect or inflammation of adjacent neural structures. Studies have demonstrated that partially thrombosed aneurysms in the cavernous segment of the internal carotid artery (ICA) frequently cause severe headaches, often described as unilateral and refractory to conventional analgesics [3, 4].Additional symptoms such as nausea and vomiting in this case may be attributed to the activation of central pain pathways and elevated intracranial pressure due to local mass effect. Similar cases in the literature report visual disturbances, diplopia, or cranial nerve palsies when large aneurysms compress adjacent neural structures, such as the optic chiasm or cranial nerves III, IV, or VI [5,6]. However, this patient exhibits mild visual disturbancesdiplopia and ipsilateral ptosis, which may be indicative of the early stage of disease progression or the location of the aneurysm.Radiological imaging played a crucial role in diagnosing this case. Initial computed tomography (CT) scan revealed a lesion in the region of the sella turcica, accompanied by signs of cavernous sinus infiltration and temporal lobe compression, prompting suspicion for an infiltrative mass, such as a pituitary macroadenoma or cavernous si-nus meningioma. However, subsequent magnetic resonance imaging (MRI) and computed tomography angiography (CTA) provided a definitive diagnosis as a large, partially thrombosed saccular aneurysm located within the cavernous segment of the in-ternal carotid artery (ICA). In the literature, aneurysms in this specific location pose diagnostic challenges due to their atypical imaging characteristics, which can mimic neoplastic processes [4,7]. The presence of partial thrombosis in this case manifested as irregular contours with regions of signal void on MRI, a hallmark feature that distinguishes vascular lesions from solid masses [8].CTA and digital subtraction angiography (DSA) further confirmed the diagnosis and provided crucial information for treatment planning. The utilization of 3D-reconstructed imaging enabled precise visualization of the aneurysm’s dimensions, morphology, and its relationship to surrounding structures. Advanced imaging techniques, such as contrast-enhanced MRI and angiography, are indispensable in cases of suspected partially thrombosed aneurysms, as they facilitate precise characterization and guide therapeutic decision-making [9].In this case, endovascular embolization utilizing a cobalt-chromium 4.5x40 mm flow-diverting stent was employed. Flow-diversion therapy has established itself as the standard of care for large and giant aneurysms in anatomically challenging locations. The stent facilitates progressive aneurysm thrombosis while preserving parent artery patency, resulting in superior outcomes compared to surgical approaches in such in-stances [10,11]. Post-procedure imaging confirmed successful stent deployment, and the patient exhibited no neurological

deficits, demonstrating the safety and efficacy of this technique. Complications such as in-stent thrombosis or ischemic events were effectively prevented through double antiplatelet therapy tailored to the patient's sensitivity to aspirin and clopidogrel [8].This case emphasizes the significance of integrating advanced neuroimaging modalities and multidisciplinary care in the management of intricate intracranial vascular lesions. Early identification of partially thrombosed aneurysms and prompt intervention are crucial in preventing rupture or progressive neurological deficits. Despite the advancements in endovascular techniques, challenges persist in diagnosing and man-aging such aneurysms, particularly in cases with atypical presentations. Further re-search is necessary to refine diagnostic algorithms and optimize treatment strategies, including personalized approaches for patients with antiplatelet sensitivities or comorbidities [12,13].

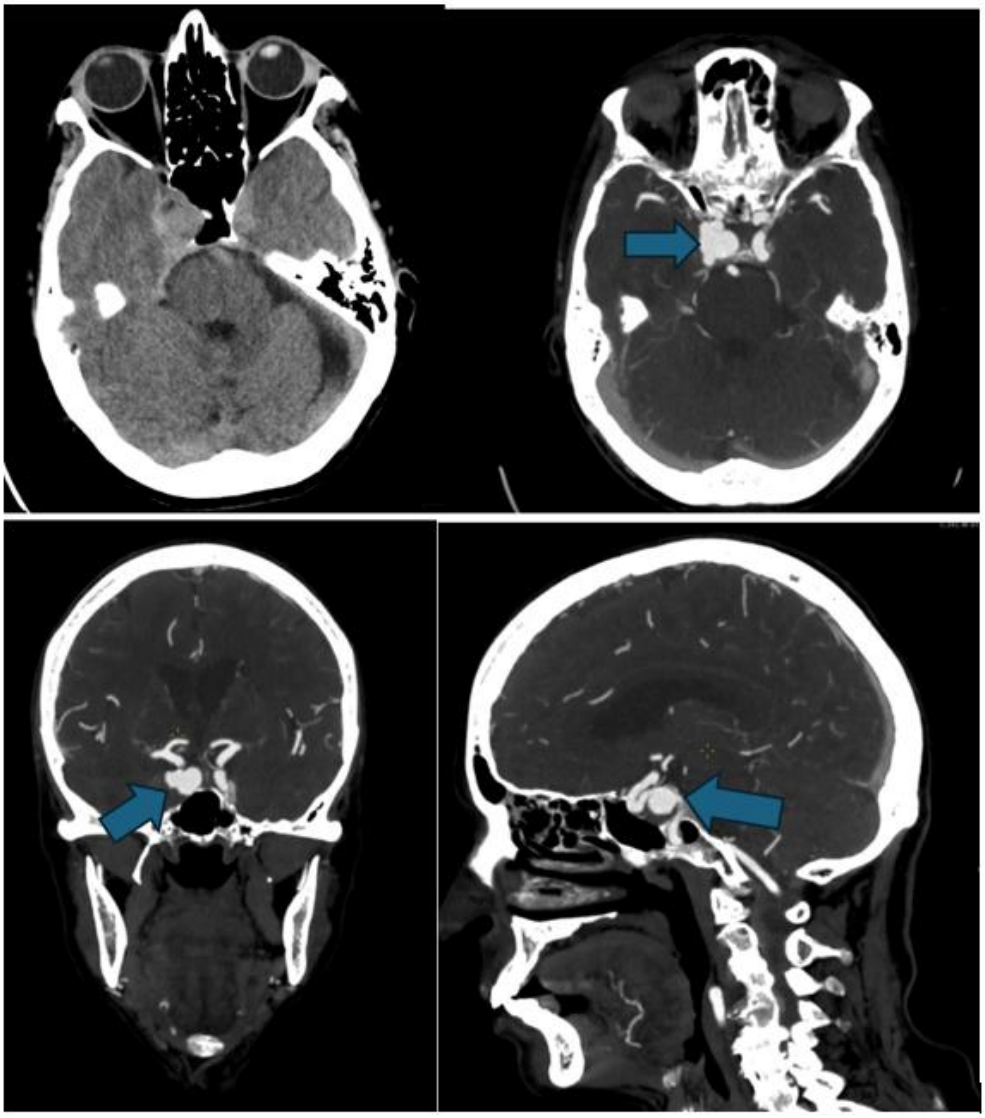

Figure 1: (a) Axial non-contrast computed tomorgraphy (CT) shows an aneurysmal dilation in the region of sella turcica, corresponding to the cavernous segment in the internal carotid artery (ICA), (b)-(d) axial CTA with contrast (b) sagittal plane CT, (c) coronal plane CT, (d) axial plane CT.

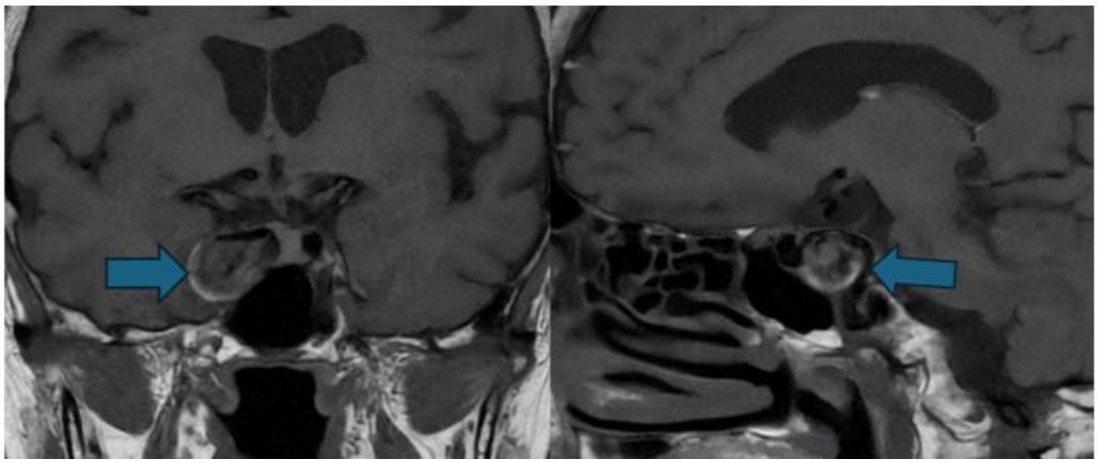

Figure 2: MR T1 without contrast showing dysplastic aneurysm of the cavernous segment with partial thrombosis. (a) coronal plane MRI, (b) sagittal place MRI.

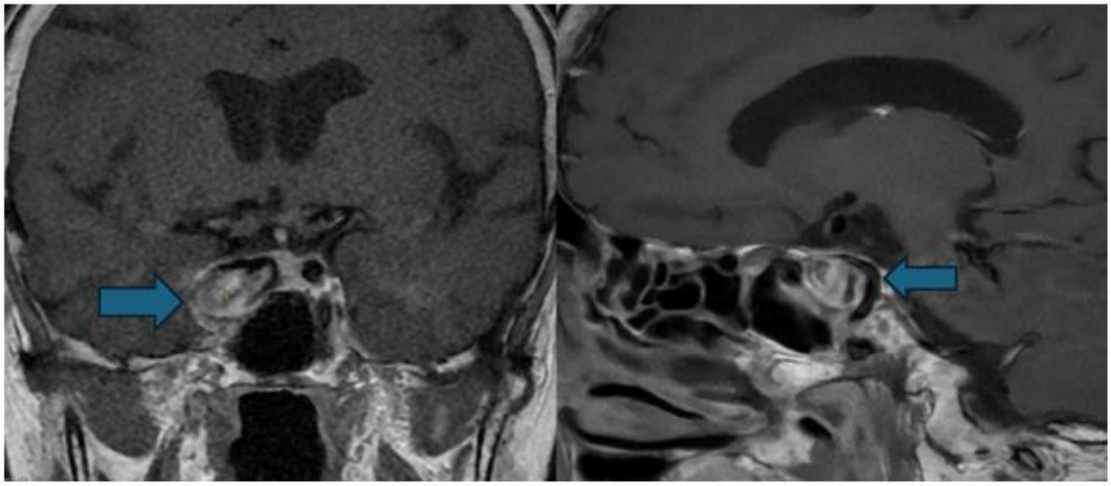

Figure 3: MR T1 with contrast showing dysplastic aneurysm of the cavernous segment with partial thrombosis. (a) coronal plane MRI, (b) sagittal place MRI.

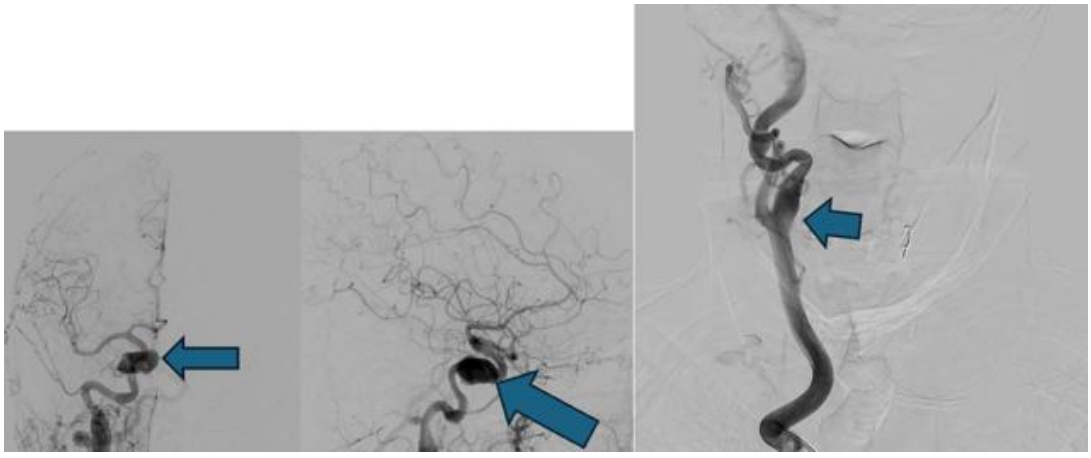

Figure 4: PA and Lateral projection, Digital Subtraction Angiography (DSA) images of the cerebral vasculature demonstrate an aneurysmal dilation in the region of the cavernous segment of the internal carotid artery (ICA), c) shows dysplastic extracranial part of internal carotid artery suggesting fibromuscular dysplasia.

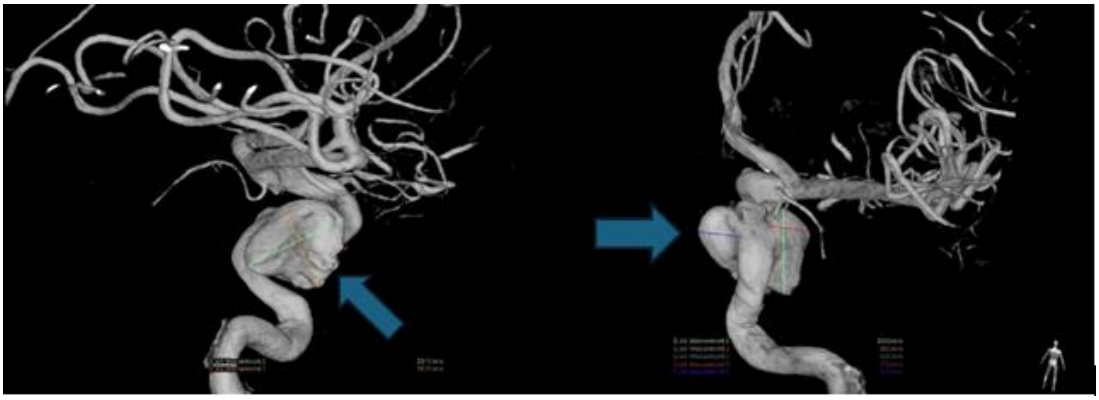

Figure 5: 3D reconstructed angiographic images of the cerebral vasculature demonstrate a large aneurysm arising from the cavernous segment of the internal carotid artery (ICA).

5. Conclusions

This case study underscores the complex nature of symptoms, and the challenges associated with diagnosing a partially thrombosed saccular aneurysm in the cavernous segment of the internal carotid artery (ICA). The patient's abrupt onset, severe headaches accompanied by nausea and vomiting, were pivotal clinical symptoms.Thesesymptoms,whicharenotuncommoninaneurysmal pathologies, emphasize the significance of considering vascular etiologies in patients presenting with refractory headaches. Lack of subarachnoid bleeding and simultaneous cranial nerve deficit made the initial clinical presentation misleading but consistent with other reports of partially thrombosed aneurysms.Radiological imaging played a vital role in establishing the diagnosis. Initial computed tomography (CT) findings raised concerns for a space-occupying lesion in the sella region. Subsequent magnetic resonance imaging (MRI) and computed tomography angiography (CTA) provided crucial details that differentiated the lesion as a large, partially thrombosed aneurysm. Advanced imaging techniques, including contrast-enhanced studies and 3D-reconstructed angiography, were instrumental in elucidating the anatomy, size, and morphology of the aneurysm, enabling precise pre-operative planning. Such imaging modalities are indispensable for distinguishing vascular lesions from neoplasms, particularly when typical clinical signs are absent.The successful endovascular treatment of this aneurysm using a cobalt-chromium flow-diverting stent with high radial force exemplifies the efficacy of minimally invasive interventions in complex vascular cases. This approach, which promotes progressive thrombosis while preserving parent artery patency, has demonstrated effective-ness in managing aneurysms in challenging anatomical locations. Tailoring antiplate-let therapy to the patient's specific sensitivities further underscores the highest im-portance of personalized care to minimize procedural risks and enhance outcomes.This case study emphasizes the critical role of recognizing atypical presentations of vascular lesions, utilizing advanced imaging for accurate diagnosis, and leveraging endovascular techniques for effective treatment. While advancements in diagnostics and therapeutics have significantly improved outcomes in such cases, further research is necessary to optimize management strategies, particularly in patients with atypical presentations or unique procedural challenges.

6. Conflicts of Interest:

The authors declare no conflicts of interest.

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