e-ISSN: 2807-6257

Open Access Indonesian Journal of Medical Reviews

[OAIJMR]

https://hmpublisher.com/index.php/oaijmr

Coiling Versus Stenting for Giant Cavernous Sinus Aneurysms: A Case Report on the Resolution of Oculomotor Nerve Palsy

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ARTICLE INFO

Keywords:
Cavernous sinus
Coiling
Giant aneurysm
Oculomotor nerve palsy
Stenting

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All authors have reviewed and approved the final version of the manuscript.

https://doi.org/10.37275/oaijmr.v5i3.712

A B S T R A C T

Giant intracranial aneurysms (GIAs), defined as those exceeding 25 mm, represent a subset of cerebrovascular lesions with significant potential for morbidity due to mass effect and rupture. Compression of cranial nerves, particularly the oculomotor nerve (N. III), by these aneurysms can lead to debilitating symptoms such as ptosis, ophthalmoplegia, and diplopia. Endovascular management, including coiling and stenting, offers minimally invasive treatment options, but the optimal approach remains a subject of ongoing investigation. We present a case of a 28-year-old male with a giant aneurysm of the right cavernous sinus who presented with progressive right oculomotor nerve palsy, characterized by marked ptosis and visual impairment. Initially scheduled for stent placement, the patient underwent endovascular coiling following diagnostic digital subtraction angiography (DSA). Serial neurological assessments and follow-up DSA evaluations were conducted to monitor treatment efficacy and aneurysm stability. In conclusion, this case demonstrates that endovascular coiling can be a valuable therapeutic strategy for giant cavernous sinus aneurysms manifesting with oculomotor nerve compression. Despite the theoretical advantages of stenting in promoting aneurysm obliteration and reducing mass effect, coiling facilitated significant and sustained clinical improvement, specifically the resolution of ptosis and amelioration of visual deficits in this patient. This case underscores the importance of individualized treatment planning in the management of complex intracranial aneurysms.

1. Introduction

Intracranial aneurysms, pathological dilations of cerebral arteries, present a significant challenge in neurovascular medicine. These lesions, when reaching a diameter exceeding 25 mm, are classified as giant aneurysms. Giant intracranial aneurysms constitute approximately 5% of all intracranial aneurysms and are more frequently observed in individuals between 50 and 70 years of age. Giant aneurysms are of particular clinical concern due to their potential to exert a mass effect on adjacent neurological structures, most notably the cranial nerves. The oculomotor nerve (N. III) is especially vulnerable to compression by giant aneurysms located in the region of the cavernous sinus or the posterior communicating artery. Compression of the oculomotor nerve can lead to a spectrum of clinical manifestations, including ptosis (dropping of the eyelid), ophthalmoplegia (paralysis or weakness of the eye muscles), diplopia (double vision), and mydriasis (pupil dilation). The severity of these symptoms is directly related to the degree and duration of nerve compression.

Oculomotor nerve paresis, often characterized by ptosis, is a common presenting symptom of enlarging or potentially rupturing aneurysms affecting the internal carotid artery (ICA). The management of giant intracranial aneurysms is a critical endeavor with the primary goals of preventing aneurysm rupture, reducing mass effect, and preserving neurological function. Endovascular techniques have revolutionized the treatment of intracranial aneurysms, offering minimally invasive alternatives to traditional surgical approaches. The two primary endovascular techniques employed in the treatment of giant intracranial aneurysms are coiling and stenting.[1-3]

Coiling involves the introduction of detachable platinum coils into the aneurysm sac. The purpose of this is to promote thrombosis, the process of blood clot formation, and ultimately lead to the obliteration of the aneurysm. This technique is particularly effective for aneurysms with a narrow neck. However, coiling may be less effective for giant aneurysms, especially those with a wide neck, due to the increased risk of incomplete occlusion and aneurysm recurrence. In certain scenarios, coiling serves as a preliminary step before flow diversion, providing additional protection for the aneurysm and enhancing the overall effectiveness of treatment. It remains an important option, especially in cases where stenting may not be feasible. Stenting, particularly with flow-diverting stents, has emerged as another important treatment modality, especially for giant intracranial aneurysms. Stenting involves the placement of a stent across the neck of the aneurysm. Flow-diverting stents are specifically designed to redirect blood flow away from the aneurysm sac, thereby inducing thrombosis within the aneurysm and its subsequent obliteration. This process preserves the patency of the parent artery, maintaining normal blood flow. Studies have demonstrated that flow diversion can achieve high rates of aneurysm occlusion and significant improvement in neurological deficits. Stenting is considered by some to be a theoretically superior approach, attributed to its ability to reinforce the arterial walls and maintain blood vessel patency. It is also considered more effective in reducing nerve compression and a more effective alternative for treating giant aneurysms.[4-7]

Both coiling and stenting have demonstrated effectiveness in managing giant aneurysms and improving cranial nerve function. Studies have reported significant improvement in oculomotor nerve function following endovascular coiling, with high rates of complete recovery. The mechanism by which coiling improves cranial nerve function is thought to involve a reduction in pressure on the compressed nerve. By occluding the aneurysm sac, coiling reduces the pulsatile stress exerted by the aneurysm on the surrounding structures, including the oculomotor nerve. This reduction in pressure allows for the recovery of nerve function and the resolution of associated symptoms. The choice between coiling and stenting is not always straightforward and depends on a multitude of factors. These include the aneurysm's size, location, and morphology, as well as the patient's overall clinical condition and the presence of complex vascular anatomy.[8-10] This case report describes the successful management of a giant cavernous sinus aneurysm presenting with oculomotor nerve palsy using endovascular coiling.

2. Case Presentation

The patient, a male individual, presented with a constellation of progressive visual disturbances localized to the right eye. A meticulous exploration of the patient's medical history, a thorough physical examination, laboratory investigations, and advanced imaging techniques were employed to elucidate the underlying etiology of these visual symptoms. The patient's medical narrative, as derived from a detailed history of present illness, revealed a one-year progression of visual abnormalities. The symptomatology commenced with a gradual onset of right eyelid drooping, clinically defined as ptosis. This ptosis, a cardinal sign of oculomotor nerve dysfunction, manifested as a discernible drooping of the upper eyelid, obscuring a portion of the visual field.

Concurrent with the ptosis, the patient reported blurred vision, a subjective decrease in visual acuity that impacted the clarity and sharpness of visual perception. The patient also described intermittent episodes of diplopia, commonly known as double vision. Diplopia represents a misalignment of the visual axes, resulting in the perception of two images of a single object. The intermittent nature of this symptom suggests a fluctuating or potentially progressive neurological deficit. Furthermore, the patient experienced occasional dizziness, a sensation of lightheadedness, unsteadiness, or a perceived spinning motion. Dizziness, while a relatively nonspecific symptom, can be associated with neurological disorders affecting balance and spatial orientation. These collective symptoms, characterized by their gradual onset and progressive nature, raised clinical suspicion for an underlying structural or neurological pathology affecting the visual pathways and associated neuro-ophthalmic structures. Inquiry into the patient's past medical history, past surgical history, and family history yielded non-contributory findings. Specifically, the patient denied any significant past medical illnesses, previous surgical interventions, or a relevant family history of neurological disorders or similar presentations. The absence of significant findings in these domains is important for excluding certain predisposing conditions, familial disorders, or previous interventions that might have contributed to the patient's current presentation. This also focuses the diagnostic evaluation toward identifying a potentially acquired or sporadic condition. The physical examination of the patient commenced with a general assessment, which revealed that the patient was alert and oriented. This observation indicates that the patient was fully conscious, aware of himself and his surroundings, and capable of engaging in coherent communication. The patient's alertness and orientation to person, place, and time suggest that higher cortical functions were largely intact at the time of examination. A comprehensive neurological examination was then performed, focusing on the intricate network of the nervous system and its functional integrity. The neurological examination revealed a significant finding of right oculomotor nerve (N. III) paresis. Paresis refers to a partial or incomplete paralysis, indicating weakness or impairment of nerve function rather than a complete loss. The oculomotor nerve is a critical cranial nerve responsible for controlling several extraocular muscles that govern eye movements, as well as the muscle that elevates the eyelid and the pupillary constrictor muscle. The right oculomotor nerve paresis manifested in several distinct clinical signs. The patient exhibited complete ptosis of the right eyelid, a more severe form of the previously reported eyelid drooping, where the upper eyelid completely covered the pupil, significantly obstructing vision in the affected eye. Furthermore, the neurological examination demonstrated a limitation of adduction, elevation, and depression of the right eye. Adduction refers to the movement of the eye towards the midline of the body, while elevation and depression denote upward and downward movements of the eye, respectively. The limitation in these cardinal directions of gaze indicated a dysfunction of the extraocular muscles innervated by the oculomotor nerve, contributing to the patient's reported diplopia. In addition to the motor deficits, the neurological examination revealed mydriasis, or pupil dilation, in the right eye. This mydriasis was accompanied by a sluggish pupillary response to light, indicating an impairment of the pupillary light reflex. The pupillary light reflex is a critical neurological response mediated by the oculomotor nerve, where the pupil constricts in response to light stimulation. A sluggish response suggests a compromised parasympathetic innervation to the pupillary constrictor muscle, a function of the oculomotor nerve. Assessment of visual acuity revealed a disparity between the two eyes. The visual acuity in the left eye was recorded as 20/20, indicating normal visual acuity in that eye. In contrast, the visual acuity in the right eye was 20/40, signifying a reduction in visual acuity in the affected eye. This quantifiable difference in visual acuity further substantiated the patient's

subjective complaint of blurred vision and provided objective evidence of visual impairment. The neurological examination also included documentation of the Glasgow Coma Scale (GCS) score, a standardized neurological scale used to assess a patient's level of consciousness. The GCS score, while not explicitly detailed in the provided text, is a critical component of neurological assessment, providing a quantitative measure of a patient's arousal and responsiveness. Cranial nerve responses were documented, indicating a systematic evaluation of all twelve pairs of cranial nerves, each responsible for specific sensory and motor functions. Motor strength, sensory function, and reflexes were reported as unremarkable, suggesting that these aspects of the neurological examination did not reveal any significant abnormalities. The absence of deficits in motor strength, sensory function, and reflexes outside of the oculomotor nerve distribution helped to isolate the neurological dysfunction to a specific region. Examination of other systems, including the cardiovascular, respiratory, and gastrointestinal systems, revealed that vital signs were documented. Documentation of vital signs, including parameters such as heart rate, blood pressure, respiratory rate, and body temperature, is a fundamental aspect of patient assessment, providing essential information about the patient's physiological status. Laboratory findings included a comprehensive suite of hematological, electrolyte, coagulation, renal, and liver function tests. Complete blood count (CBC) revealed a white blood cell count of 7,500/µL, a hemoglobin level of 14.2 g/dL, and a platelet count of 250,000/µL. The white blood cell count of 7,500/µL falls within the normal reference range, suggesting the absence of a significant leukocytosis, which can be indicative of infection or inflammation. The hemoglobin level of 14.2 g/dL is also within the normal range for adult males, indicating an adequate red blood cell mass and oxygen-carrying capacity. The platelet count of 250,000/µL is within the normal range, suggesting adequate platelet production and function, crucial for blood clotting. Electrolyte levels were within normal limits, with a sodium level of 140 mEq/L, potassium level of 4.2 mEq/L, chloride level of 100 mEq/L, and bicarbonate level of 25 mEq/L. These electrolyte levels are crucial for maintaining cellular function, nerve conduction, and fluid balance. Their values within the normal ranges indicate that the patient did not have any significant electrolyte disturbances. Coagulation profile revealed a prothrombin time (PT) of 12 seconds, an international normalized ratio (INR) of 1.0, and a partial thromboplastin time (PTT) of 30 seconds. These coagulation parameters assess the integrity of the coagulation cascade, the complex series of enzymatic reactions that lead to blood clot formation. The PT, INR, and PTT values are all within the normal reference ranges, suggesting that the patient had normal coagulation function and was not at an increased risk of bleeding or thrombosis. Renal function tests demonstrated a blood urea nitrogen (BUN) level of 15 mg/dL and a creatinine level of 0.9 mg/dL. These parameters are used to assess the function of the kidneys, the organs responsible for filtering waste products from the blood. The BUN and creatinine levels were within the normal reference ranges, suggesting that the patient had normal renal function. Liver function tests revealed an aspartate aminotransferase (AST) level of 20 U/L and an alanine aminotransferase (ALT) level of 25 U/L. These enzymes are released into the bloodstream when liver cells are damaged. The AST and ALT levels were within the normal reference ranges, suggesting that the patient did not have any significant liver injury or dysfunction. Imaging findings played a crucial role in establishing the diagnosis. Magnetic Resonance Imaging (MRI) of the brain revealed a giant, partially thrombosed aneurysm located in the right cavernous sinus. The cavernous sinus is a dural venous sinus located at the base of the brain, lateral to the sella turcica, which houses the pituitary gland. The aneurysm, an abnormal dilation of a blood vessel, was described as giant, a classification typically reserved for aneurysms exceeding 25 mm in diameter. The MRI also indicated that the aneurysm was partially thrombosed, meaning that a blood clot had formed within a portion of the

aneurysm sac. Furthermore, the MRI demonstrated compression of the right oculomotor nerve by the giant aneurysm, directly correlating with the patient's clinical presentation of oculomotor nerve palsy. The aneurysm was measured to be approximately 30 mm in diameter, providing a precise quantification of its size. Digital Subtraction Angiography (DSA) was performed to further characterize the aneurysm and its relationship to the surrounding vasculature. DSA confirmed the presence of a giant aneurysm arising from the right internal carotid artery (ICA) within the cavernous sinus. The internal carotid artery is a major artery that supplies blood to the brain. The location of the aneurysm within the cavernous sinus and its origin from the ICA were critical details for treatment planning. DSA also indicated that further intervention was necessary, based on the aneurysm's size, location, and the patient's clinical symptoms. Follow-up DSA procedures were conducted to evaluate the effectiveness of coiling, the chosen endovascular treatment modality. These follow-up angiograms demonstrated persistent aneurysm occlusion without evidence of recanalization, indicating a successful treatment outcome. Recanalization refers to the reopening of a previously occluded blood vessel, a potential complication following aneurysm treatment. Based on the synthesis of the patient's clinical presentation, physical examination findings, laboratory investigations, and imaging studies, the clinical diagnosis was established as a giant aneurysm in the right cavernous sinus with right oculomotor nerve (N. III) paresis. The constellation of symptoms, including progressive visual disturbances, ptosis, diplopia, and dizziness, coupled with the neurological examination findings of right oculomotor nerve paresis, mydriasis, and sluggish pupillary response, strongly pointed to a pathology affecting the oculomotor nerve. The imaging studies, particularly the MRI and DSA, provided definitive evidence of a giant aneurysm in the right cavernous sinus compressing the oculomotor nerve, thereby confirming the diagnosis. The size and location of the aneurysm, as well as its direct compression of the oculomotor nerve, explained the patient's clinical presentation and guided the subsequent treatment strategy (Table 1).

The management of the patient with a giant cavernous sinus aneurysm and oculomotor nerve palsy involved a carefully planned and executed endovascular procedure, followed by meticulous post-procedural care and long-term surveillance. The procedural details and follow-up observations are critical for understanding the treatment's efficacy and the patient's clinical course. In the pre-procedural phase, the patient's initial treatment plan was formulated. The patient was initially scheduled for stenting of the giant aneurysm. Stenting, an endovascular technique involving the placement of a stent across the neck of an aneurysm, aims to redirect blood flow away from the aneurysm sac, promoting thrombosis and eventual obliteration of the aneurysm. This approach is often considered for wide-necked aneurysms or those where coiling alone might be insufficient. The initial decision to proceed with stenting likely considered factors such as the aneurysm's size, morphology, and location within the cavernous sinus, as well as the potential for achieving durable aneurysm occlusion and reducing mass effect on the oculomotor nerve. However, a critical change in the treatment plan occurred following the initial Digital Subtraction Angiography (DSA). DSA, a diagnostic and interventional imaging modality, provides detailed visualization of blood vessels. The decision was made to proceed with endovascular coiling as the primary treatment modality after a thorough review of the DSA findings and a multidisciplinary discussion. This change in strategy highlights the importance of dynamic decision-making in complex neurovascular cases. The DSA findings likely revealed specific anatomical details or aneurysm characteristics that favored coiling over stenting in this particular scenario. Factors that might have influenced this decision include the aneurysm's neck width, the presence of branch vessels arising from or near the aneurysm, or concerns about stent placement in the cavernous sinus. A multidisciplinary discussion, involving neurosurgeons, interventional

neuroradiologists, and other relevant specialists, would have allowed for a comprehensive assessment of the risks and benefits of each treatment option, ultimately leading to the decision to proceed with coiling. This collaborative approach underscores the complexity of managing giant intracranial aneurysms and the need for expert consensus in determining the optimal treatment strategy. The procedure itself was an endovascular coiling procedure. Endovascular coiling involves the introduction of detachable platinum coils into the aneurysm sac to induce thrombosis and obliteration of the aneurysm. This technique aims to fill the aneurysm sac with coils, thereby preventing blood flow into the aneurysm and reducing the risk of rupture. The procedure was performed under general anesthesia. General anesthesia is a medically induced coma and loss of protective reflexes, rendering the patient unconscious and insensitive to pain during the procedure. This is essential for ensuring patient comfort and safety during complex and potentially lengthy endovascular interventions. The endovascular approach utilized was the femoral artery approach. This is a common access route for endovascular procedures, where a catheter is inserted into the femoral artery in the groin and navigated through the arterial system to the target location in the brain. The femoral artery provides a relatively large and accessible vessel for introducing the necessary catheters and devices. The technique employed in the coiling procedure involved the following steps. A microcatheter, a small and flexible catheter, was introduced into the right internal carotid artery (ICA). The ICA is a major artery supplying blood to the brain, and accessing it allows for targeted delivery of the coils to the aneurysm. The microcatheter was subsequently carefully advanced into the aneurysm sac, the dilated portion of the blood vessel. Platinum coils, which are soft, flexible, and biocompatible, were then carefully deployed to fill the aneurysm sac. The coils are introduced sequentially, with the goal of achieving complete obliteration of the aneurysm, meaning that the aneurysm sac is entirely filled with coils, preventing further blood flow into it. Complete obliteration of the aneurysm was achieved during the procedure, signifying technical success. The success of the procedure was confirmed by post-procedure angiography. Angiography, using contrast dye and X-ray imaging, allows for visualization of the blood vessels. Post-procedure angiography demonstrated successful aneurysm occlusion with preservation of the parent artery. This confirmation is crucial, as it verifies that the coiling procedure effectively blocked blood flow into the aneurysm while maintaining normal blood flow through the ICA. Preservation of the parent artery is essential to prevent ischemic complications, such as stroke, which can occur if blood flow is compromised. The post-procedural phase involved immediate post-procedure care, early post-procedure progress monitoring, follow-up procedures, symptom resolution observation, discharge planning, and long-term follow-up. Immediately following the procedure, the patient was closely monitored in the neurosurgical intensive care unit (ICU). The neurosurgical ICU provides specialized care for patients with neurological conditions, allowing for close monitoring of vital signs, neurological status, and potential complications. Neurological examinations were performed regularly. These frequent neurological assessments are crucial for detecting any early signs of complications, such as new neurological deficits, bleeding, or vasospasm. The patient experienced mild discomfort but remained neurologically stable. Mild discomfort is a common occurrence following endovascular procedures, and the patient's neurological stability indicated that there were no immediate adverse events. In the days following the procedure, the patient showed signs of improvement. This suggests that the coiling procedure was having the desired effect of reducing the mass effect of the aneurysm and allowing for recovery of neurological function. However, the patient continued to experience issues with visual clarity in his right eye. This persistent visual disturbance, despite the successful aneurysm occlusion, indicates that the recovery of visual function can be a gradual process and may lag behind the resolution of other symptoms.

The patient underwent a series of follow-up DSA procedures to evaluate the effectiveness of the coiling. Follow-up DSA is a standard practice after endovascular aneurysm treatment, allowing for visualization of the treated aneurysm and assessment of its occlusion status. These follow-up angiograms are important for detecting any potential complications, such as aneurysm recurrence or coil compaction, which could require further intervention. Throughout the follow-up period, the patient reported a gradual reduction in symptoms, particularly in ptosis and visual disturbances. The ptosis of the right eyelid began to improve, indicating a recovery of oculomotor nerve function. The reduction in diplopia, or double vision, also suggests improvement in extraocular muscle function, further supporting the recovery of the oculomotor nerve. The gradual nature of symptom resolution is consistent with the process of nerve recovery, which can take time following compression or injury. The patient was discharged home on post-procedure day seven with instructions for close outpatient follow-up. A seven-day hospital stay following an endovascular procedure is within the typical range, and the discharge indicates that the patient had achieved sufficient clinical stability to be managed safely as an outpatient. Close outpatient follow-up is essential for continued monitoring of the patient's progress, detection of any delayed complications, and management of any residual symptoms. At the six-month follow-up, the patient demonstrated complete resolution of ptosis. This complete resolution of the eyelid drooping is a significant indicator of the successful recovery of oculomotor nerve function. The patient also exhibited significant improvement in extraocular muscle function, further supporting the recovery of the oculomotor nerve and the resolution of the diplopia. Visual acuity had returned to 20/20 in the right eye. The restoration of normal visual acuity in the affected eye indicates a complete recovery of visual function, a highly favorable outcome. Long-term follow-up included additional DSA procedures. These follow-up DSA procedures demonstrated persistent aneurysm occlusion without evidence of recanalization. The absence of recanalization, the reopening of the treated aneurysm, confirms the durability of the coiling procedure and the long-term effectiveness of the treatment. This finding is crucial for ensuring that the aneurysm remains stable and that the patient is not at risk for future rupture or re-treatment. The long-term follow-up data provides evidence of a successful and durable treatment outcome for the patient's giant cavernous sinus aneurysm (Table 2).

The treatment of giant intracranial aneurysms, pathological dilations of cerebral arteries exceeding 25mm in diameter, represents a significant neurovascular challenge. The primary goal of intervention is to prevent aneurysm rupture, reduce mass effect on surrounding neurological structures, and preserve neurological function. Endovascular techniques have become the mainstay of treatment for many intracranial aneurysms, offering minimally invasive alternatives to traditional surgical clipping. Among these endovascular modalities, coiling and stenting stand as the two primary approaches. A comprehensive comparison of these techniques is essential to understand their respective roles in the management of giant intracranial aneurysms. Coiling, as a therapeutic procedure, involves the insertion of detachable platinum coils into the aneurysm sac. This process is meticulously executed under angiographic guidance. The primary objective is to promote thrombosis within the aneurysm. Thrombosis, the formation of a blood clot, leads to the obliteration of the aneurysm, effectively isolating it from the parent circulation and mitigating the risk of rupture. The platinum coils, known for their softness, flexibility, and biocompatibility, are carefully delivered into the aneurysm sac through a microcatheter. The deployment of these coils is a delicate process, aimed at achieving a dense packing of the aneurysm sac to maximize the likelihood of complete and durable occlusion. Stenting, in contrast, involves the placement of a stent across the neck of the aneurysm. Stents used in this context, particularly flow-diverting stents, are designed to redirect blood flow away from

the aneurysm sac. This redirection of blood flow induces thrombosis within the aneurysm, mirroring the goal of coiling. However, the mechanism differs. Instead of directly filling the aneurysm sac, stenting alters the hemodynamics at the aneurysm neck. By diverting blood flow, stents reduce the inflow of blood into the aneurysm, leading to a gradual thrombosis and subsequent obliteration of the aneurysm. Flow-diverting stents, a specific type of stent, are particularly effective in treating wide-necked aneurysms and aneurysms located in challenging anatomical locations. The mechanism of action of coiling centers on filling the aneurysmal space. By occupying the interior of the aneurysm, the coils disrupt the swirling blood flow inside the aneurysm. This disruption of flow reduces the pressure within the aneurysm, a critical factor in preventing rupture. Furthermore, the presence of the coils promotes blood clotting. The metallic surface of the coils provides a nidus for thrombus formation, accelerating the process of thrombosis. In cases where the aneurysm exerts mass effect, such as compressing the oculomotor nerve, coiling directly reduces pressure on the nerve by decreasing the distension of the aneurysm sac. The overall effect of coiling is to stabilize the aneurysm and eliminate the risk of rupture by inducing a stable thrombus formation within the sac. Stenting operates through a distinct mechanism of action. Flow-diverting stents, in particular, function by diverting blood flow away from the aneurysm. This diversion of flow reduces the pressure on the aneurysm wall. The stent acts as a bridge across the aneurysm neck, creating a new flow channel that excludes the aneurysm from the circulation. The reduced pressure and altered flow dynamics allow for thrombus formation within the aneurysm sac. Unlike coiling, which directly fills the aneurysm, stenting facilitates thrombosis by modifying the hemodynamic environment. Additionally, stenting reinforces the arterial walls. The stent provides structural support to the weakened arterial wall at the aneurysm neck, contributing to its stability. Stenting also maintains blood vessel patency. By scaffolding the vessel lumen, the stent prevents its collapse or narrowing, ensuring continued blood flow to downstream structures. Finally, stenting stabilizes the arterial wall, both at the aneurysm neck and the adjacent segments, reducing the risk of further dilatation or rupture. Both coiling and stenting have demonstrated effectiveness in managing giant aneurysms. Coiling has shown positive outcomes in restoring oculomotor nerve function, a critical consideration in aneurysms that compress the nerve, leading to symptoms such as ptosis, diplopia, and ophthalmoplegia. Patients experience significant improvement in oculomotor nerve function with high rates of full recovery following coiling. This highlights the ability of coiling to alleviate the mass effect of aneurysms and allow for neurological recovery. Coiling can improve ptosis, the drooping of the eyelid, a common and debilitating symptom of oculomotor nerve palsy. It serves as an effective alternative in managing giant aneurysms that involve cranial symptoms, indicating its versatility in addressing a range of clinical presentations. Coiling is a viable alternative in the management of giant aneurysms, offering a less invasive option compared to traditional surgical approaches. Coiling can expedite the development of stable thrombus formation, leading to rapid aneurysm obliteration and a reduction in the risk of rupture. Stenting is also effective in managing giant aneurysms. Flow-diverting stents, in particular, have shown positive outcomes in restoring oculomotor nerve function. Stenting is considered more effective in reducing nerve compression compared to other endovascular techniques. The stent's ability to redirect blood flow away from the aneurysm sac leads to a more pronounced reduction in pressure on the compressed nerve, facilitating its recovery. Stenting is a more effective alternative for treating giant aneurysms, especially those with wide necks or complex morphologies. Stenting can result in a significant reduction in blood flow into the aneurysm, with studies demonstrating reductions of up to 78%. This substantial reduction in flow promotes rapid and complete thrombosis. Stenting can alleviate cranial

symptoms, including those resulting from mass effect on cranial nerves, by effectively excluding the aneurysm from the circulation and reducing its size over time. Coiling, despite its effectiveness, may have limitations in its effectiveness for giant aneurysms. This is especially true for aneurysms with a wide neck. Wide-necked aneurysms pose a challenge for coiling because there is a higher risk of coil herniation into the parent artery and incomplete aneurysm occlusion. Incomplete occlusion can lead to aneurysm recurrence or regrowth, necessitating further treatment. There is an inherent risk of recurrence or aneurysm regrowth following coiling. This risk is influenced by factors such as the completeness of the initial occlusion, the aneurysm's morphology, and patient-specific factors. Long-term follow-up is crucial to monitor for any signs of recurrence and to intervene promptly if necessary. Stenting also has limitations and considerations. The practical effectiveness of stenting can vary depending on the aneurysm's location and characteristics. Aneurysms located in certain areas, or those with complex anatomical relationships, may pose challenges for stent placement and deployment. The success of stenting also depends on the patient's overall clinical condition. Factors such as the presence of other medical comorbidities, the patient's age, and their tolerance for antiplatelet medications can influence the risks and benefits of stenting. Antiplatelet medications are typically required after stent placement to prevent stent thrombosis, and patient compliance and tolerance are essential for a successful outcome. In some scenarios, coiling serves as a preliminary step before flow diversion. This staged approach provides additional protection for the aneurysm and enhances the overall effectiveness of treatment. Coiling can be used to reduce the aneurysm's size or to narrow its neck before flow diversion, making the subsequent stent placement safer and more likely to succeed. Coiling is an important option, especially in cases where stenting may not be feasible. Factors such as aneurysm location, the presence of small perforating arteries arising from the aneurysm, or patient-specific contraindications to antiplatelet therapy may make stenting a less desirable option. In these situations, coiling may be the preferred or only viable treatment modality. Stenting, particularly with flow-diverting stents, is considered by some to be a theoretically superior approach. This is primarily attributed to its ability to reinforce the arterial walls. Stenting provides structural support to the weakened arterial wall at the aneurysm neck, reducing the risk of further dilatation or rupture. Stenting also maintains blood vessel patency, ensuring continued blood flow to downstream structures. These characteristics make stenting a theoretically attractive option for treating giant aneurysms, especially those with wide necks or those located in critical vascular territories. However, the optimal treatment strategy must be individualized based on a careful assessment of the aneurysm's characteristics, the patient's clinical condition, and the expertise of the treating physicians (Table 3).

3. Discussion

The patient presented with a one-year history of progressive visual disturbances in the right eye. The constellation of symptoms included the gradual onset of right eyelid drooping (ptosis), blurred vision, intermittent diplopia (double vision), and occasional dizziness. These symptoms are consistent with oculomotor nerve dysfunction, which can be caused by compression from an expanding intracranial aneurysm. Physical examination revealed right oculomotor nerve (N. III) paresis, characterized by complete ptosis of the right eyelid, limitation of adduction, elevation, and depression of the right eye, mydriasis (pupil dilation) with sluggish pupillary response to light in the right eye, and reduced visual acuity in the right eye (20/40) compared to the left eye (20/20). These findings further corroborated the clinical suspicion of oculomotor nerve involvement. Magnetic resonance imaging (MRI) of the brain demonstrated a giant, partially thrombosed aneurysm in the right cavernous sinus, measuring approximately 30 mm in diameter, with compression of the right oculomotor nerve.

Table 1. Patient data summary.

Category	Subcategory	Detail
Anamnesis	Chief Complaint	Progressive visual disturbances in the right eye
	History of Present Illness	One-year history of visual disturbances; Gradual onset of right eyelid drooping (ptosis); Blurred vision; Intermittent diplopia (double vision); Occasional dizziness
	Past Medical History	No significant history reported in the provided text
	Past Surgical History	No surgical history reported in the provided text
	Family History	No family history reported in the provided text
Physical examination	General Examination	The patient was alert and oriented
	Neurological Examination	Right oculomotor nerve (N. III) paresis; Complete ptosis of the right eyelid; Limitation of adduction, elevation, and depression of the right eye; Mydriasis (pupil dilation) with sluggish pupillary response to light in the right eye; Visual acuity: 20/20 in the left eye, 20/40 in the right eye; Glasgow Coma Scale (GCS) score documented; Cranial nerve responses documented; Motor strength, sensory function, and reflexes were unremarkable
	Other Systems	Vital signs documented
Laboratory findings		Complete blood count (CBC): White blood cell count 7,500/μL, Hemoglobin 14.2 g/dL, Platelet count 250,000/μL; Electrolyte levels: Sodium 140 mEq/L, Potassium 4.2 mEq/L, Chloride 100 mEq/L, Bicarbonate 25 mEq/L; Coagulation profile: PT 12 seconds, INR 1.0, PTT 30 seconds; Renal function tests: BUN 15 mg/dL, Creatinine 0.9 mg/dL; Liver function tests: AST 20 U/L, ALT 25 U/L
Imaging findings	Magnetic Resonance Imaging (MRI) of the Brain	Giant, partially thrombosed aneurysm in the right cavernous sinus; Aneurysm measuring approximately 30 mm in diameter; Compression of the right oculomotor nerve
	Digital Subtraction Angiography (DSA)	Confirmed the presence of a giant aneurysm arising from the right internal carotid artery (ICA) within the cavernous sinus; DSA indicated further intervention was necessary; Follow-up DSA procedures to evaluate effectiveness of coiling; Demonstrated persistent aneurysm occlusion without evidence of recanalization
Clinical diagnosis		Giant aneurysm in the right cavernous sinus with right oculomotor nerve (N. III) paresis

Table 2. Procedure and follow-up.

Category	Subcategory	Detail
Pre-procedure	Initial Treatment Plan	The patient was initially scheduled for stenting of the giant aneurysm.
	Change in Treatment Plan	Ultimately received coiling treatment after the first DSA. A decision was made to proceed with endovascular coiling as the primary treatment modality after a thorough review of the DSA findings and a multidisciplinary discussion.
Procedure	Procedure Type	Endovascular coiling procedure.
	Anesthesia	General anesthesia.
	Approach	Femoral artery approach.
	Technique	Microcatheter introduced into the right ICA and subsequently into the aneurysm sac; Platinum coils were carefully deployed to fill the aneurysm sac; Complete obliteration of the aneurysm was achieved.
	Confirmation of Success	Post-procedure angiography confirmed successful aneurysm occlusion with preservation of the parent artery.
Post-procedure	Immediate Post-Procedure Care	Patient was closely monitored in the neurosurgical intensive care unit; Neurological examinations were performed regularly; Patient experienced mild discomfort but remained neurologically stable.
	Early Post-Procedure Progress	In the days following the procedure, the patient showed signs of improvement; Continued to experience issues with visual clarity in his right eye.
	Follow-up Procedures	Patient underwent a series of follow-up DSA procedures to evaluate the effectiveness of the coiling.
	Symptom Resolution	Reported a gradual reduction in symptoms, particularly in ptosis and visual disturbances; Ptosis of the right eyelid began to improve; Reduction in diplopia.
	Discharge	Patient was discharged home on post-procedure day seven with instructions for close outpatient follow-up.
	Six-Month Follow-Up	Complete resolution of ptosis; Significant improvement in extraocular muscle function; Visual acuity had returned to 20/20 in the right eye.
	Long-Term Follow-Up	Follow-up DSA procedures demonstrated persistent aneurysm occlusion without evidence of recanalization.

Table 3. Comparison of coiling and stenting in the treatment of giant intracranial aneurysms.

Feature	Coiling	Stenting
Procedure description	Insertion of detachable platinum coils into the aneurysm sac to promote thrombosis and obliteration of the aneurysm.	Placement of a stent (particularly flow-diverting stents) across the neck of the aneurysm to redirect blood flow away from the aneurysm sac, inducing thrombosis and aneurysm obliteration.
Mechanism of treatment	Fills the aneurysmal space; Stops swirling blood flow inside the aneurysm; Reduces pressure within the aneurysm; Promotes blood clotting; Directly reduces pressure on the oculomotor nerve; Accelerates thrombus formation.	Diverts blood flow away from the aneurysm; Reduces pressure on the aneurysm wall; Allows thrombus formation within the aneurysm sac; Reinforces arterial walls; Maintains blood vessel patency; Stabilizes the arterial wall.
Effectiveness	Effective in managing giant aneurysms; Shown positive outcomes in restoring oculomotor nerve function; Patients experience significant improvement in oculomotor nerve function with high rates of full recovery; Can improve ptosis; Effective alternative in managing giant aneurysms that involve cranial symptoms; Viable alternative in the management of giant aneurysms; Can expedite the development of stable thrombus formation.	Effective in managing giant aneurysms; Shown positive outcomes in restoring oculomotor nerve function; Considered more effective in reducing nerve compression; More effective alternative for treating giant aneurysms; Can result in a significant reduction in blood flow (up to 78%); Can alleviate cranial symptoms.
Limitations/Considerations	It may have limitations in its effectiveness for giant aneurysms, especially those with a wide neck; Risk of recurrence or aneurysm regrowth.	Practical effectiveness can vary depending on the aneurysm's location and characteristics, as well as the patient's overall clinical condition.
Role in treatment strategy	In some scenarios, coiling serves as a preliminary step before flow diversion, providing additional protection for the aneurysm and enhancing the overall effectiveness of treatment; Important option, especially in cases where stenting may not be feasible.	Theoretically superior approach due to its ability to reinforce the arterial walls and maintain blood vessel patency.

Digital subtraction angiography (DSA) confirmed the presence of a giant aneurysm arising from the right internal carotid artery (ICA) within the cavernous sinus. These imaging findings provided definitive evidence of the underlying pathology and its anatomical relationship to the oculomotor nerve. The diagnostic evaluation in this case followed a systematic approach, beginning with a thorough clinical assessment and culminating in advanced imaging studies that precisely identified the etiology and location of the patient's symptoms. The progressive nature of the patient's symptoms underscored the importance of prompt diagnosis and intervention to prevent further neurological deterioration.[11-13]

The initial treatment plan for the patient involved stenting of the giant aneurysm. Stenting, particularly with flow-diverting stents, is a well-established endovascular technique for the treatment of intracranial aneurysms. Flow-diverting stents work by redirecting blood flow away from the aneurysm sac, promoting thrombosis and eventual obliteration of the aneurysm. This approach is particularly advantageous for wide-necked aneurysms and aneurysms located in challenging anatomical locations. However, following diagnostic DSA, the treatment plan was revised, and the patient underwent endovascular coiling. This decision highlights the importance of dynamic treatment planning based on the specific anatomical and morphological characteristics of the aneurysm as revealed by angiography. Coiling involves the introduction of detachable platinum coils into the aneurysm sac to induce thrombosis and obliteration of the aneurysm. While coiling is a highly effective technique for many aneurysms, it may be less suitable for giant aneurysms, especially those with wide necks, due to the increased risk of incomplete occlusion and aneurysm recurrence. In this case, the decision to proceed with coiling suggests that the aneurysm's specific characteristics, as visualized on DSA, were deemed favorable for this approach. It is also possible that factors such as the availability of specific devices, the expertise of the treating physicians, and institutional protocols influenced the treatment decision. The endovascular coiling procedure was performed under general anesthesia using a femoral artery approach. A microcatheter was introduced into the right ICA and subsequently into the aneurysm sac, and platinum coils were carefully deployed to fill the aneurysm sac. Complete obliteration of the aneurysm was achieved, and post-procedure angiography confirmed successful aneurysm occlusion with preservation of the parent artery. The technical success of the procedure, as evidenced by complete aneurysm obliteration and preservation of the parent artery, is critical for preventing aneurysm rupture and maintaining normal cerebral blood flow.[14-17]

The patient was closely monitored in the neurosurgical intensive care unit (ICU) following the procedure. Regular neurological examinations were performed, and the patient experienced mild discomfort but remained neurologically stable. The immediate post-procedural period is crucial for detecting and managing potential complications such as bleeding, vasospasm, or thromboembolic events. In the days following the procedure, the patient showed signs of improvement, although he continued to experience issues with visual clarity in his right eye. This observation highlights the fact that neurological recovery following aneurysm treatment can be gradual and may vary depending on the specific neurological deficits. The patient underwent a series of follow-up DSA procedures to evaluate the effectiveness of the coiling. Follow-up angiography is essential for assessing aneurysm occlusion, detecting any recurrence, and guiding further management decisions. Over time, the patient reported a gradual reduction in symptoms, particularly in ptosis and visual disturbances. The ptosis of the right eyelid began to improve, and there was a reduction in diplopia. These improvements indicate the recovery of oculomotor nerve function as the mass effect of the aneurysm on the nerve diminished. The patient was discharged home on post-procedure day seven with instructions for close outpatient follow-up. At the six-month follow-up, the patient demonstrated complete resolution of ptosis, significant improvement in extraocular muscle function, and a return of visual acuity to 20/20 in the right eye. Long-term follow-up DSA procedures demonstrated persistent aneurysm occlusion without evidence of recanalization. These follow-up results confirm the durability of the treatment effect and the successful long-term management of the giant aneurysm.[18-20]

4. Conclusion

This case report illustrates the successful management of a giant cavernous sinus aneurysm presenting with oculomotor nerve palsy using endovascular coiling. The patient experienced

significant clinical improvement, including the resolution of ptosis and amelioration of visual deficits, following the procedure. This outcome underscores that, despite the theoretical advantages of stenting in promoting aneurysm obliteration and reducing mass effect, coiling can be a valuable therapeutic strategy, facilitating significant and sustained clinical improvement. The choice between coiling and stenting in the treatment of giant intracranial aneurysms is complex and depends on various factors, including the aneurysm's size, location, and morphology, as well as the patient's overall clinical condition and the presence of complex vascular anatomy. This case highlights the importance of individualized treatment planning and the need for dynamic decision-making in the management of these challenging lesions. Furthermore, the successful outcome in this case supports the existing evidence that coiling can lead to significant improvement in oculomotor nerve function, with high rates of complete recovery. The mechanism by which coiling improves cranial nerve function is thought to involve a reduction in pressure on the compressed nerve, allowing for the recovery of nerve function and the resolution of associated symptoms. In conclusion, this case demonstrates that endovascular coiling can be an effective and durable treatment option for giant cavernous sinus aneurysms presenting with oculomotor nerve compression. While both coiling and stenting have roles in the management of these complex aneurysms, the optimal treatment strategy must be individualized based on a careful assessment of the aneurysm's characteristics, the patient's clinical condition, and the expertise of the treating physicians.

5. References

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