

Case Report

Endovascular Stent Graft with Staged Hybrid Vascular Surgery of a Giant Extracranial Internal Carotid Artery Aneurysm: A Rare Case Report

Endovaskular *Stent Graft* dengan Pendekatan Operasi *Staged Hybrid* pada Aneurisma Raksasa Arteri Karotis Interna Ekstrakranial: Laporan Kasus Langka

Hadiyan A Muhammad^{1*}, Ramzi Asrial², Tommy Kuswara², Achroma Fora², Tubagus OR Wahid³, Ade Wirdayanto³

¹*Surgical Resident of Medical Faculty, Arifin Achmad General Hospital, Faculty of Medicine Riau University, Indonesia*

Jl. Diponegoro No. 1, Pekanbaru, Riau, Indonesia

²*Vascular Surgery Department of Arifin Achmad General Hospital, Faculty of Medicine Riau University, Indonesia*

Jl. Diponegoro No. 1, Pekanbaru, Riau, Indonesia

³*Surgery Department of Arifin Achmad General Hospital, Faculty of Medicine Riau University, Indonesia*

Jl. Diponegoro No. 1, Pekanbaru, Riau, Indonesia

**Corresponding author*

Email: boyanadhli@gmail.com

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Abstract

Extracranial internal carotid artery aneurysm (EICAA) is a rare vascular entity defined as focal dilation exceeding 1.5 times the normal arterial diameter. Although uncommon, EICAA carries a high risk of thromboembolism, rupture, and neurological complications. This case report aims to describe the clinical characteristics, diagnostic approach, and endovascular management strategy of a giant extracranial internal carotid artery aneurysm, contributing to the limited literature on this rare condition. A patient presenting with a progressively enlarging left cervical mass over four months, accompanied by pain and intermittent bleeding. Physical examination revealed a well-defined, pulsatile, solitary mass measuring approximately 10 × 8 × 7 cm, with elastic consistency and fixation to surrounding tissues. Contrast-enhanced imaging, including computed tomography angiography and carotid angiography with three-dimensional reconstruction, confirmed the diagnosis of a large extracranial internal carotid artery aneurysm. Advanced imaging plays a crucial role in establishing the diagnosis and guiding treatment planning. Management options include open surgical repair and endovascular intervention using stent grafts, with the choice of approach based on aneurysm morphology, anatomical location, patient comorbidities, and operator expertise. In conclusion, early recognition of EICAA is essential to prevent life-threatening complications. Comprehensive imaging and individualized treatment strategies are key to achieving optimal outcomes.

Keywords: *internal carotid artery aneurysm; endovascular repair; stent graft*

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Introduction

Extracranial internal carotid artery aneurysm (EICAA) is an exceedingly rare vascular abnormality, with a reported incidence of less than 1% of all carotid artery procedures and approximately 0.4-4% of peripheral arterial aneurysms. Although uncommon, EICAA has significant clinical implications because it may cause cerebral thromboembolism, rupture, compression of adjacent structures, and neurological deficits. The most frequently reported etiologies include atherosclerosis, fibromuscular dysplasia, trauma, infection, and complications after vascular procedures.¹⁻³

In recent years, clinical attention to EICAA has increased alongside advances in imaging techniques and endovascular therapy. However, most available literature remains limited to case reports and small series, so no strong consensus has been established regarding the optimal management strategy. Treatment selection generally considers aneurysm location, lesion morphology, clinical symptoms, and patient comorbidities. Aneurysm size is an important factor because large aneurysms tend to increase the risk of local and embolic complications, while also affecting procedural complexity and the choice between open surgical and endovascular approaches.^{2,4,5}

Therefore, reporting a large EICAA case has important scientific value, particularly in describing the clinical characteristics, diagnostic challenges, and therapeutic considerations for a rare but potentially life-threatening condition.

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A 30-year-old male presented with a chief complaint of a painful left neck mass that had occasionally bled over the past month. The mass was first noticed by the patient approximately four months before hospital admission, when it was the size of a marble. Initially, the patient did not pay attention to the complaint because he considered it as an ordinary lump. During the last two months, the mass enlarged rapidly until it reached the size of a tennis ball. The patient described the lesion as painful and pulsatile, and it was occasionally accompanied by bleeding at its tip. The patient denied dysphagia or hoarseness. Neurological symptoms, such as slurred speech and limb weakness, were also absent, although the patient reported numbness on the left side of the face. No masses were found in the axilla, abdomen, or other body regions, and no significant weight loss was reported. A history of chronic cough, dyspnea, bone pain, headache,

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seizures, or decreased consciousness was denied. The patient was subsequently referred to the vascular surgery outpatient clinic for further evaluation and management. The patient had no previous history of tumor, hypertension, diabetes mellitus, trauma, or surgery. A family history of tumor was also denied. The patient had a smoking habit of approximately one pack per day. The disease course, characterized by progressive mass enlargement with pulsatile features and intermittent bleeding episodes, increased suspicion of a vascular lesion rather than a soft tissue mass or cervical malignancy.

On initial examination, hemodynamic parameters were within normal limits, and the patient was conscious, alert, and cooperative. General physical examination revealed no significant abnormalities. Examination of the left cervical region showed a left neck mass with clear borders, relatively regular margins and surface, and hyperemia without active bleeding. Palpation revealed a solitary mass measuring approximately $10 \times 8 \times 7$ cm, with a firm-elastic consistency, fixation to surrounding tissues, tenderness, and pulsation synchronous with the heartbeat. The lesion also appeared prone to bleeding after mild manipulation, as shown in Figure 1. These findings of a large pulsatile neck mass suggested an extracranial carotid artery aneurysm, and further vascular imaging evaluation was required to confirm the diagnosis and plan the management strategy.



Figure 1 Clinical Appearance of The Left Neck Mass, which Appeared Protruding and Pulsatile

To establish the diagnosis, the patient underwent computed tomography angiography of the head and neck with three-dimensional reconstruction. Axial images showed proximal dilatation of the left internal carotid artery originating from the carotid bifurcation, extending approximately 87 mm with a maximum diameter of approximately 85 mm, accompanied by intraluminal thrombus, as shown in Figures 2 and 3. These findings confirmed the diagnosis of a large extracranial internal carotid artery aneurysm, or giant extracranial internal carotid artery aneurysm. Imaging evaluation of the hyperdense lesion in the left neck, which represented an aneurysm of the internal carotid artery, also provided important information regarding lesion length, bifurcation involvement, and the presence of intraluminal thrombus, which were key considerations in planning endovascular intervention or open surgery.

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Figure 2 Contrast-enhanced CT Scan of The Head and Neck

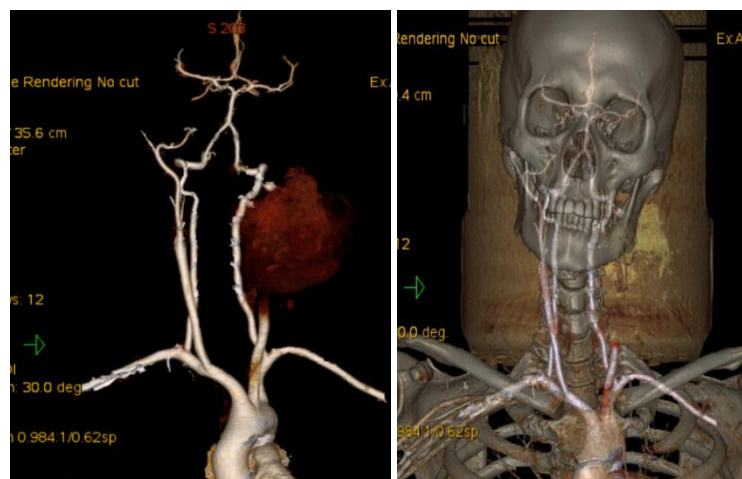


Figure 3 Contrast-enhanced CT Scan of The Head and Neck with Three-Dimensional Vascular Reconstruction Showing Blood Flow Filling The Left Cervical Cavity

Based on these clinical and radiological findings, the patient was scheduled for endovascular treatment consisting of diagnostic angiography and stent graft placement. The procedure was performed on May 13, 2025 in the catheterization laboratory operating room under general anesthesia and standard aseptic technique. Vascular access was obtained through the right femoral artery under fluoroscopic guidance using a C-arm, after which the catheter was advanced into the left internal carotid artery. Contrast injection demonstrated a large aneurysm measuring approximately 8.7×8.8 cm that originated from the proximal segment of the internal carotid artery (Figure 4A). A stent graft was then deployed precisely across the aneurysm orifice to exclude blood flow from the aneurysm sac. This procedure achieved complete success, confirmed by post-intervention angiography, which demonstrated absence of blood flow into the aneurysm (Figure 4B). The endovascular approach was selected as the initial stage because of the extremely

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large aneurysm size and previous bleeding episodes, with the aim of rapidly controlling blood flow and reducing the risk of massive hemorrhage if direct open resection was performed.



Figure 4 Endovascular Stent Graft Procedure

(A) Contrast opacification of the extracranial internal carotid artery aneurysm; (B) Contrast imaging demonstrating loss of aneurysmal flow after stent graft placement.

During therapeutic decision-making, primary open surgery consisting of aneurysm resection and vascular reconstruction was considered one of the alternative treatments. Considering the extremely large aneurysm size and the risk of intraoperative bleeding and cranial nerve injury during the initial dissection, a staged hybrid strategy was selected because it was considered safer and offered better hemodynamic control before definitive surgery.

After endovascular stent graft placement, pulsation in the mass immediately disappeared, indicating satisfactory occlusion of flow within the aneurysm. The patient was then planned for open aneurysm removal one month later. This delay aimed to allow optimal intraluminal thrombus formation and to provide time for stabilization of the patient's condition before definitive surgery. During this period, the patient received supportive medical therapy, including blood pressure control, analgesics, and antiplatelet therapy according to the post-stent placement protocol to maintain vascular patency and prevent thromboembolic complications.

During follow-up evaluation in this interval, the patient reported that the mass no longer enlarged, no longer pulsated, and showed no active bleeding. Neck pain had also resolved. Open surgical aneurysm repair was then performed one month after stent graft placement with adequate perioperative preparation. The procedure was carried out under general anesthesia, and an incision was made directly over the mass in the left cervical region (Figure 5). During exploration, an aneurysm sac was identified and was largely filled with thrombus secondary to previous flow

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exclusion. Hematoma evacuation and repair of the internal carotid artery aneurysm were then performed.



Figure 5 Open Hematoma Evacuation and Internal Carotid Artery Aneurysm Repair Performed One Month after Stent Graft Placement (Staged Hybrid)

Three days after surgery, the patient was discharged in a hemodynamically stable condition with a favorable surgical wound. Monitoring was continued to detect possible early complications, such as wound hematoma. Postoperative evaluation revealed no neurological deficit, recurrent bleeding, or signs of wound infection, and the pulsatile neck mass had completely disappeared, indicating a favorable clinical outcome after the staged hybrid approach. The patient provided written consent for publication of this case report and for the use of relevant clinical data and image documentation. The preparation of this case report followed the ethical principles of medical research and maintained the confidentiality of the patient's identity.

Discussion

Extracranial internal carotid artery aneurysm (EICAA) is a rare entity with highly variable clinical presentation. Modern studies show that most EICAAs are detected as pulsatile neck masses without severe symptoms, whereas large aneurysms are rarely reported and have a higher risk of complications such as rupture, thromboembolism, and local compression. In this case, an aneurysm measuring approximately 8-9 cm with intermittent bleeding demonstrated the characteristics of a rarely reported giant EICAA, giving it clinical implications distinct from smaller aneurysms that are often asymptomatic.⁶⁻⁷

The Attigah classification is widely used to determine therapeutic approaches according to aneurysm location. Attigah classifies EICAA into five types based on the relationship to the carotid bifurcation and lesion length. The aneurysm in this patient originated from the internal carotid artery distal to the bifurcation and extended cranially, consistent with Attigah type II, which is known to have greater complexity during open surgical repair because of limited access

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and the risk of cranial nerve injury. This explains why a single approach using primary resection carried a high risk in this case.^{4,5,8}

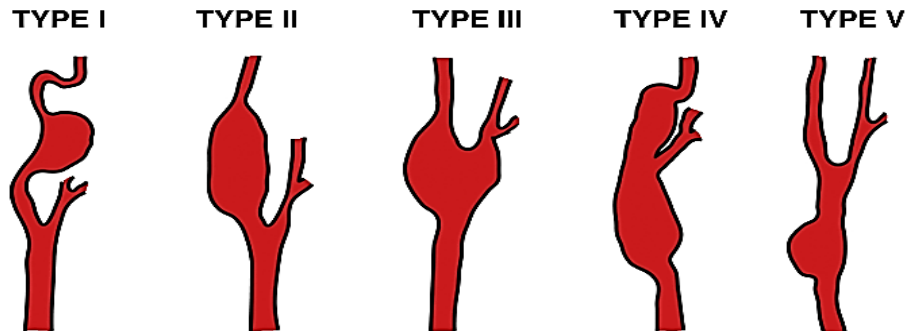


Figure 6 Classification of Internal Carotid Artery Aneurysms

Type I: isolated and short aneurysm of the internal carotid artery (ICA) above the carotid bulb; Type II: long aneurysm of the ICA, extending from the carotid bulb to the Blaisdell line; Type III: aneurysm of the proximal ICA and carotid bifurcation; Type IV: aneurysm involving the common carotid artery (CCA) and ICA, similar to type III but extending more distally and proximally; Type V: isolated aneurysm of the CCA.¹²

From a diagnostic perspective, computed tomography angiography with three-dimensional reconstruction has become a primary modality for evaluating complex EICAA. Recent studies emphasize that 3D CTA provides important information regarding lesion length, aneurysm diameter, bifurcation involvement, and the presence of intraluminal thrombus, all of which guide endovascular and open surgical planning.^{2,4} In this patient, the finding of an aneurysm length of approximately 87 mm with intraluminal thrombus could be evaluated optimally only through 3D CTA, which served as the basis for stent graft landing zone planning.

Current EICAA management strategies increasingly favor individualized approaches based on lesion characteristics. Recent studies indicate that, in addition to location and etiology, aneurysm size and anatomical complexity are major factors in selecting open surgery, endovascular treatment, or a combination of both. In large or complex aneurysms, hybrid approaches are increasingly reported because they can reduce the risk of intraoperative bleeding and neurological complications compared with primary resection. A hybrid approach for vascular aneurysms combines open surgical techniques and endovascular intervention to treat aneurysms with complex anatomy or patients at high risk for open surgery. This procedure usually involves surgical debranching or vascular bypass followed by endovascular stent graft placement to exclude the aneurysm from the circulation. A hybrid approach expands the indications for endovascular therapy and may reduce perioperative morbidity while achieving favorable clinical outcomes in complex aneurysm cases. This is consistent with the staged approach used in the present case.^{1,3,8-11}

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In selecting an EICAA treatment strategy, each approach has advantages and limitations. Open surgery has historically been regarded as the standard treatment because it enables direct aneurysm resection and arterial reconstruction with good anatomical control. The main advantages of this approach are definitive elimination of the aneurysm sac and the ability to relieve compression of adjacent structures. However, this procedure also carries a higher risk of morbidity, particularly cranial nerve injury, intraoperative bleeding, and difficult access in aneurysms located high in the internal carotid artery.^{4,8,18} In contrast, the endovascular approach offers a less invasive procedure with faster recovery and a lower risk of cranial nerve injury, but it has limitations, including the possibility of endoleak, stent thrombosis, and dependence on vascular morphology and adequate landing zone availability.^{2,8,13}

In this case, the extremely large aneurysm size, or giant aneurysm, and intermittent bleeding were important risk factors that influenced the therapeutic strategy. A large aneurysm mass not only increases the risk of rupture and thromboembolism but may also cause compressive effects on adjacent structures, such as cranial nerves and cervical tissues. The prominent mass in the cervical region also had the potential to cause cosmetic concerns and functional discomfort for the patient. Endovascular treatment successfully occluded blood flow into the aneurysm; however, open resection remained necessary to definitively remove the aneurysm mass and prevent long-term local complications.^{6,7,18,19}

The decision to choose a stent graft as the initial treatment in this case was based on specific clinical characteristics, namely the extremely large aneurysm size, intermittent bleeding, and the risk of rupture during surgical manipulation. The literature shows that endovascular intervention can reduce the risk of cranial nerve injury and provide rapid hemodynamic control through a flow exclusion mechanism. This finding is consistent with the outcome in this patient, in whom mass pulsation disappeared immediately after stent graft placement.^{2,8,13,14}

The staged hybrid approach used in this case has received increasing attention in modern literature, particularly for large or complex aneurysms. Recent studies report that a staged strategy allows intraluminal thrombosis before open resection, thereby reducing bleeding risk and facilitating dissection of surrounding tissue. A staged strategy in aneurysm management refers to a therapeutic approach performed gradually through two or more separate procedures to improve the safety of definitive treatment. The initial stage usually aims to reduce blood flow into the aneurysm sac and facilitate intraluminal thrombus formation, so that the subsequent operative stage has a lower risk of bleeding and easier tissue dissection. This was demonstrated in the present patient by the dominant intrasaccular thrombus found during definitive surgery one month later.^{2-4,15-17}

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Although the staged hybrid approach offers several advantages, this strategy also has limitations. A two-stage procedure requires greater resources, prolongs the overall duration of treatment, and may increase patient exposure to invasive procedures. In addition, the success of endovascular therapy depends strongly on aneurysm morphology and stent graft landing zone quality. Therefore, the selection of a hybrid approach must consider the patient's clinical condition, the anatomical complexity of the lesion, and operator experience so that the therapeutic benefits outweigh the potential risks.^{2,8,18,19}

Postoperative complications in the management of extracranial internal carotid artery aneurysm (EICAA) include neck hematoma, cranial nerve injury, cerebral thromboembolism, wound infection, and vascular occlusion or restenosis. Hematoma is an important complication because it can compress the airway and neurovascular structures in the cervical region. This condition is generally caused by bleeding from uncontrolled small vessels, impaired hemostasis, antiplatelet or anticoagulant therapy, and postoperative hypertension that triggers leakage at the operative site. Prevention can be achieved through adequate hemostatic technique, strict blood pressure control, monitoring of antiplatelet therapy, and placement of a wound drain for early detection of postoperative blood accumulation.^{4,8,18,19}

Aneurysm size and clinical symptoms are important prognostic factors in determining patient outcomes. Recent studies show that large and symptomatic aneurysms carry a higher risk of complications, but timely intervention can produce favorable outcomes with low mortality. In this case, the combination of endovascular intervention and open surgery resulted in significant clinical improvement without neurological complications, supporting an individualized approach to giant EICAA.^{4,5,19,20}

Overall, this case confirms that giant EICAA with bleeding presentation requires a lesion-based approach. The combination of endovascular therapy and open surgery provided initial hemodynamic control and definitive correction with minimal complication risk. The staged hybrid approach in this case contributes to modern literature as a rational strategy for managing complex carotid aneurysms.^{18,19}

Conclusion

This case demonstrates that giant extracranial internal carotid artery aneurysm (EICAA) presenting with bleeding is a rare condition that requires lesion-based management. Large aneurysm size, rapid growth, and active clinical symptoms are important factors in determining individualized therapeutic strategies. A staged hybrid approach consisting of initial endovascular intervention followed by open surgical correction enables early hemodynamic control, reduces

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bleeding risk, and facilitates definitive treatment with improved safety. These findings support the role of a combined strategy as a rational option for complex EICAA and contribute to modern literature on the management of large carotid aneurysms.

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