


## CASE REPORT

# Surgical management of extracranial internal carotid artery aneurysm—Case report and literature review

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## Key Clinical Message

Extracranial internal carotid artery aneurysms (EICAAs) can lead to serious medical conditions, such as stroke or compression over cranial nerves. In very few cases, there may be hemorrhagic complications due to the rupture. Although rare, they should be suspected cause in every patient with transitory ischemic attack or stroke, especially in the presence of pain, palpable mass or bruit in the neck.

## Abstract

Extracranial internal carotid artery aneurysms (EICAAs) are rare arterial aneurysms, with a prevalence of less than 1%. Although they are not common, these aneurysms can lead to serious medical conditions, such as stroke or compression over cranial nerves. In very few cases, there may be hemorrhagic complications due to the rupture of the aneurysm. This report presents a case of a successful surgical intervention for EICAA, and an overview of symptoms, risk factors, causes, diagnostic procedures, treatments, and potential postoperative complications. A 70-year-old Albanian lady had been experiencing pain due to a pulsating mass in her neck for many years. Physical examination did not reveal any signs of infection, injury, or previous surgery. A palpable thrill and a carotid bruit were detected over an evident pulsating mass on the left side of her neck. Her past medical history was consistent with three transitory ischemic attacks in recent months and a stroke 5 years earlier. Comorbidities included hypercholesterolemia, hypertension, and long-standing coronary artery disease. Imaging investigation in terms of ultrasound and CT-scan confirmed the presence of an aneurysm of the proximal tract of the internal carotid artery measuring 42 × 31 mm. Surgery was indicated on symptomatic and anatomical grounds. The procedure was carried out under general anesthesia. After proximal and distal clamping, the aneurysm was excised followed by end-to-end anastomosis of the internal carotid artery. The postoperative course was uneventful, and the patient was discharged home on the fifth postoperative day. Despite the growing number of reported cases of successful endovascular treatment for internal carotid artery aneurysms, open

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surgery remains a safe and effective treatment option. However, it is crucial to provide customized treatment plans for each patient based on their individual characteristics and the particularities of their aneurysm.

#### KEYWORDS

internal carotid artery aneurysm, literature review, surgical treatment

## 1 | BACKGROUND

An extracranial internal carotid artery aneurysm (EICAA) is defined as an increase in diameter by more than 1.5 times. It can be true or false. While the specific causes of ECA aneurysms are yet to be fully understood, atherosclerosis is the most frequently acknowledged cause among elderly patients, alongside other factors such as trauma, fibromuscular dysplasia, previous surgery, congenital and acquired malformation, infection, and radiation exposure.<sup>1–6</sup> There are articles suggesting that occurrence of the ECCA may be linked to body mass index.<sup>7</sup> On the contrary, a false aneurysm can be caused by medical intervention, such as carotid endarterectomy, or as a result of trauma or dissection or spontaneously, including in children and pregnant women.<sup>8,9</sup> It has been observed that up to 13% of patients with EICAA exhibit bilateral EICAAs. Additionally, multiple synchronous aneurysms, specifically intracranial ones, have been documented in approximately 15%–20% of patients diagnosed with EICAA.<sup>10–14</sup>

There are various classifications of EICAA based on their anatomic location. Bouthillier's classification categorizes the cervical, petrous, and intracranial parts as C1, C2, and 3-C7, respectively. Attigah and Malikov, on the contrary, use the line of Blaisdell which is a notional line drawn between the mastoid process and the angle of the mandible. If an aneurysm is located above this line, it is considered less accessible through standard surgical procedures. In such cases, alternative exposure techniques and/or endovascular assistance may be required.<sup>15,16</sup>

Aneurysms located in the extracranial internal carotid artery are considered rare and typically asymptomatic, except for a pulsating mass or localized pain in the neck. Distal embolization from the aneurysmal sac can manifest as transient ischemic attack, ischemic stroke, and amaurosis fugax. Symptoms like dysphasia, auricular pain, Horner syndrome, and voice hoarseness can also occur as a result of local compression from mass effect. In very few cases, there may be hemorrhagic complications due to the rupture of aneurysms. It is therefore critical to recognize, diagnose, and manage these aneurysms before they lead to life-threatening complications.<sup>17,18</sup>

## 2 | CASE REPORT

A 70-year-old Albanian lady had been experiencing pain due to a pulsating mass in her neck for many years. Physical examination did not reveal any signs of infection, injury, or previous surgery. A palpable thrill and a carotid bruit were detected over an evident pulsating mass on the left side of her neck. Her past medical history was consistent with three transitory ischemic attacks in recent months and a stroke 5 years earlier. Comorbidities included hypercholesterolemia, hypertension, and longstanding coronary artery disease. Imaging investigation in terms of ultrasound and CT-scan confirmed the presence of an aneurysm of the proximal tract of the internal carotid artery measuring 42 × 31 mm (Figure 1A–C). No associated pathology was found involving intracranial vessels. Surgery was indicated on symptomatic and anatomical grounds.

The procedure was carried out under general anesthesia. An incision along the anterior border of the left sternocleidomastoid muscle allowed exposure of the left internal carotid artery bifurcation as well as its proximal and distal site (Figure 2A). After proximal and distal clamping, the aneurysm was excised (Figure 2B) followed by end-to-end anastomosis of the internal carotid artery (Figure 2C). The postoperative course was uneventful, and the patient was discharged home on the fifth postoperative day.

The first three-year follow-up was relatively uneventful with occasional episodes of headache and dizziness. Subsequently, her symptoms subsided in frequency and severity. Ultrasound imaging revealed satisfactory repair without evidence of residual stenosis of the left internal carotid artery (Figure 3A,B).

## 3 | DISCUSSION

The management of EICAAs is dependent on size, location, etiology of the aneurysm, and potential coexisting medical conditions in patients. Although a collective strategy for managing EICAA has yet to be established, it is advisable to undergo surgery in all instances where symptoms or increased growth in the aneurysm are present. Without treatment, fatal consequences are possible.<sup>15,19</sup> Small EICAAs

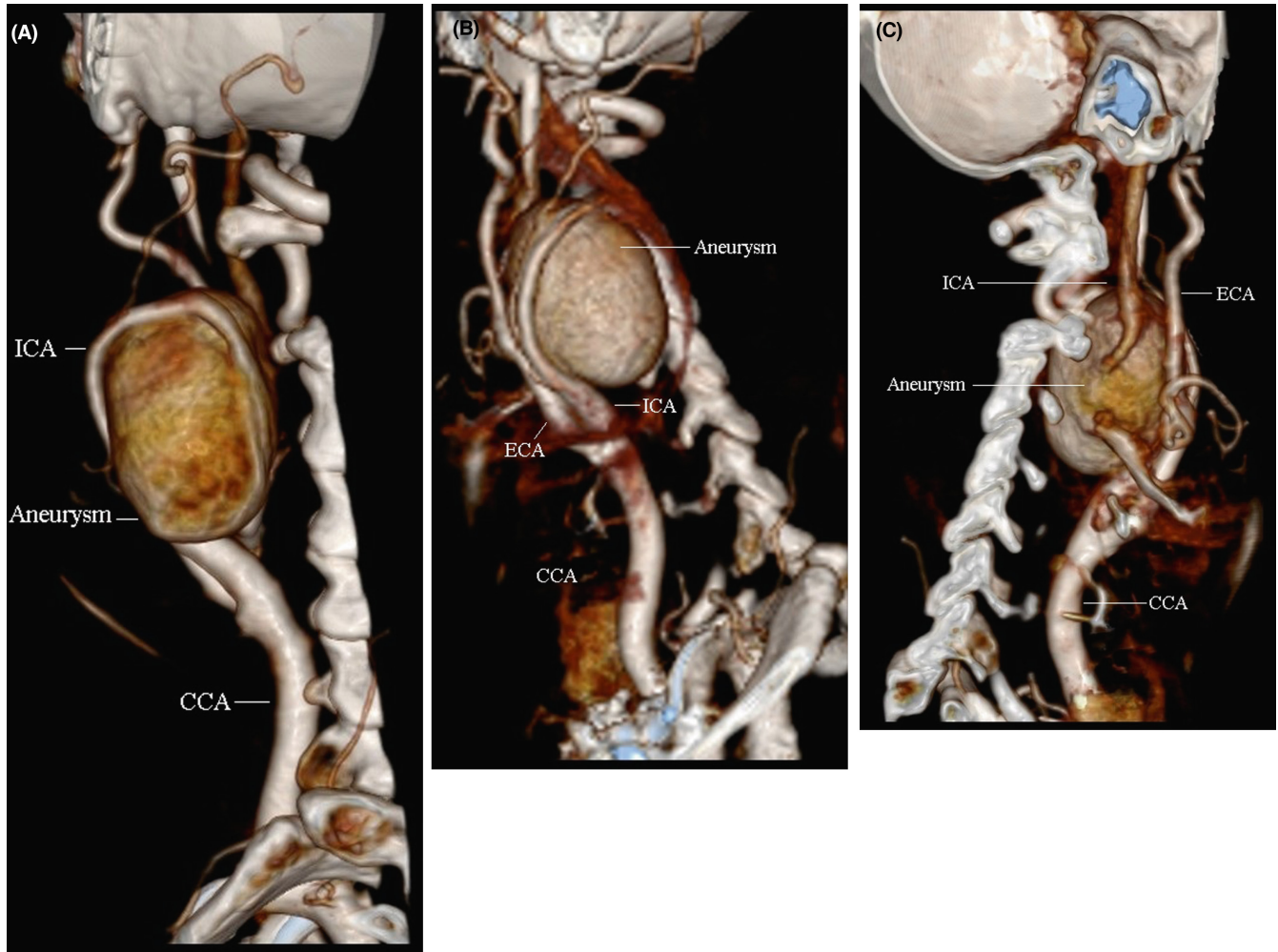


FIGURE 1 Preoperative AngioCT. Large aneurysm of the ICA. Lateral (A), Medial (B), and Posterior (C) views.

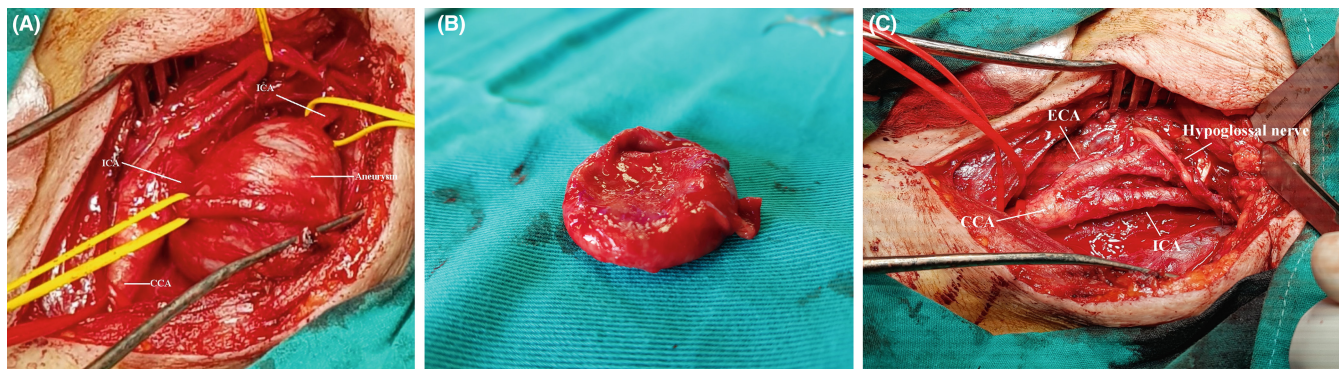


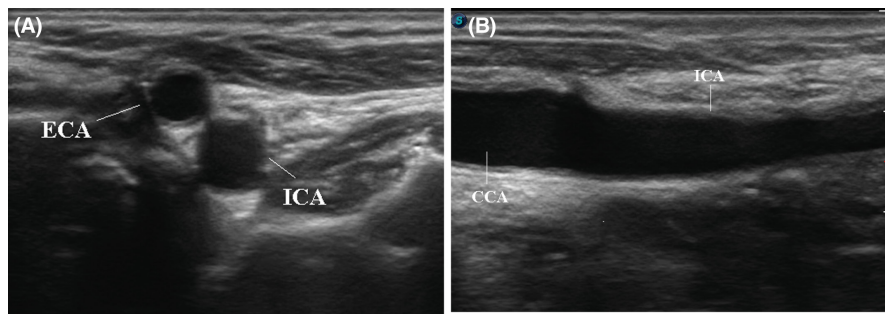
FIGURE 2 Intraoperative details. (A). Exposure of the Aneurysm. (B). Resected aneurysm. (C). Repaired ICA.

may be asymptomatic and pose less of a risk for ischemic stroke when compared to larger aneurysms. However, regardless of size all EICAA should be operated. The smaller the aneurysm, the safer is surgical intervention.<sup>20</sup>

Operative options include open, endovascular surgery and hybrid surgery. Open surgery is usually used to treat symptomatic and true aneurysms and endovascular to treat

pseudoaneurysms.<sup>2</sup> When dealing with ICA aneurysms that are distal to the common carotid bifurcation, difficult to fully expose, and situated on an extremely tortuous common carotid artery or unfavorable aortic arch anatomy, treatment options become more challenging, particularly when considering endovascular options. In these situations, hybrid surgery may be an excellent option.<sup>21–23</sup>





**FIGURE 3** Postoperative Ultrasound. (A). Transversal View. (B). Longitudinal View.

There are several open surgery options to consider aneurysm clipping, excision with primary anastomosis, excision with graft interposition, extracranial-intracranial bypass, and ligation of the carotid artery. The later, ligation of the carotid artery, is now considered a last resort due to the high risks of stroke (25%) and high mortality rate (20%).<sup>24</sup> In our case, we performed excision of the aneurysm with primary anastomosis.

On the contrary, endovascular options include flow diverter devices (FDD), covered stents, bare metal stents alone, or combined with coil embolization. Endovascular treatment of atherosclerotic extracranial carotid artery aneurysm has largely replaced open surgery because it is associated with fewer nerve injuries and shorter recovery times and may also be suitable for patients with severe comorbidities or neck conditions that are not amenable to surgery.<sup>25–40</sup>

Although with favorable outcomes in both short and long term, open surgery is associated with high occurrence of cranial nerve damage.<sup>11</sup> On the contrary, covered stent in endovascular therapy can immediately exclude blood flow from aneurysms, thereby minimizing complications associated with rupture or local compression.<sup>32,33,41–46</sup>

## 4 | CONCLUSION

Various treatment methods are available for EICAA, and the decision between endovascular repair and conventional surgery is dependent on factors such as the type and location of the aneurysm, any co morbidities present, the presence of symptoms, and the surgeon's level of experience and preferences. In summary, both the removal of the aneurysm with an end-to-end anastomosis and the use of covered stents for EICAA have been found to be safe and effective procedures.

### AUTHOR CONTRIBUTIONS

**Luan Jaha:** Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; resources; software; supervision; validation; visualization; writing – original draft; writing – review and editing. **Bekim Ademi:** Conceptualization;

data curation; methodology; validation; writing – original draft. **Hajriz Rudari:** Conceptualization; methodology. **Lulzim Vokri:** Conceptualization; investigation. **Bujar Gjilkoli:** Data curation; methodology; visualization; writing – review and editing. **Adhurim Koshi:** Data curation; formal analysis; methodology; writing – review and editing. **Astrit Kuçi:** Formal analysis; methodology; writing – review and editing. **Art Jaha:** Conceptualization; formal analysis; investigation; writing – original draft; writing – review and editing.

### FUNDING INFORMATION

Not applicable.

### CONFLICT OF INTEREST STATEMENT

The authors declare that they have no competing interests.

### DATA AVAILABILITY STATEMENT

The data are available under consideration of the corresponding author on reasonable request.

### ETHICS STATEMENT

This study was approved by the Ethical Committee of the Chamber of Doctors of Kosovo.

### CONSENT

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the editor in chief of this journal.

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