



ISSN (E): 2277- 7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2022; 11(1): 94-98

© 2022 TPI

www.thepharmajournal.com

Received: 06-11-2021

Accepted: 16-12-2021

Ihor Kobza

Professor, HOD, Department of Surgery, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

Taras Vykhtiuk

Ph.D., Assistant Professor, Department of Surgery, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

Oleh Zubenko

Department of Surgery, Lviv Clinical Municipal Communal Emergency Hospital, Lviv, Ukraine

Yuliya Mota

Ph.D., Assistant Professor, Head Professor, Department of Surgery №2, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

Post-traumatic aneurysm of the internal carotid artery: A case-report

Ihor Kobza, Taras Vykhtiuk, Oleh Zubenko and Yuliya Mota

Abstract

Purpose to describe a case of posttraumatic extracranial internal carotid artery pseudoaneurysm, surgically treated and to review the experiences of major referral centers. Case Report: a 21-year-old man presented with a numerous stab wounds of the right side of the neck and chest and bleeding. Urgent operation was performed, total aneurysmectomy with end to end anastomosis of internal carotid artery was successfully performed. In postoperative period patient was at cerebral coma for 17 days. After discharge patient had symptoms of neurological complication which performed by brachial plexitis. Conclusions: open surgery remains may be the gold standard for the treatment of extracranial internal carotid artery pseudoaneurysms in terms of patency and reduced risk of adverse complications; endovascular procedures may, in selected cases, provide a valuable additional tool in the armoury of the physician.

Keywords: Extracranial carotid artery, carotid pseudoaneurysm, surgery

Introduction

Extracranial internal carotid artery (ICA) aneurysm is a rare pathology, which according to various authors occurs in 0.1–2.0%, and accounts for 4.0% of all peripheral aneurysms^[1, 2]. Surgical interventions due to ICA aneurysms account for 0.2–5.0% of all interventions on the ICA^[3]. Post-traumatic extracranial ICA aneurysms have a particularly low incidence^[4]. The most common etiological factors for the development of ICA aneurysms include: atherosclerosis, infection, traumatic injury, systemic connective tissue lesions, fibromuscular dysplasia and previous surgery in this area^[5].

Extracranial ICA aneurysms may be asymptomatic, at the same time as cases with clinical symptoms are often accompanied by neurological manifestations^[6]. The increasing of aneurysm size is associated with a high risk of thromboembolic events and, as a consequence of neurological deficit, cranial nerve compression and, less frequently, rupture^[7]. Conservative treatment can be indicated as first-line therapy in asymptomatic patients, while surgical treatment is the «gold» standard and is determined by the etiology, size and location of the aneurysm^[8].

The surgical management aims to prevent the most severe and life-threatening complications, including embolism and rupture of aneurysm^[9]. Open surgical interventions for ICA aneurysms demonstrate the best treatment results both within 30 days and in the long-term period^[10]. With the active development of endovascular treatment ICA stenting can be considered as an alternative to open intervention, but only in some clinical cases^[11], however, long-term results of endovascular interventions are not described in the literature.

In order to the rarity of this pathology, peculiarities of the clinical course, diagnosis and surgical treatment, we consider expedient to share the following clinical case-report.

Case presentation

The 21-year-old man 30.11.2018 was admitted to the emergency department of Lviv Clinical Municipal Communal Emergency Hospital presenting with signs of hemorrhagic shock and a tight bandage around his neck.

From anamnesis: on 30 November 2018 at 5 p.m. the patient suffered multiple stab wounds of the right side of the neck and chest.

Objectively: consciousness, memory, orientation in time and space are preserved. The skin is pale, vesicular breathing, hemodynamically – a tendency to hypotension. Complete blood count: erythrocytes – $2.8 \times 10^{12}/l$, hemoglobin – 84 g/L, white blood cells – $6.8 \times 10^9/l$, eosinophils – 2%, stab leukocytes – 10%, segmented leukocytes – 60%, lymphocytes – 22%,

Corresponding Author:

Ihor Kobza

Professor, HOD, Department of Surgery, Danylo Halytsky Lviv National Medical University, Lviv, Ukraine

monocytes – 6%, erythrocyte sedimentation rate – 21 mm/h. Biochemical blood test: glucose – 4.9 mmol/L, total bilirubin – 11.4 mmol/l, creatinine – 89.0 mmol/l, aspartate aminotransferase – 16.0 U/L, alanine aminotransferase – 11.0 U/L. Coagulogram: prothrombin time – 20", prothrombin index – 80%, total fibrinogen – 4.44 g/l, hematocrit – 0.29, ethanol test – negative, soluble fibrin-monomer complexes – negative.

Based on the anamnesis, objective examination and laboratory studies, the diagnosis «Multiple stab wounds of the head, neck, chest, upper extremities, hemorrhagic shock» has been confirmed.

30.11.2018 the patient was urgently taken to the operating room and together with vascular surgeons the surgical operation – wound revision, bleeding control was performed. Protocol of operation: application of antiseptic solution on the operating area. After removing the bandage, bleeding was revealed from the area of the stab wound near the corner of the jaw. The incision of soft tissues along the anterior border of the sternocleidomastoid muscle was performed. The common carotid artery and its bifurcation were mobilized, without signs of damage. Wound canal without signs of bleeding. Small branches of the jugular vein were ligated, hemostasis was achieved by electrocoagulation. Surgical wound debridement. Wound drainage. During the revision of chest wounds penetrating injuries of the pleural cavity and mediastinum were not detected. Suturing of wounds. Aseptic bandage.

In the postoperative period the patient's general condition has remained severe. Mechanical ventilation has been continued. The X-ray examination of the chest was performed 01.12.2018: lung tissue and pleural cavity without signs of post-traumatic damage (Fig.1).

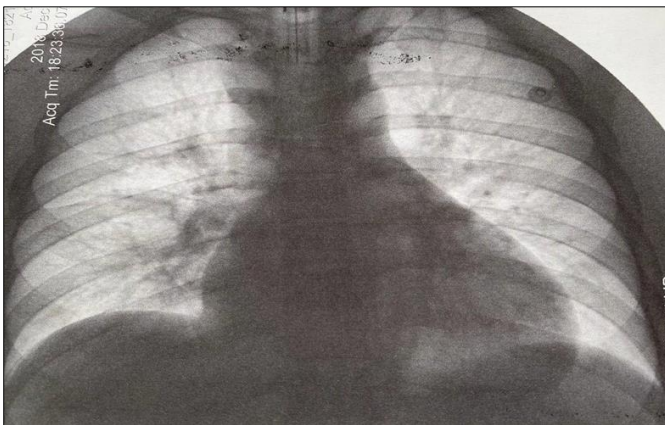


Fig 1: X-ray examination of the chest

03.12.2018 the general condition of the patient worsened, the neurological deficit increased, consciousness – coma I. On head computed tomography (CT) from 03.12.2018: signs of ischemic lesions in the pool of the terminal branches of the right middle cerebral artery (MCA) – hypodense areas of ischemia, 20.0x9.0 mm, 10.0x8.0 mm in diameter (Fig. 2). Intensive conservative therapy has been continued.

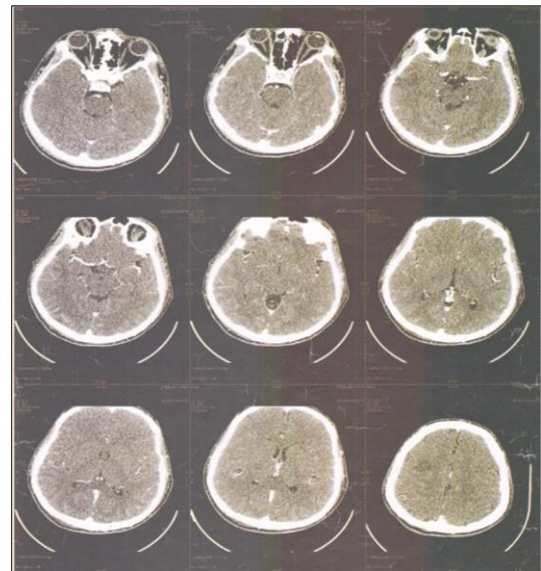


Fig 2: Head CT scans

On head and neck CT with contrast enhancement from 04.12.2018 (Fig. 3–7): on the right side distal of the common carotid artery bifurcation a clearly contoured area of contrast accumulation, 15.0x30.0 mm in diameter, is visualized (pseudoaneurysm of the ICA).



Fig 3: Head and neck CT with contrast enhancement. *Frontal view*



Fig 4: Head and neck CT with contrast enhancement. *Sagittal view*



Fig 5: Head and neck CT with contrast enhancement. 3d reconstruction, posterior-oblique view

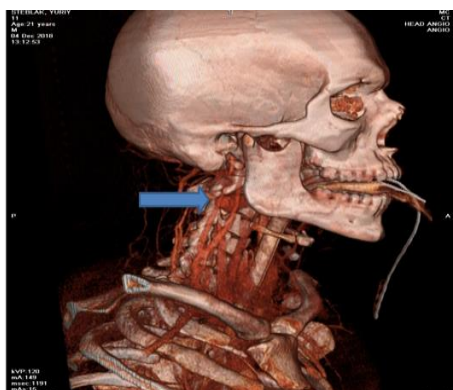


Fig 6: Head and neck CT with contrast enhancement. 3d reconstruction, side view

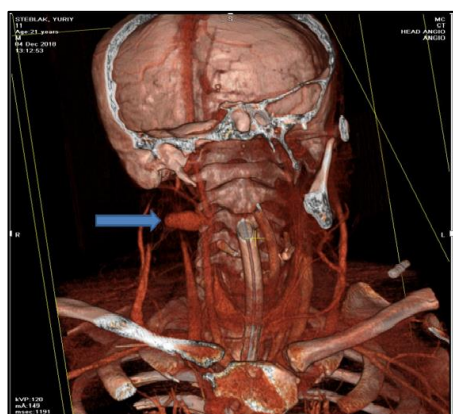


Fig 7: Head and neck CT with contrast enhancement. 3d reconstruction, frontal view

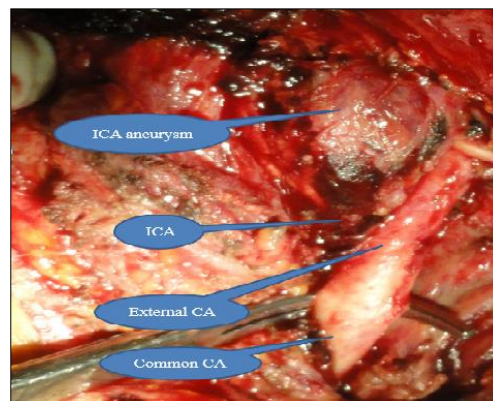


Fig 8: Intraoperative foto: pulsating formation (post-traumatic ICA aneurysm)

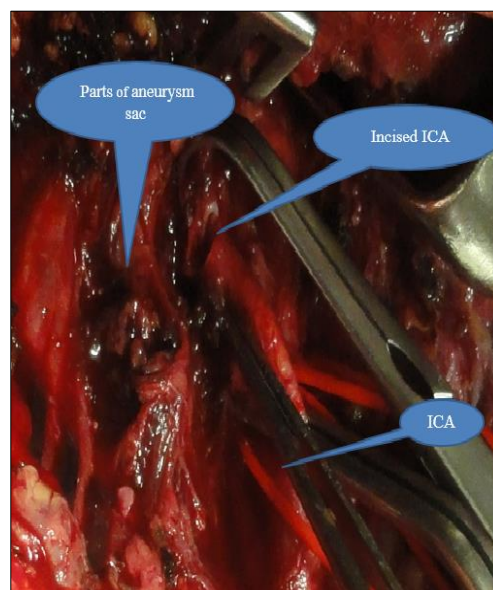


Fig 9: Intraoperative foto: incised distal part of ICA

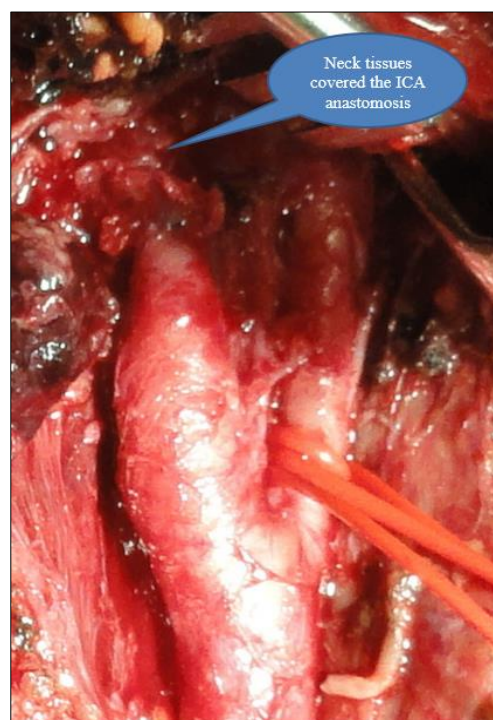


Fig 10: Intraoperative foto: the blood flow through ICA is restored

04.12.2018 an emergency operation was performed: resection of a post-traumatic ICA aneurysm with formation of ICA anastomosis by «end to end». Protocol of operation: application of antiseptic solution on the operating area. The sutures were removed. Common, external and internal carotid arteries were mobilized. A pulsating formation (post-traumatic ICA aneurysm), 3.0x3.0 cm in diameter, was found in the upper left corner of the wound (Fig. 8). Systemic heparinization (5.000 units of unfractionated heparin). ICA was mobilized within 4.0-5.0 cm distal of the bifurcation. After clamping ICA, pseudoaneurysm was resected. At a distance of 3.5-4.0 cm from the bifurcation of the carotid arteries an oblique defect of the ICA was revealed with the incised of the artery lumen by two thirds and partial dissection of the distal intima (Fig. 9). The injured edge of the vessel was excised and the ICA anastomosis by «end to end» was performed using polypropylene suture 6/0. Blood flow to the brain was restored (Fig. 10). Hemostasis. Wound drainage. Suturing of the wound. Aseptic bandage.

In the postoperative period the patient's general condition remained severe. Consciousness – coma I. Tracheostomy was performed. The patient was in the intensive care unit. The neurological deficit regression and the general condition improvement occurred 20.12.2018. The duration of cerebral coma was 17 days.

21.12.2018 the patient was transferred to the general surgical department. Neurological deficit of the humeral plexus and facial nerve was confirmed during the hospital stay. As a consequence of post-traumatic lesions of the peripheral nerves of the left upper extremity traumatic left-sided brachioplexitis was diagnosed, with severe monoparesis, which was manifested by limited abduction of the left shoulder. Facial nerve damage was characterized by clinical difficulties during swallowing, limited opening of the oral cavity and asymmetry of the nasolabial folds. 02.01.2019 the patient was discharged for outpatient treatment and further rehabilitation.

On March 20, 2019 at the State Institution «Romodanov Neurosurgery Institute National Academy of Medical Sciences of Ukraine» the patient underwent surgery: neuroticization of the suprascapular nerve by a branch of the accessory nerve to the lower parts of the trapezius muscle on the left side. In the postoperative period on the background of active rehabilitation, significant positive dynamics of left-sided brachioplexitis was observed with almost complete recovery of movements of the left upper extremity. The clinical course of post-traumatic neuritis of the facial nerve was also with positive dynamics.

At follow-up within 6 and 12 months signs of minor residual neurological deficit of the left upper extremity and facial nerve are persisted. The patient is currently under observation. Thus, the disadvantages of this clinical case included absence of detailed examination of the damaged area during patient's admission:

- Auscultation of the carotid arteries (systolic murmur over the site of arterial damage);
- High-quality ultrasound duplex examination of extracranial carotid arteries;
- CT or MRI angiography of the vessels of the neck;
- Insufficient ICA mobilization at the first surgery.

Our observation confirms the thesis of native and foreign authors that open surgery – post-traumatic ICA aneurysm resection and blood flow restoration through the ICA by «end-to-end» anastomosis formation is an effective method of treatment in patients with this complication.

Discussion

Aneurysms of the extracranial ICA are uncommon and are defined as a local increase in diameter of more than 50% compared to the reference values of ICA (0.55 ± 0.06 cm in men; 0.49 ± 0.07 in women) [6].

Today one of the largest scientific works about ICA aneurysms is Kraemer CJ *et al.* review publication, published in 2019, which presents data from 531 cases [1]. According to this review, the Mayo Clinic has the most experience in treating of this pathology. Fankhauser GT *et al.* presented the experience of treating 141 ICA aneurysms in 132 patients over 15 years [12]. Also worth mentioning are 67 cases from the Texas Heart Institute published in 2000 by El-Sabroun R and Cooley DA [13].

Aneurysms of the extracranial part of the ICA can be classified according to etiology into true and

pseudoaneurysms. The last ones are usually the result of trauma or previous surgical interventions on the ICA and account about 14% of all ICA aneurysms [6]. The most common causes of true aneurysms are atherosclerotic lesions or fibromuscular dysplasia. Atherosclerotic aneurysms usually appear in patients aged 50-70 years with a male to female ratio of 1.9:1.0 [14]. The most frequent manifestation of the extracranial ICA aneurysm is focal neurological deficit; the clinic of compression of cranial nerves is less commonly described [15]. Spontaneous progression of the aneurysm size can lead to thromboembolism and, as a result, ischemic stroke or rupture and massive bleeding. The main principle of conservative treatment is the anticoagulation or antiplatelet therapy [15].

However, in many cases, conservative treatment is ineffective or even dangerous because of the risk of bleeding. Most publications describe the benefit of open surgical treatment with revascularization after aneurysm resection. Reconstruction is performed by aneurysmectomy with anastomosis formation by «end-to-end», aneurysm resection with interposition grafting by prosthetic or autologous vein, ICA ligation is also used as a last resort for aneurysm rupture to stop bleeding.

In recent years, the use of an endovascular approach for the treatment of patients with ICA aneurysms has been described. Endovascular treatment may be the method of choice in patients with true ICA aneurysms without severe kinking and with the most distal location of the aneurysm [4, 11].

In most other clinical cases, and especially in patients with ICA pseudoaneurysms, open surgery is the «gold» standard. Among the relative disadvantages of the last one we can mention the higher frequency of cranial nerve damage. In particular, a group of authors from the Texas Center describes a total mortality/major stroke rate of 9.0%, and the incidence of cranial nerve damage – 6.0% [13].

Conclusions

1. In patients after traumatic injuries of the neck ICA pseudoaneurysm may develop, which can cause fatal bleeding or irreversible neurological deficit.
2. If neck vascular injury is suspected, auscultation of the extracranial carotid arteries (systolic murmur over the site of injury), duplex ultrasound, CT or MRI angiography of the neck should be performed as soon as possible.
3. An effective method of surgical treatment of post-traumatic ICA aneurysm includes its resection with blood flow restoration through the ICA, which is confirmed by this clinical case.

Conflict of interest: The authors declare no conflict of interest.

References

1. Kraemer CJ, Zhou W. Carotid Aneurysm Review. International Journal of Angiology [Internet]. Georg Thieme Verlag KG. 2019 Feb 27;28(01):017-9. Available from: <http://dx.doi.org/10.1055/s-0039-1677675>
2. Al Miraj AK, Saleh Ahammed M, Ata Ullah M, Abdus Zaher M, Latiful Bari AKM, Mahmud Khan S, *et al.* Extracranial Internal Carotid Artery Aneurysms: Case Report of a Saccular Wide-Necked Aneurysm and Review of the Literature. Scholars Journal of Applied Medical Sciences [Internet]. SASPR Edu International

- Pvt. Ltd. 2021 Feb 27;9(2):271-6. Available from: <http://dx.doi.org/10.36347/sjams.2021.v09i02.019>
3. Martins de Souza N, Vikatmaa P, Tulamo R, Venermo M. Etiology and treatment patterns of ruptured extracranial carotid artery aneurysm. *Journal of Vascular Surgery* [Internet]. Elsevier BV. 2021 Dec;74(6):2097-2103.e7. Available from: <http://dx.doi.org/10.1016/j.jvs.2021.06.023>
 4. Ni L, Weng H, Pu Z, Zheng Y, Liu B, Ye W, *et al.* Open surgery versus endovascular approach in treatment of extracranial carotid artery aneurysms. *Journal of Vascular Surgery* [Internet]. Elsevier BV. 2018 May;67(5):1429-37. Available from: <http://dx.doi.org/10.1016/j.jvs.2017.08.093>
 5. De Borst GJ. Re: "Management of Extracranial Carotid Artery Aneurysm." *European Journal of Vascular and Endovascular Surgery* [Internet]. Elsevier BV. 2016 Jan;51(1):157-8. Available from: <http://dx.doi.org/10.1016/j.ejvs.2015.10.002>
 6. Rivera-Chavarría IJ, Alvarado-Marín JC. Endovascular repair for an extracranial internal carotid aneurysm with cervical access: A case report. *International Journal of Surgery Case Reports* [Internet]. Elsevier BV. 2016;19:14-6. Available from: <http://dx.doi.org/10.1016/j.ijscr.2015.11.029>
 7. Pulli R, Dorigo W, Alessi Innocenti A, Pratesi G, Fargion A, Pratesi C. A 20-year Experience with Surgical Management of True and False Internal Carotid Artery Aneurysms. *European Journal of Vascular and Endovascular Surgery* [Internet]. Elsevier BV. 2013 Jan;45(1):1-6. Available from: <http://dx.doi.org/10.1016/j.ejvs.2012.10.011>
 8. Nordanstig J, Gelin J, Jensen N, Österberg K, Strömberg S. National Experience with Extracranial Carotid Artery Aneurysms: Epidemiology, Surgical Treatment Strategy, and Treatment Outcome. *Annals of Vascular Surgery* [Internet]. Elsevier BV. 2014 May;28(4):882-6. Available from: <http://dx.doi.org/10.1016/j.avsg.2013.08.011>
 9. Welleweerd JC, de Borst GJ. Extracranial Carotid Artery Aneurysm: Optimal Treatment Approach. *European Journal of Vascular and Endovascular Surgery* [Internet]. Elsevier BV. 2015 Mar;49(3):235-6. Available from: <http://dx.doi.org/10.1016/j.ejvs.2014.11.007>
 10. Giannopoulos S, Trinidad E, Aronow H, Soukas P, Armstrong EJ. Endovascular Repair of Extracranial Carotid Artery Aneurysms: A Systematic Review. *Vascular and Endovascular Surgery* [Internet]. SAGE Publications. 2020 Jan 2;54(3):254-63. Available from: <http://dx.doi.org/10.1177/1538574419895383>
 11. Xue S, Tang X, Zhao G, Tang H, Shen Y, Yang EY, *et al.* Contemporary Outcomes of Open and Endovascular Intervention for Extracranial Carotid Artery Aneurysms: A Single Centre Experience. *European Journal of Vascular and Endovascular Surgery* [Internet]. Elsevier BV. 2020 Sep;60(3):347-54. Available from: <http://dx.doi.org/10.1016/j.ejvs.2020.04.042>
 12. Fankhauser GT, Stone WM, Fowl RJ, *et al.* Surgical and medical management of extracranial carotid artery aneurysms. *J Vasc Surg* 2015;61(02):389-393
 13. El-Sabroun R, Cooley DA. Extracranial carotid artery aneurysms: Texas Heart Institute experience. *J Vasc Surg* 2000;31(04): 702-712
 14. Mokri B, Piepgra DG, Sundt Jr TM, Pearson BW. Extracranial internal carotid artery aneurysms. In *Mayo Clinic Proceedings*. 1982 May;57(5):310-321.
 15. Xue S, Tang X, Zhao G, Tang H, Shen Y, Yang EY, *et al.* Contemporary Outcomes of Open and Endovascular Intervention for Extracranial Carotid Artery Aneurysms: A Single Centre Experience. *European Journal of Vascular and Endovascular Surgery* [Internet]. Elsevier BV. 2020 Sep;60(3):347-54. Available from: <http://dx.doi.org/10.1016/j.ejvs.2020.04.042>