



# Posttraumatic Pseudoaneurysm of Internal Carotid Artery: Endovascular Treatment: Case Report

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## SUMMARY

**Introduction:** The occurrence of Internal Carotid Artery (ICA) pseudoaneurysm after trauma is rare. According to the literature, most cases of ICA pseudoaneurysms were associated with vehicle accidents and males were most affected. The treatment of traumatic ICA pseudoaneurysm (TICAP) with open surgery poses excess risk, thus endovascular treatment strategies have been applied during last decade.

**Case report:** In this manuscript, we presented a patient, a twenty-year-old young man who was injured in a traffic accident and was admitted to the Clinical Center of Montenegro. After the, the final angiographic control showed the symmetry of the arterial and venous timing in both hemispheres of the brain. The patient was discharged from the hospital seven days after the endovascular procedure and did not complain of further bleeding episodes or any neurological deficit during the 24-month follow-up.

**Conclusion:** CTA or MRA are commonly used imaging modalities to evaluate aneurysm involving carotid arteries, but gold standard tool is digital subtraction angiography. Given our case experience, trauma patients who have persistent epistaxis associated with a mid-face fracture must be monitored for a longer postoperative period.

**Keywords:** Pseudoaneurysm, Epistaxis, Endovascular Treatment

## INTRODUCTION

The safety of surgical and neurosurgical procedures has emerged as a significant global public health problem [1]. Pseudoaneurysms of the internal carotid artery are rare and involve any segment of the ICA. According to some meta analysis more than 90% of total pseu-

doaneurysm is located in extracranial carotid artery (ECA) [2,3,4,5]. Etiological factor are different: trauma, dissection, infection, malignancies, iatrogenic (carotid endarterectomy), and in some cases the reason is unclear [6,7]. The clinical picture depends on the factors of

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origin, size and localization of the pseudoaneurysm. Reason for delayed epistaxis could be attributed to the time taken for the arterial pulsatile pressure to weaken the injured vessel wall and erode through the sphenoid sinus. In pseudoaneurysm is a lack a true wall, so, the size of the sac would also usually increase with time [8,9]. Therefore, a high index of suspicion diagnosis for this condition is warranted. Carotid angiography is gold standard. CT angiography is rapid and non invasive method for detect a pseudoaneurysm, and good way to start to planning further management (open surgery or endovascular embolization) [10,11,12].

## CASE REPORT

Academic research was approved by the Ethic Committee of The Clinical Center of Montenegro, number 03/01-1231. The patient gave consent for his case to be published anonymously in a scientific journal Hospital Pharmacology – International Multidisciplinary Journal.

We present a case of 20-years old man who was injured in a traffic accident and admitted to the Clinical Center of Montenegro. The patient had no comorbidities and received no therapy before the injury. The patient was hospitalized due to profuse bleeding from the right nasal passage, headaches and disorder of consciousness. On CT scan, he had a fracture of the frontal bone, the base of the skull and the base of the right orbit, and a small amount of hemorrhagic content in the maxillary sinuses on both sides (Figure 1). The ORL and maxillofacial surgeon performed osteoplasty

of the frontal sinus and base of the orbit. No immediate complication was observed. During hospitalization, about 48 hours later of surgery, he started to complain about active and intense epistaxis and headaches. MSCT angiography of the brain verified a bisacral pseudoaneurysm of the final part of the cavernous segment of the right ICA (Figure 2a). Initially, t embolisation of pseudoaneurysm was performed with coils, however, within a few days, epistaxis recurred. We perform control DSA of the brain, which indicated the impaction of coils, so the decision was made to close the right internal carotid artery (Figure 2b). We did not perform ballon occlusion test (BOT) first, because the patient had good cross flow across anterior/posterior communicating arteries, so he showed good collateral circulation with prompt appearances of angiographic phases (Figure 3). To perform embolisation, we use microcatheter with a coil through the femoral route under general anesthesia, and we occluded right ICA. The final angiographic control showed symmetry in arterial and venous times in both brain hemispheres (Figure 4).

## DISCUSSION

Head trauma is the number one injury in Montenegro in traffic accidents after chest injuries and bleeding [13]. In past several technical approaches have been advocated for the management of traumatic ICA pseudoaneurysms, including sacrificing the main artery either surgically or byendovascular technique [14]. Endovascular techniques have an advantage over surgical treatment of cavernous ICA

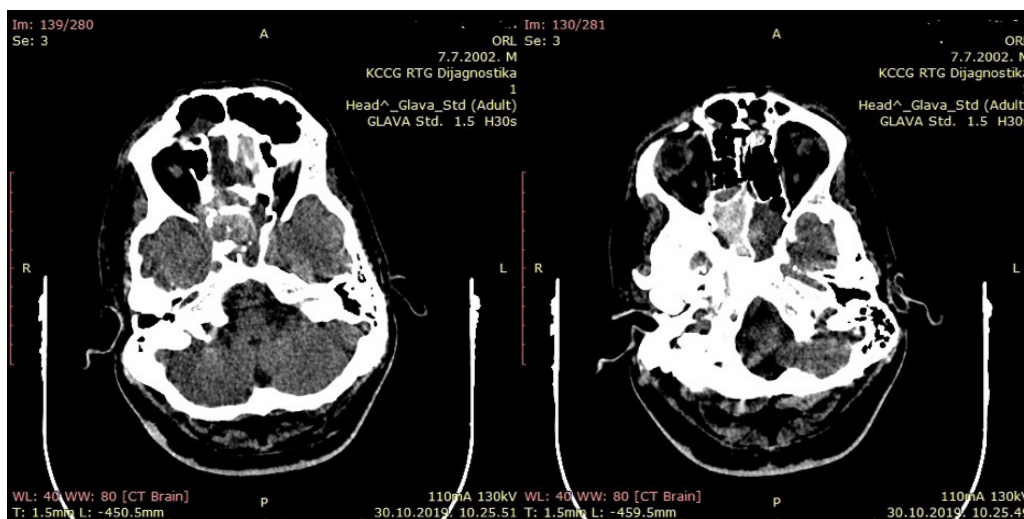


Figure 1. Initial CT scan show fracture of the skull base and bleeding in the maxillary sinus

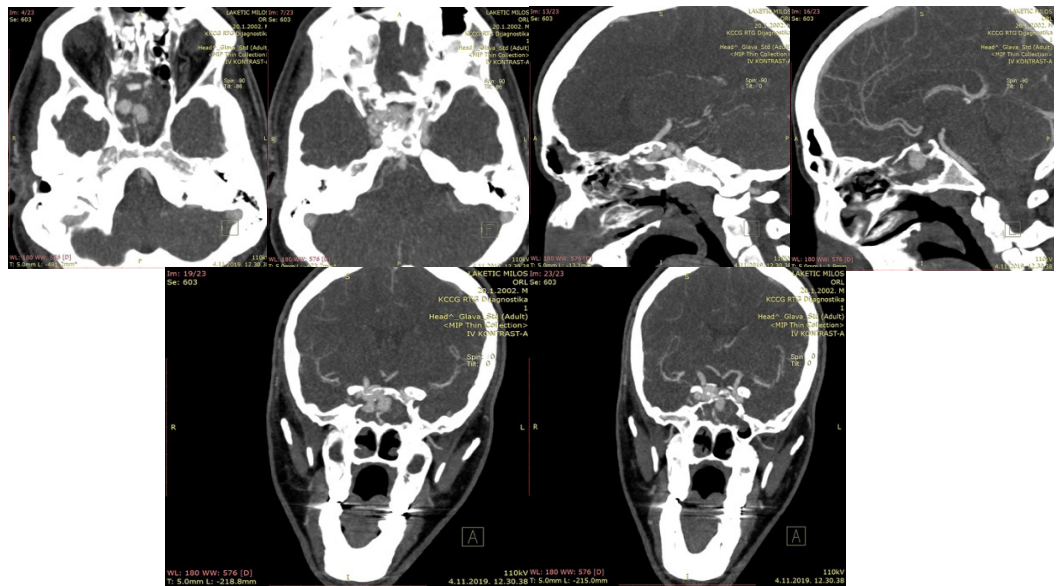
**Figure 2a.** MSCT angiography showed pseudoaneurysm right ICA



pseudoaneurysm, because the location of the blood vessel at the base of the skull, surrounded by the adjacent sphenoid bone, cavernous sinus and cranial nerves, makes direct surgical access to the patient difficult. Sacrificing the artery may not be tolerated by the patient and may lead to cerebral hypoperfusion and ischemia [15]. Endovascular ICA occlusion

with coils has a low risk of thromboembolic stroke due to slow blood flow through the incompletely occluded artery [16,17]. Several new study articles on the use of flow diverting stents and covered stents as sole treatment, or with coils as treatment for pseudoaneurysms [18]. Trauma victims who have severe and late bleeding should be investigated for the presence of pseudoaneurysms. CTA or MRA are commonly used imaging modalities to evaluate aneurysm involving carotid arteries, but gold standard tool is digital subtraction angiography. Data from the literature indicate a high success rate of about 96%, and complications occur in 1.9% to 21% of cases. Given our case experience, trauma patients who have persistent epistaxis associated with a midface fracture must be monitored for a longer postoperative period [19,20]. The patient was discharged from the hospital seven days after the endovascular procedure, and he did not complain of further episodes of bleeding or any neurological deficit on his 24-month follow-up.

**Figure 2b.** MSCT angiography



**Figure 3.** DSA before closing the right ICA





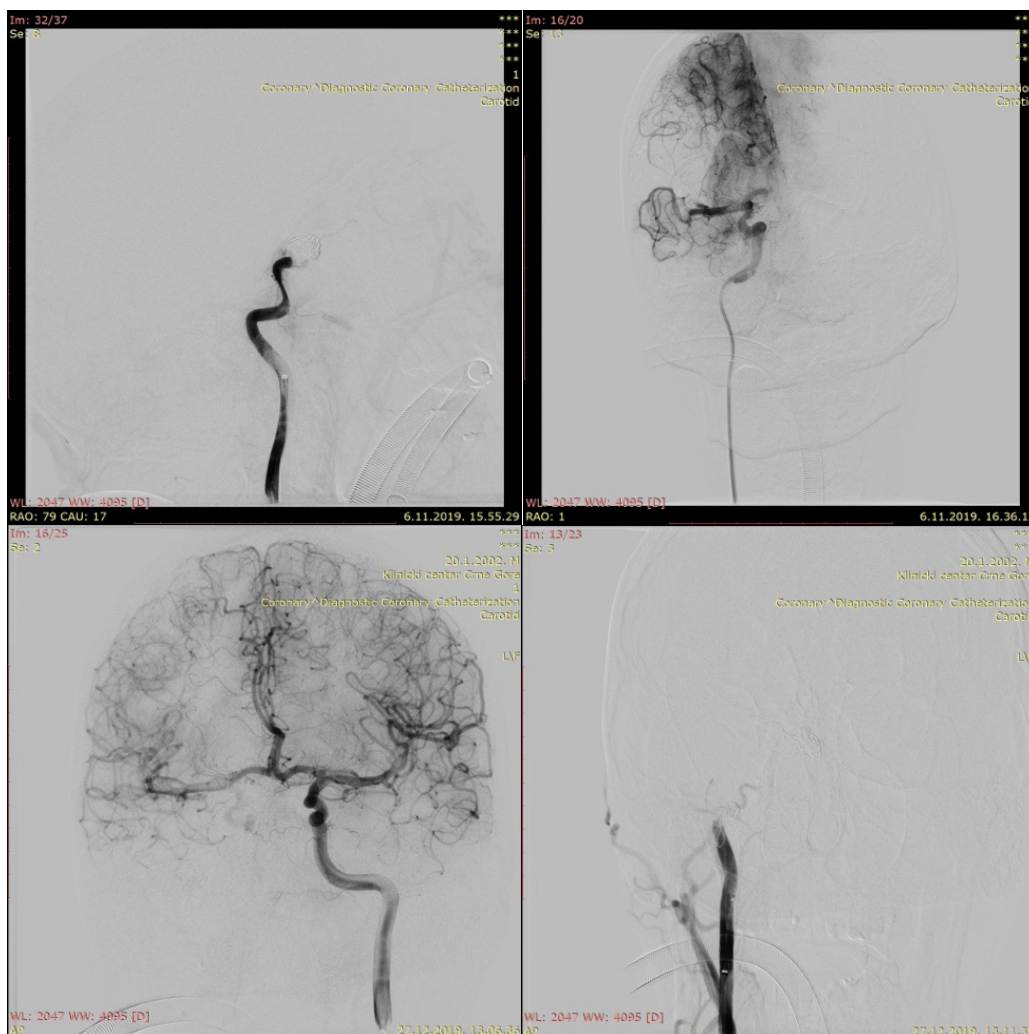


Figure 4. DSA after closing right ICA

## CONCLUSION

CTA or MRA are commonly used imaging modalities to evaluate aneurysm involving carotid arteries, but gold standard tool is digital subtraction angiography. Regarding our experience, trauma patients who have persistent epistaxis associated with a midface fracture must be monitored for a longer postoperative period.

## CONFLICTS OF INTEREST

All authors declare no conflict of interest.

## ACKNOWLEDGEMENT

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The patient gave consent for his case

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## REFERENCES

1. Vuković MH, Ilić VR. Reduction of the Mortality to the General Surgical Department of General Hospital Valjevo. Hospital Pharmacology - International Multidisciplinary Journal . 2018;5(1):617-24.
2. Dubey A, Sung WS, Chen YY, et al. Traumatic intracranial aneurysm: a brief review. J Clin Neurosci. 2008;15(6):609-612.
3. Maurer JJ, Mills M, German WJ. Triad of unilateral blindness, orbital fractures and massive epistaxis after head injury. J Neurosurg. 1961;18(6):837-840.
4. Cogbill TH, Cothren CC, Ahearn MK, et al. Management of maxillofacial injuries with severe oronasal hemorrhage: a multicenter perspective. J Trauma. 2008;65(5):994-9.
5. Wu SC, Chen RJ, Lee KW, Tung CC, Lin WP, Yi P. Angioembolization as an effective alternative for hemostasis in intractable life-threatening maxillo-

- facial trauma hemorrhage: case study. *Am J Emerg Med.* 2007;25(8):988.e1-5.
6. Sharma A, Gupta R, Singh D, Singh H. Posttraumatic carotid-cavernous fistula associated with evolving contralateral internal carotid artery pseudoaneurysm. *J Neurol Surg.* 2013;74(Suppl 1):e76-e80.
  7. Sridharan R, Low SF, Ismail MR, Kew TY. Intracavernous internal carotid artery pseudoaneurysm. *Case Rep Singapore Med.* 2014;55(10):165-168.
  8. Malcolm D, Fernando G, Lond DMJ, Aluthgedara R, Hewavithana PB. Penetrative injury to the face resulting in delayed death after rupture of a cavernous sinus aneurysm on the contralateral side. *Am J Forensic Med Pathol.* 2015;36(4):271-273.
  9. Pelliccia P, Surgery N. Traumatic intra-sphenoidal pseudoaneurysm lodged inside the fractured sphenoidal sinus. *Acta Otorhinolaryngol Ital.* 2016;36(2):149-152.
  10. Liu Q, Xue H, Qi C, Zhao P, Wang D, Li G. Traumatic anterior cerebral artery pseudoaneurysmal epistaxis. *World Neurosurg.* 2017;100:713.e9-713.e1.
  11. Amenta PS, Starke RM, Jabbour PM, Tjounakaris SI, Gonzalez LF, Rosenwasser RH, et al. Successful treatment of a traumatic carotid pseudoaneurysm with the Pipeline stent: Case report and review of the literature. *Surg Neurol Int* 2012; 3: 160.
  12. Monteiro JL, de Arruda JA, de Melo AR, et al. Updated review of traumatic dislocation of the mandibular condyle into the middle cranial fossa. *J Oral Maxillofac Surg.* 2019;77(1):132.e1-132.e16.
  13. Pelicic D, Ristic B, Radojevic N, Djonovic N, Radevic S. Influence of Spatial and Temporal Distance of the Hospital on Survival of Patients with Dangerous Injuries Sustained in Traffic Accidents. *Iran J Public Health.* 2022 Oct;51(10):2289-2297. doi: 10.18502/ijph.v51i10.10987.
  14. Inoue K, Tsutsumi A, Iijima M, Shinozaki M, Ishida J, Yako K. Urgent treatment of severe subarachnoid hemorrhage caused by ruptured traumatic aneurysm of the cavernous internal carotid artery using coil embolization followed by superficial temporal artery-middle cerebral artery anastomosis: a case report. *Surg Neurol.* 2005;64(5):450-454.
  15. Chen YF, Tzeng IH, Li YH, et al. Transcatheter arterial embolization in the treatment of maxillofacial trauma induced life-threatening hemorrhages. *J Trauma.* 2009;66(5):1425-1430.
  16. Strach K, Schrack A, Wilhelm K, et al. Endovascular treatment of epistaxis: indications, management, and outcome. *Cardiovasc Intervent Radiol.* 2011;34(6):1190-1198.
  17. Strach K, Schrack A, Wilhelm K, et al. Endovascular treatment of epistaxis: indications, management, and outcome. *Cardiovasc Intervent Radiol.* 2011;34(6):1190-1198.
  18. J.c Wellweerd, F.L. Moll, G.J. de Borst :Technical options for the treatment of extracranial carotid aneurysms ; *Expert Rev. Cardiovasc. Therapy,* 10 (2012): 925-931.
  19. A.C Yi, E. Palmer, G.Y. Luh, J.P. Jacobson, D.C. Smith: Endovascular treatment of carotid and vertebral pseudoaneurysms with covered stents; *AJNR Am. J. neuroradiol.* (2008); 983-987.
  20. A. Reisner, G.S. Marshall, K. Bryant, et al.: Endovascular occlusion of a carotid pseudoaneurysm complicating deep neck space infection in a child . Case report: *J. Neurosurg.* (1999): 510-514

## Posttraumatska pseudoaneurizma unutrašnje karotidne arterije: Endovaskularni tretman: Prikaz slučaja

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### KRATAK SADRŽAJ

**Uvod:** Pojava pseudoaneurizme unutrašnje karotidne arterije (ICA) nakon traume je veoma retka. Prema literaturi, većina slučajeva ICA pseudoaneurizme bila je povezana s saobraćajnim nesrećama, a najviše su pogođeni muškarci. Lečenje traumatske pseudoaneurizme ICAP (TICAP) otvorenom operacijom predstavlja višak rizika, pa su se tokom poslednje decenije primjenjivale strategije endovaskularnog lečenja.

**Prikaz slučaja:** U ovom rukopisu želeli smo da predstavimo pacijenta, dvadesetogodišnjeg mladića koji je povređen u saobraćajnoj nesreći i hospitalizovan je u Kliničkom centru Crne Gore. Nakon hirurške intervencije, konačna angiografska kontrola pokazala je simetriju arterijskog i venskog vremena u obe hemisfere mozga. Pacijent je otpušten iz bolnice sedam dana nakon endovaskularne procedure i nije se žalio na dalje epizode krvarenja ili bilo kakav neurološki deficit tokom 24-mjesečnog praćenja.

**Zaključak:** CTA ili MRA su najčešće korišteni modaliteti snimanja za procenu aneurizme, koji uključuje karotidne arterije, ali je zlatni standard digitalna subtraktivna angiografija. S obzirom na naše iskustvo, pacijente nakon traume koji imaju perzistentnu epistaksu kod preloma srednjeg dela lica, potrebno je pratiti duži postoperativni period.

**Ključne reči:** pseudoaneurizma, epistaksa, endovaskularno lečenje

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