



Visual Impairment in High Flow Carotid-Cavernous Fistula: Case Report

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Abstract: Carotid-cavernous fistula (CCF) is the most common abnormal connection between the carotid artery and the cavernous sinus. There are 2 types of CCF: direct and indirect. Direct CCF is a high-flow fistula that occurs due to a tear in the carotid artery, most often caused by penetrating or nonpenetrating head trauma. Visual disturbances can be one of the symptoms of CCF in post-traumatic patients. With proper diagnosis and management, the patient's condition can significantly improve. A 22-year-old man came with symptoms of bilateral chemosis and bilateral proptosis, which had developed progressively for 1 month. The patient had a history of a traffic accident 2 months before with mandibular trauma. The patient had undergone mandibular surgery, but at that time, no neurological symptoms had appeared. Physical examination revealed bilateral chemosis, bilateral proptosis, blurred vision and ophthalmoplegi with diplopia. Magnetic Resonance Angiography (MRA) of the head showed features that led to a diagnosis of carotid-cavernous fistula. Cerebral angiography was performed and confirmed there was a high-flow carotid-cavernous fistula. Endovascular intervention was performed, and a decision was made to perform balloon embolization. Four months after the procedure, the patient's complaints improved, blurred vision decreased, and proptosis disappeared. Based on this case report, carotid-cavernous fistula can be used as a differential diagnosis for the cause of visual impairment in post-head trauma patients. Appropriate management can treat the patient's clinical symptoms.

Keywords: CCF, Cerebral Angiography, Embolization

Introduction

Carotid-cavernous fistula (CCF) is an abnormal vascular flow between the carotid artery system and its branches and the cavernous sinus system.(Ma et al., 2023) Carotid cavernous fistula due to trauma is a rare and special disease that causes rupture of the wall of the artery or its branches in the segment of the carotid-cavernous sinus, which causes the formation of an abnormal arteriovenous communication between this

artery and the cavernous sinus.(Wang et al., 2022) Fistulas, a direct shunting between the internal carotid artery (ICA) and cavernous sinus (CS) with high flow rates occur in approximately 75% of CCFs and are most often caused by trauma (70%-90%).(Hamedani et al., 2022) The classic clinical sign of immediate CCF is the sudden onset of three clinical symptoms: exophthalmos, cephalic bruit, and conjunctival congestion.(Joshi et al., 2016) CCF treatment has evolved over time as technology has developed. Currently, the treatment of

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CCF with modern endovascular techniques is standard. A catheter is navigated to the CS to deliver the coil, balloon goldball and/or liquid embolic agent to obliterate the fistula. (Sur et al., 2020) In this case, we report a patient with high-flow CCF who was treated by sacrificing the parent vessel in order to obliterate the fistula.

Case Report

Male, 22-years-old admitted to hospital with sign and symptoms of both eyes proptosis and chemosis since a month after a traffic accident. Initial symptom was only mandibular fracture which then underwent the surgery. During a month patient felt his eyes were becoming prominent, enlarged, and reddish (Fig. 1 A) also began more simptoms of double and blurred vision due to right abducen nerve paralysis, beside periodic throbbing like headache. No abnormality in laboratory findings. Brain MRI/MRA were performed (Fig. 2), consecutive with cerebral angiography.



Figure 1. (A) before embolization, (B) after embolization

The angiogram showed non-visualized of the anterior cerebral artery (ACA), middle cerebral artery (MCA), and the distal circulation, from right internal carotid artery (RICA) injection. There was a total stealing phenomena of RICA circulation to the

cavernous sinus. From the left internal carotid artery (LICA) injection, showed a cross filling from the anterior communicating artery (A.Comm.A) to contralateral ACA and MCA circulation. This revealed a high flow carotid cavernous fistula (CCF) originating from the right ICA (Fig. 3). The patient then performed the endovascular intervention approach with embolization. It was carried out by preparing a size 4 Goldbalt balloon and the purpose was to put the balloon inside the fistula. Since the strategy was failed after several advanced navigation into the fistula, we decided the alternative approach by sacrificing the RICA as a parent vessel. First, we perfomed a second contralateral femoral puncture (double puncture procedure) and by doing the balloon test occlusion (BTO) from RICA, we checked the collateral circulation from LICA to right MCA and ACA through A.Comm.A and from posterior circulation to LICA and RICA terminus, then right MCA, right ACA, through P.Comm.A. BTO showed an overt collateral from either contralateral and posterior circulation. We inflated the balloon in RICA side to the fistula. After optimum inflated, we evaluated the angiography, there were a patent circulation from LICA and posterior circulation to right MCA and ACA territory, as well as fistula obliteration. (Fig 4. A, B, & C). Four months follow up result an improvement of sign and symptoms (Fig 1. B).

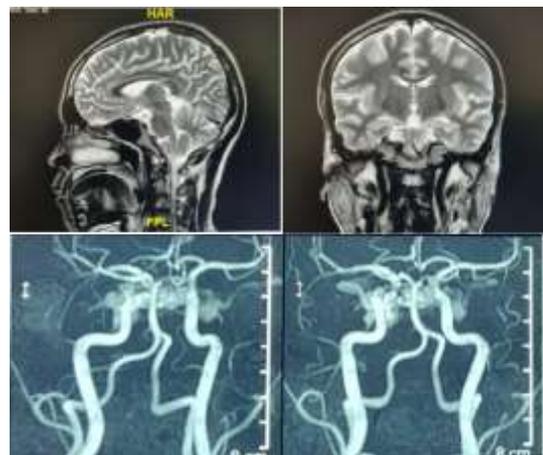


Figure 2. Brain MRI/MRA



Figure 3. (A) RICA injection: non-visualized of ACA, MCA and distal circulation, total stealing of ICA circulation flow to the cavernous sinus. (B) Carotid-cavernous fistula visible

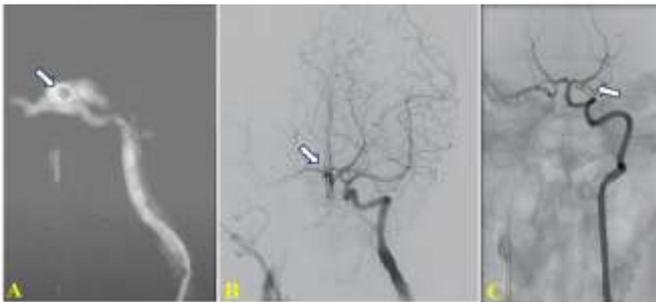


Fig 4. (A) Balloon Goldball inflated. (B) It appears that the ICA, MCA, ACA, and distal circulation are well supplied with flow from the contralateral and (C) posterior circulation

Discussion

CCF can be easily identified in outpatients by clinical presentation with the sudden development of the classic triad of pulsatile exophthalmos, bruits, and chemosis. Additional symptoms may include conjunctival vein arterialization, diplopia, retroorbital headache, increased intraocular pressure, and decreased visual acuity. The most frequently occurring signs and symptoms are proptosis (72-98%), chemosis (55-100%), orbital bruits (71-80%), and headache (25-84%). (Hamedani et al., 2022; Permana et al., 2021) In this case, the patient showed classic symptoms in the form of proptosis, chemosis, and headache. Patients with clinical

symptoms suggestive of CCF must undergo initial supporting examination in the form of CTA or MRA. CTA and MRA are usually used as initial imaging techniques for CCF. (Hamedani et al., 2022; Kim et al., 2020) In this case, an MRA examination was carried out and the results showed abnormalities in the patient's N VI, but it could not be ascertained whether there was CCF or not. DSA remains the gold standard for diagnosing CCF. (Zhu et al., 2018) In this patient, a DSA procedure was carried out, and it was found that there was total stealing of ICA circulation flow to the cavernous sinus, and based on Barrow's classification it was type A or high flow. (Henderson & Miller, 2018) High flow CCF is defined as a direct communication between the cavernous segment of the internal carotid artery and the cavernous sinus. (Alam et al., 2019)

Endovascular embolization is a treatment that can be carried out and produces good outcomes and minimal complications. (Hamedani et al., 2022) The success rate of this procedure can be described as improvement of clinical symptoms of proptosis (89%), chemosis (92%), cephalic bruit (87.5%), tinnitus (100%), and diplopia (66.6%), N.III paresis (50 %), Paresis N.VI (50%), and loss of vision (100%). (Permana et al., 2021) In this case, the patient underwent fistula embolization in the right ICA, and the right brain hemisphere was perfused via collateralization of the left ICA and right vertebral artery via the anterior and posterior communicating arteries. Four months after the procedure, the patient's clinical symptoms improved significantly (Fig. 1B).

Conclusion

CCF is one of the events that can occur in post-traumatic patients. Typical clinical symptoms can

include proptosis, chemosis, cephalic bruits, and headaches. A good physical examination and initial supporting examinations (CTA and MRA) can be performed to assess a CCF. The gold standard for CCF inspection is the DSA procedure. The treatment that can be carried out in CCF patients is endovascular embolization. This procedure has very good results and minimal complications. Establishing a good diagnosis and appropriate management in CCF cases can provide excellent benefits in improving the patient's clinical condition.

References

- Alam, M. S., Jain, M., Mukherjee, B., Sharma, T., Halbe, S., Jaisankar, D., & Raman, R. (2019). Visual impairment in high flow and low flow carotid cavernous fistula. *Scientific Reports*, 9(1). <https://doi.org/10.1038/s41598-019-49342-3>
- Hamedani, H., Hellmann, D., Boyce, W., & Alesio, N. D. (2022). Traumatic carotid-cavernous fistula: A case report. *Radiology Case Reports*, 17(6), 1955–1958. <https://doi.org/10.1016/j.radcr.2022.02.065>
- Henderson, A. D., & Miller, N. R. (2018). Carotid-cavernous fistula: Current concepts in aetiology, investigation, and management. *Eye (Basingstoke)*, 32(2), 164–172. <https://doi.org/10.1038/eye.2017.240>
- Joshi, K. C., Singh, D., Garg, D., Singh, H., & Tandon, M. S. (2016). Assessment of clinical improvement in patients undergoing endovascular coiling in traumatic carotid cavernous fistulas. *Clinical Neurology and Neurosurgery*, 149, 46–54. <https://doi.org/10.1016/j.clineuro.2016.06.008>
- Kim, D., Choi, Y. J., Song, Y., Chung, S. R., Baek, J. H., & Lee, J. H. (2020). Thin-section MR imaging for carotid cavernous fistula. *American Journal of Neuroradiology*, 41(9), 1599–1605. <https://doi.org/10.3174/ajnr.A6757>
- Ma, L., Tiantan Hospital, B., Williams, R., Luca Alatzides, G., Opitz, M., Li, Y., Goericke, S., Darkwah Oppong, M., Frank, B., Katrin Eckstein, A., Köhrmann, M., Wrede, K., Forsting, M., Wanke, I., & Deuschl, C. (2023). *Management of carotid cavernous fistulas: A single center experience*.
- Permana, G., Suroto, N., & Al Fauzi, A. (2021). Clinical improvement of patients with endovascular treatment in the traumatic carotid-cavernous fistula. *Asian Journal of Neurosurgery*, 16(02), 376–380. https://doi.org/10.4103/ajns.ajns_246_20
- Sur, S., Menaker, S. A., Alvarez, C., Chen, S., Shah, S. S., Peterson, E. C., Elhammady, M. S., & Starke, R. M. (2020). Multimodal Management of Carotid-Cavernous Fistulas. *World Neurosurgery*, 133, e796–e803. <https://doi.org/10.1016/j.wneu.2019.10.004>
- Wang, J., Shen, X., Miao, N., Yang, G., Zhang, M., Yang, D., Liu, Y., & Wu, T. (2022). Interventional treatment of traumatic carotid-cavernous fistula A case report. *Medicine (United States)*, 101(52). <https://doi.org/10.1097/MD.0000000000032265>
- Zhu, L., Liu, B., & Zhong, J. (2018). Post-traumatic right carotid-cavernous fistula resulting in symptoms in the contralateral eye: A case report and literature review. In *BMC Ophthalmology* (Vol. 18, Issue 1). BioMed Central Ltd. <https://doi.org/10.1186/s12886-018-0863-6>