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Trauma Case Reports

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Case Report

Traumatic carotid cavernous fistulas. Rare and life threatening[☆]

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ARTICLE INFO

Keywords:

Carotid-cavernous fistula

Red eye

Internal carotid artery occlusion

ABSTRACT

Purpose: Carotid-cavernous fistulas (CCFs) are often underdiagnosed or misdiagnosed. In poly-traumatized patients, the focus is primarily on treating potentially life-threatening conditions such as increased intracranial pressure and hemorrhages. This case report aims to identify common diagnostic mistakes in rare pathologies.

Objective: We present a case of a young female patient who was admitted to the emergency room after a motorbike accident. The patient's vital parameters were successfully stabilized, and she spent approximately four weeks in the ICU and neurosurgical ward. The patient exhibited limited communication, ophthalmoplegia, and a swollen, red left eye. After four weeks, the patient's parents initiated admission to our department due to the suspicious red swollen eye. Angiography revealed a complete rupture of the internal carotid artery (ICA) into the cavernous sinus, and occlusion of the ICA showed significant improvement in the eye edema and the patient's mental state. Two days later, the patient was able to communicate with complex sentences. Three months after the occlusion, the patient showed positive progress, posting dancing videos on TikTok.

Conclusion and Importance: A carotid-cavernous fistula presenting with a red swollen eye can be misdiagnosed as retrobulbar hematoma or conjunctivitis. Failure to recognize and treat it promptly can lead to severe morbidity.

Introduction

We present a case of a direct carotid-cavernous fistula, highlighting the potential consequences of missing such a diagnosis. In most cases, misdiagnosis occurs not due to incompetence or negligence on the part of healthcare providers, but rather because rare diagnoses are often overlooked or a comprehensive clinical examination cannot be performed in severe trauma cases. A comatose patient with multiple injuries, including a swollen eye, would not immediately lead to a differential diagnosis of a carotid-cavernous fistula. Other vital functions must be stabilized first. In this case, we discuss strategies to prevent discharging patients with unrecognized carotid-cavernous fistulas.

[☆] Informed consent for publishing the case has been obtained by the patient's parents.

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<https://doi.org/10.1016/j.tcr.2023.100884>

Accepted 6 August 2023

Available online 9 August 2023

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Case presentation

We present the case of a 17-year-old female involved in a motorbike accident. Upon admission, her Glasgow Coma Scale (GCS) was 7, and she was intubated and transported to the emergency department. Anisocoria of the left eye without light reaction was observed. A trauma scan revealed multiple head injuries and a pelvic fracture (Fig. 1A, B and E). The head injuries included a small acute subdural hematoma (aSDH) and epidural hematoma (EDH) of 3 mm on the left side, along with a temporal bone fracture. No orbital fractures were detected, and intracranial pressure (ICP) did not exceed 14 mmHg. During the hospital stay, the patient regained consciousness, and a thorough clinical examination revealed left facial nerve palsy and left eye ophthalmoplegia. The GCS improved to 15. Ophthalmological consultation recommended a brain MRI with arterial and venous phases, but due to the patient's hypermobility, the MRI failed to show any signs of cavernous sinus thrombosis or a carotid-cavernous fistula. The patient was discharged from the neurosurgical unit after four weeks with a diagnosis of exophthalmos and ophthalmoplegia, with the advice for neurosurgical re-evaluation in four weeks.

Due to the concerns of the patient's parents, the patient was brought to our hospital's emergency unit. In our department, four weeks after the initial trauma, the patient responded to most questions with the answer "I am hungry." Ophthalmoplegia and left facial palsy were still present. A closer examination of the eye revealed hyperemic extended veins and conjunctival edema. Auscultation with a stethoscope on the left eye revealed a pulsatile sound. Magnetic resonance angiography (MRA) and digital subtraction angiography (DSA) showed extremely extended intraorbital veins and a complete rupture of the left internal carotid artery (ICA), establishing a fistula to the cavernous sinus, resulting in pressure on the optic nerve (Fig. 1 C,D and E and Fig. 2A). The left ICA was occluded with coils (Fig. 2). Two days after the occlusion, the veins around the eye disappeared, and the edema and exophthalmos improved. A brain MRA/MRI performed ten days after the procedure showed no remnant of the carotid-cavernous fistula, with excellent brain perfusion (Fig. 3). Furthermore, the patient's mental state improved. One week later, the patient underwent facial nerve decompression, and the known pelvic fracture healed conservatively. Ten days after the occlusion the chemosis of the eye was improving significantly (Fig. 4). Three months after the procedure, the patient is socially active, with no exophthalmos. The facial palsy has improved from House Brackmann grade 5 to grade 1, and while ophthalmoplegia persists, the vision in the patient's left eye is improving.

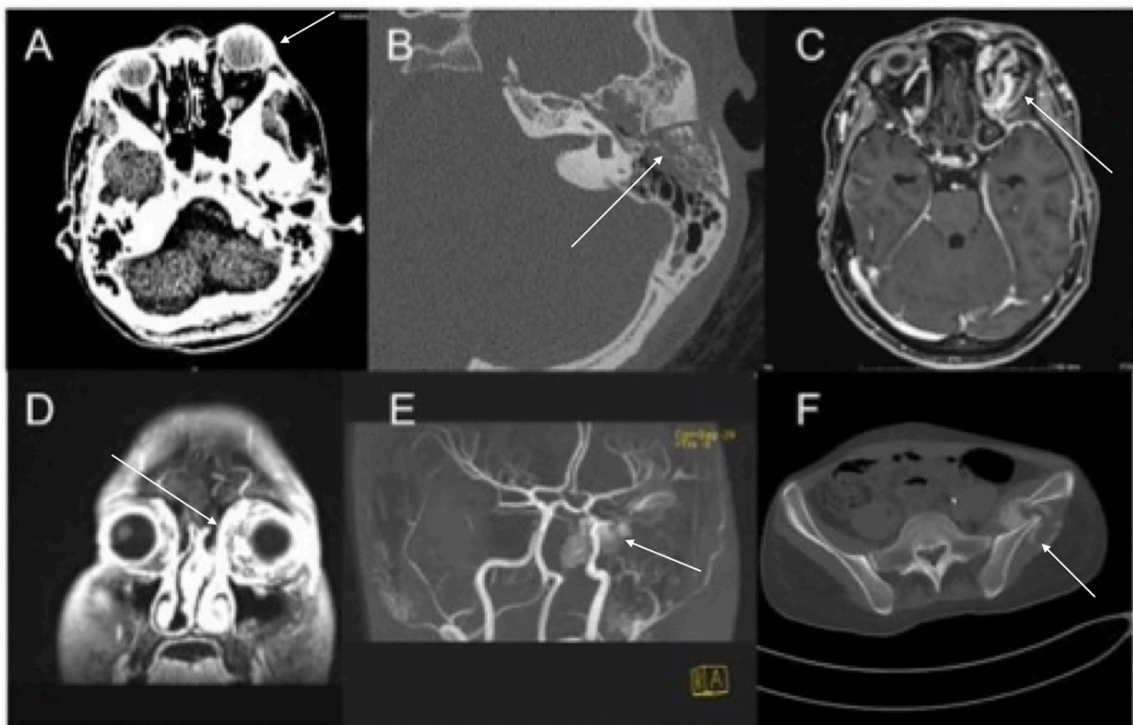


Fig. 1. Neuroimaging of the patient 4 weeks after head trauma.

- A. CCT showing the exophthalmic left eye.
- B. CCT bone scan showing the fracture of the temporal bone with caused the facial palsy.
- C. MRI (transverse sections) of the brain which shows congested and hyperaemic veins retrobulbar.
- D. MRI (coronal sections) showing again the hyperextended veins around the bulb.
- E. MRA of the brain vessels indicates towards a CCF fistula.
- F. Pelvic fracture left which is treated conservatively.

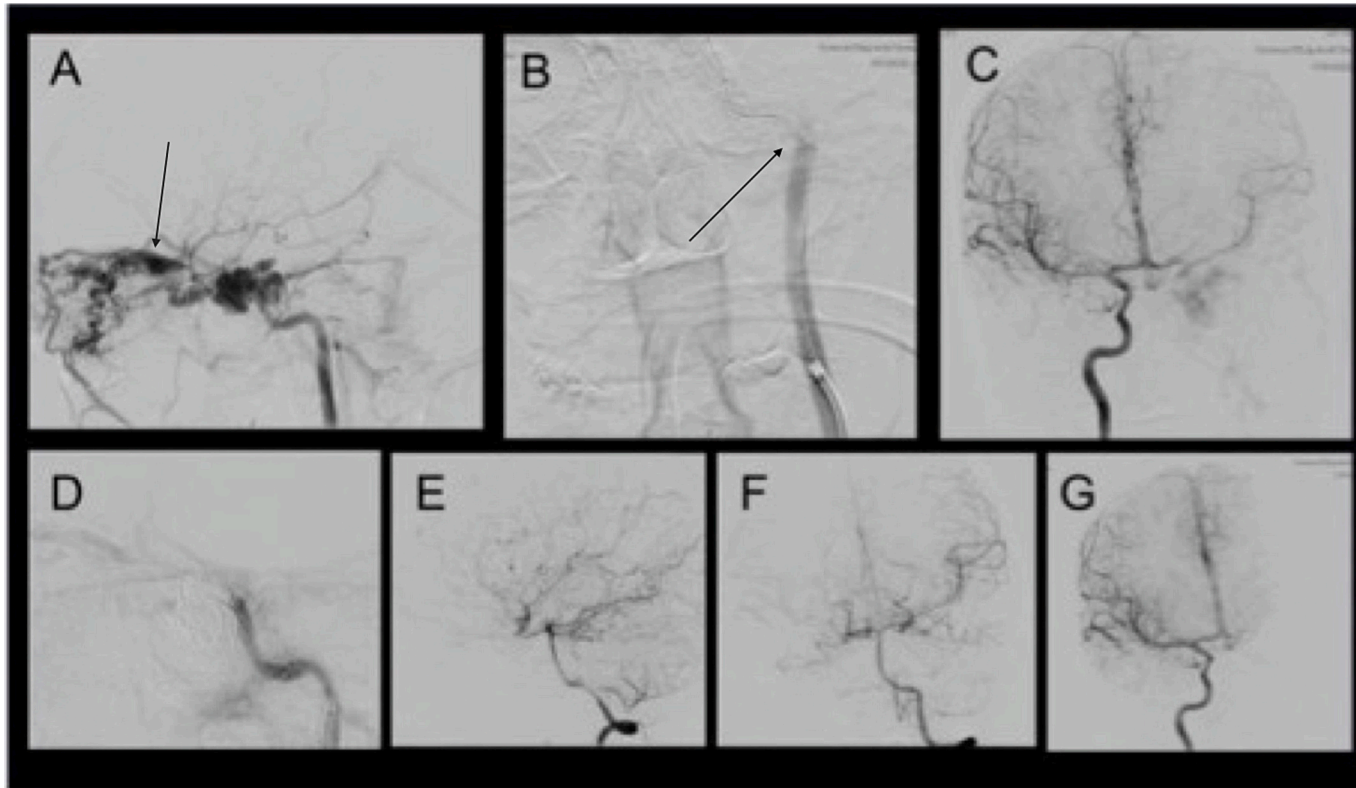


Fig. 2. DSA of the CCF.

- A. Injection of the left ICA indicates that the artery is ruptured. No perfusion of the brain arteries is supplied by the left ICA. Instead, the artery drains its blood completely into retrobulbar veins.
- B. Ballon occlusion of the left ICA. Positioning the ballon.
- C. During ballon occlusion of the left ICA the right ICA is injected with contrast enhancement and cross flow from the right ICA to the left ACA and MCA is shown.
- D. Coilembolization of the CCF.
- E. CE of the vertebral artery shows an intact PcomA which perfuses the MCA on the left side in a lateral view and in anteroposterior view (F).
- G. The perfusion of the left brain hemisphere after coilembolisation of the CCF seems to be feasible through a cross flow from the right ICA to both ACAs and from the basilar artery - PcomA to the left MCA.

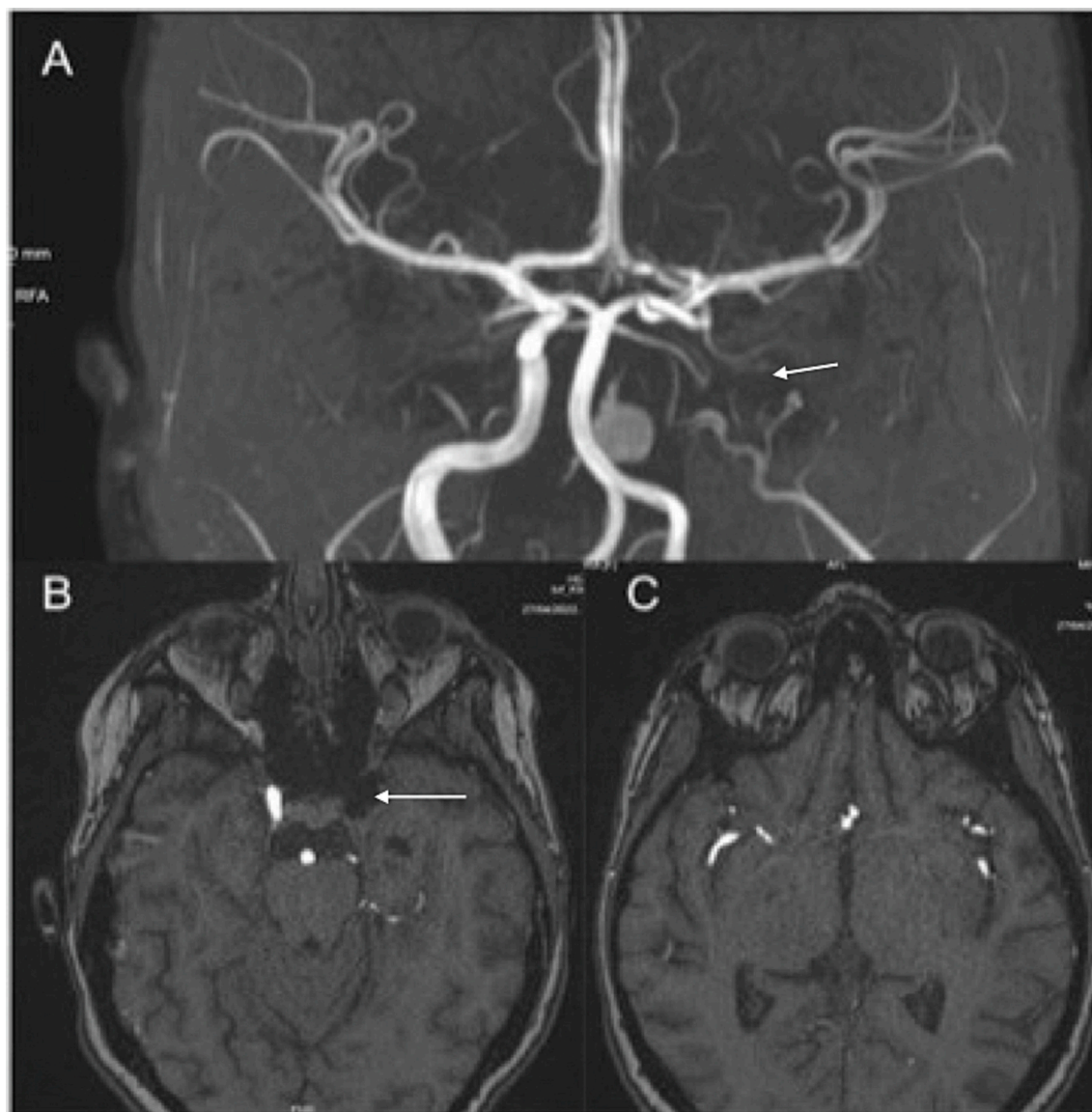


Fig. 3. MRA ten days post-occlusion of the left ICA and CCF.

A. MRA of the brain showing the occluded ICA left with no signs of distended retrobulbar veils left and a good signal from MCAs and ACAs on both sides.

B. Transverse section through the skull base showing again an absent ICA.

C. Transverse section of the brain showing an excellent CE enrichment in MCAs and ACAs.

Discussion

The management of most carotid-cavernous fistulas involves endovascular techniques such as occlusion of the fistula with detachable balloons, coils, or liquid embolic agents (1). Low-risk fistulas, such as dural CCFs, can be managed conservatively or with stereotactic radiosurgery (1). Recognizing a carotid-cavernous fistula in a comatose patient can be challenging, as a swollen eye can easily be attributed to orbital fractures or retrobulbar hematomas, leading to exophthalmos. After stabilizing the patient's vital signs and extubating, it is important to re-evaluate the diagnostic possibilities. Questions such as the origin of retrobulbar blood, the presence of orbital fractures, or the source of blood in the sphenoid sinus should raise suspicion and prompt further investigation. In the present case, a failure cascade can be identified, with the suspicion of a carotid-cavernous fistula mentioned during ophthalmological consultation, but the imaging modalities failing to establish a clear diagnosis due to artifacts.

An interdisciplinary approach is crucial in managing these cases, with effective communication between disciplines being of utmost importance (2). Carotid-cavernous fistulas are often misdiagnosed as conjunctivitis and treated as such (3). A high index of suspicion in

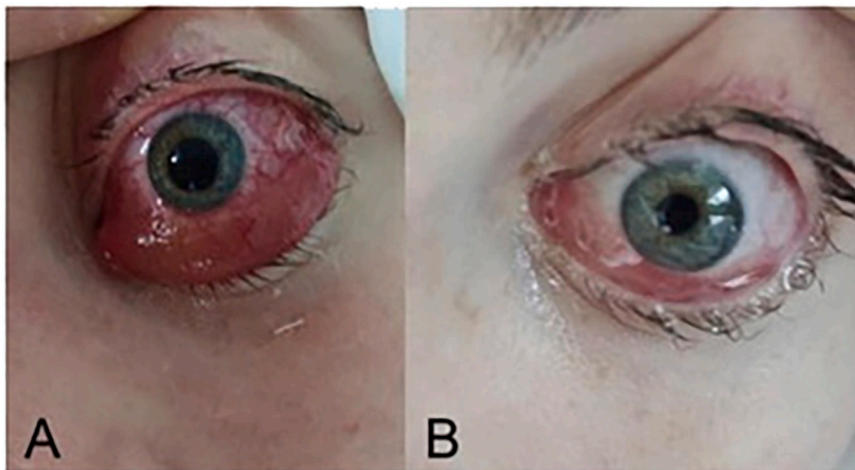


Fig. 4. Photograph of the patients eye before the ICA occlusion (A) showing a chemosis and 10 days after the occlusion (B), showing the improvement of the hyperaemic state 6.

patients with atypical red eyes is essential for diagnosing carotid-cavernous fistulas. The classical triad of pulsating exophthalmos, ocular bruit, and conjunctival chemosis may not always present together, making the diagnosis even more challenging (4).

Patient consent

Written consent to publish the case has not been obtained. This report does not contain any personal identifying information.

Funding

No funding or grant support.

CRediT authorship contribution statement

All authors attest that they meet the current ICMJE criteria for Authorship.

Declaration of competing interest

All the authors have no financial disclosures.

Acknowledgements

None.

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