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Emergency Department Lateral Canthotomy for Traumatic Orbital Compartment Syndrome: A Case Report"

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Abstract

Background

Trauma to face and eyes can result in retrobulbar hemorrhage. Significant hemorrhage in a closed orbital space can result in orbital compartment syndrome (OCS) which is dealt as an ophthalmic emergency. OCS can cause irreversible vision loss, if not treated timely. Lateral canthotomy is readily performed on the bedside and can prevent irreversible vision loss, caused by acute OCS. Although consultation and intervention by an ophthalmologist is ideal but emergency physicians (EP) often do not have specialty support in the timeframe required to treat OCS. Therefore, EP should be familiar with lateral canthotomy in case of OCS to minimize the chance of vision loss.

Case Presentation

We reported a case of 80 years old Caucasian male who had an accidental injury to the right eye that happened around 12:30 pm. Patient self-presented to emergency department (ED) at 1:30 pm with pain and complete loss of vision in right eye. Clinical examination of right eye revealed proptosis, grade IV hyphema and extensive sub conjunctival hemorrhage with visual acuity reduced from 6/18 to light perception in right eye. Although tonometer was not available in ED but on palpation, right eyeball was found to be hard compared to the left. A diagnosis of OCS was made. As the nearest eye center was at 1 hour drive so the decision to perform lateral canthotomy was made after consulting with ophthalmologist in view to save the vision. The procedure was performed in ED under local anesthesia. Pain improved and eyeball felt less hard on repeat palpation. Patient was transferred to eye center. Patient had successful surgery and was discharged. Visual acuity in right eye improved gradually and patient showed significant improvement in vision on subsequent visits.

Conclusion

This case highlights the importance of emergency lateral canthotomy in event of OCS due to traumatic retro bulbar hemorrhage. The EP encountering such injuries must be able to evaluate, diagnose and treat OCS secondary to retrobulbar hemorrhage.

Background

Orbital compartment syndrome (OCS) is a sight-threatening emergency that develops when pressure inside the rigid, bone-walled orbit rises faster than the surrounding tissues can accommodate it. Because the bony orbit cannot expand, even a modest increase in orbital volume can raise intra-orbital pressure above the perfusion pressure of the vessels supplying the retina and optic nerve, producing ischaemia and, if not relieved promptly, permanent visual loss [1,2]. Retrobulbar haemorrhage after facial or orbital trauma is by far the commonest trigger. Less often, OCS follows traumatic lens dislocation,

retro- or peribulbar injection, orbital infection or abscess, an orbital foreign body, spontaneous (e.g. Valsalva-related) haemorrhage, or aggressive fluid resuscitation after burns; thyroid eye disease and an enlarging orbital mass can produce a more subacute form [2]. Clinically, the rising pressure pushes the globe forward against the resistance of the eyelids and canthal tendons, producing the classic combination of proptosis, a tense, resistant globe, and falling vision; this same anatomical restraint is what makes lateral canthotomy and cantholysis effective, since dividing the lateral canthal tendon gives the swollen orbit somewhere to decompress into. The retina and optic nerve tolerate only a limited period of ischaemia before damage becomes irreversible, so management cannot wait for formal tonometry or ophthalmology review where these are not immediately to hand [3]. Emergency physicians are therefore expected to recognise OCS from the history and examination alone, and to be able to perform canthotomy and cantholysis themselves when specialist help cannot reach the patient in time. We report a case in which bedside digital palpation, rather than tonometry, supported the diagnosis, and in which canthotomy was carried out in the emergency department ahead of transfer to a regional eye unit.

Case presentation

80 years old Caucasian man while gardening, accidently stepped on the metal rake having a metal handle on the other end. Rake flipped and the metal handle hit the right eye around 1230. Patient self-presented to A&E at 1330 with complaints of severe right eye pain and complete visual loss in the right eye. According to the patient his visual acuity was 6/18 and he only uses glasses during reading. By the time he arrived at our ED, his visual acuity had reduced to light perception only. Apart from injury to the Right eye no other signs of fascial or head injuries noted.

Clinical Findings

On clinical examination his right eye was protruding. There was extensive sub conjunctival hemorrhage and grade IV hyphema. Pupillary reflex was absent. Visual acuity was 6/18 in left eye but limited to light perception only in the right eye. Eye movements are intact but painful in the right eye. There was no orbital margins bony tenderness. There were no lacerations or bruising on the face and scalp. Rest of his examination was unremarkable.

Timeline

Date / Time	Event
1 June 2023, approx. 12:30	Accidental injury: metal handle of a garden rake struck the patient's right eye while gardening.
1 June 2023, 13:30	Presented to our emergency department with severe right eye pain and visual loss (light perception only).
1 June 2023, during ED attendance	Clinical examination revealed proptosis, grade IV hyphema, and extensive subconjunctival haemorrhage. Intraocular pressure estimated by the fingertip (digital palpation) test, as a tonometer was unavailable.
1 June 2023, during ED attendance	Diagnosis of orbital compartment syndrome, secondary to presumed retrobulbar haemorrhage, made on clinical grounds. Ophthalmologist consulted by telephone; nearest eye centre approximately 1 hour away.
1 June 2023, during ED attendance	Emergency lateral canthotomy and inferior cantholysis performed under local anaesthesia. Pain and globe firmness improved immediately post-procedure.
1 June 2023, same day	Patient transferred to the regional eye centre for definitive ophthalmic care.
Following transfer, at the eye centre	CT of the orbit performed, demonstrating right retrobulbar hematoma, globe rupture, and lens displacement.
Following transfer, at the eye centre	Lens replacement surgery performed. Patient subsequently discharged, with visual acuity in the right eye limited to light perception.
22 June 2023 (3 weeks post-injury)	Patient attended our emergency department for follow-up. Visual acuity had improved to hand movement, with continued improvement noted. Written informed consent for publication was obtained, and the accompanying photographs (Fig. 2) were taken.

Diagnostic Assessment

As tonometer was not available in the department to measure the intra ocular pressure, fingertip test (digital palpation) was used to estimate the intra ocular pressure.[3] Patient was told to close the eye and tips of both index fingers were placed on the closed upper eye lid. Figure 1A Gentle pressure was applied to the eyeball with the fingertips keeping them in contact with the eye lid first with the right finger and then with the left finger. The process was repeated on the left eye for comparison. The right eye felt abnormally hard and solid compared to the left eye. The diagnosis of OCS was made secondary to retrobulbar haemorrhage (likely) based on the history and clinical examination. Decision was made to perform lateral canthotomy due to raised IOP, tight eye lids and relative afferent pupil defect. [1] CT scan of the orbit was delayed as the patient was running out of time due to late presentation to hospital and was arranged urgently at eye center. Figure 3

Therapeutic Intervention

Patient was given analgesia. As no ophthalmologist was available onsite and nearest eye center was at 1 hour drive, decision was made to perform lateral canthotomy and cantholysis after discussing with the ophthalmologist to prevent irreversible vision loss. The procedure was performed in ED. Local anaesthesia was then obtained using lidocaine with epinephrine and using a 25-gauge needle, injected into the lateral canthus. Lateral canthal tendon identified and cantholysis was performed using blunt tip suture cutting scissor. Successful cantholysis was indicated by release of eye lid and proptosis of the eyeball. Patient's pain improved significantly, and eyeball felt less hard. The patient was then transferred to nearest eye center where patient underwent CT scan of orbit. CT showed displacement of lens along with retrobulbar hemorrhage. He was then successfully operated for lens replacement surgery. On discharge his visual acuity in right eye was limited to light perception that gradually improved to hand movement after 3 weeks. Patient showed significant improvement on subsequent visits.

Follow up and Outcome

On discharge from the eye center his visual acuity in right eye was limited to light perception that gradually improved to hand movement after 3 weeks. Patient showed significant improvement on subsequent visits. Figure 2

Discussion

Relevant Orbital Anatomy

The orbit is an anatomical structure which is bounded by bones posteriorly and on all sides and anteriorly by the eye lids and orbital septa. The upper and lower eye lids meet at medial and lateral angles (Canthi). The elliptical opening between the eye lids is known as palpebral aperture or fissure. A thin sheet of connective tissue extends into the eye lids from the orbital margins called orbital septum. Within the eye lids the septum is thickened to form canthal tendons (tarsal plates) that gives rigidity to the eye lids. The lateral canthal tendon has superior and inferior portion. The orbicularis oculi muscle lies anterior to the tarsal plates. There is small amount of orbital fat anterior to the lateral canthal tendon. Figure 1B–D

Pathophysiology of Ocular Compartment Syndrome

The adult orbit holds roughly 30 ml and normally sits at 3–6 mmHg, well below the eye's own 10–20 mmHg, leaving almost no reserve volume to absorb bleeding or oedema before perfusion of the optic nerve and retina is compromised. A second proposed mechanism is direct occlusion of the central retinal artery (CRA); ischaemia sustained beyond roughly 120 minutes is generally considered irreversible [3]. While trauma accounts for most ED presentations of OCS, orbital cellulitis, abscess, tumour, and spontaneous haemorrhage remain important alternative causes to consider.

Literature Review

Previous case studies and literature were reviewed and compared with this case. In all case reports diagnosis of OCS was made by using tonometer but in this case due to lack of instruments, clinical presentation along with digital palpation method [4] was used to establish the diagnosis.

Timely diagnosis and prompt intervention play the vital role in the outcome the procedure. As suggested by the case series [5] the success of procedure and chances of vision recovery increases dramatically when the intervention is performed within 90–120 mins. Delayed presentation and intervention resulted in irreversible visual loss.

Medical management particularly anti glaucomatous eye drops have very limited use and can be used only if there is no visual compromise. More definitive treatment (lateral canthotomy) is considered as patient presented with reduced vision after the injury. [6] [7]

Conclusion and take-home Message

- A tense, proptotic globe with falling vision after orbital trauma should be managed as OCS on clinical grounds; a tonometer is helpful but, as in this case, bedside digital palpation can support the diagnosis when one is not available.
- Visual recovery depends on how quickly the orbit is decompressed; our patient's improvement after canthotomy performed within an hour of presentation fits the general pattern that outcomes worsen the longer decompression is delayed.
- When same-day ophthalmology attendance is not possible, as in many units without an on-site eye service, telephone advice from ophthalmology should guide but not delay bedside decompression by the treating emergency physician.
- Lateral canthotomy and inferior cantholysis is a low-risk, sight-saving procedure that emergency physicians managing orbital trauma should be confident performing themselves, rather than waiting for a specialist to arrive.

Patient Perspective

When the patient returned to our emergency department three weeks after his injury for follow-up, and to provide consent for this case report, he said he was very happy and satisfied with the care he had received, and felt that the timely intervention in the emergency department had been instrumental in saving his sight. As a gesture of his gratitude, he brought flowers and sweets for the team who had treated him.

Abbreviations

• OCS
Orbital Compartment Syndrome

• EP
Emergency Physician
• ED
Emergency Department
• CRA
Central Retinal Artery

Declarations

Ethical approval & consent to participate: Not applicable

Consent for publication:

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

Competing Interest:

The authors declare that they have no competing interests.

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Author Contribution

Dr Qureshi Dr Javaid, Lisa Hatful, Tess Wild. Dr Khan & Dr Fasih were directly involved in the management of the case. Dr Qureshi is the main writer of the case report while Dr Jalil contributed to discussion part of case report.

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None

Availability of data and materials:

All data generated or analyzed during this study is included in the publication.

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Figures

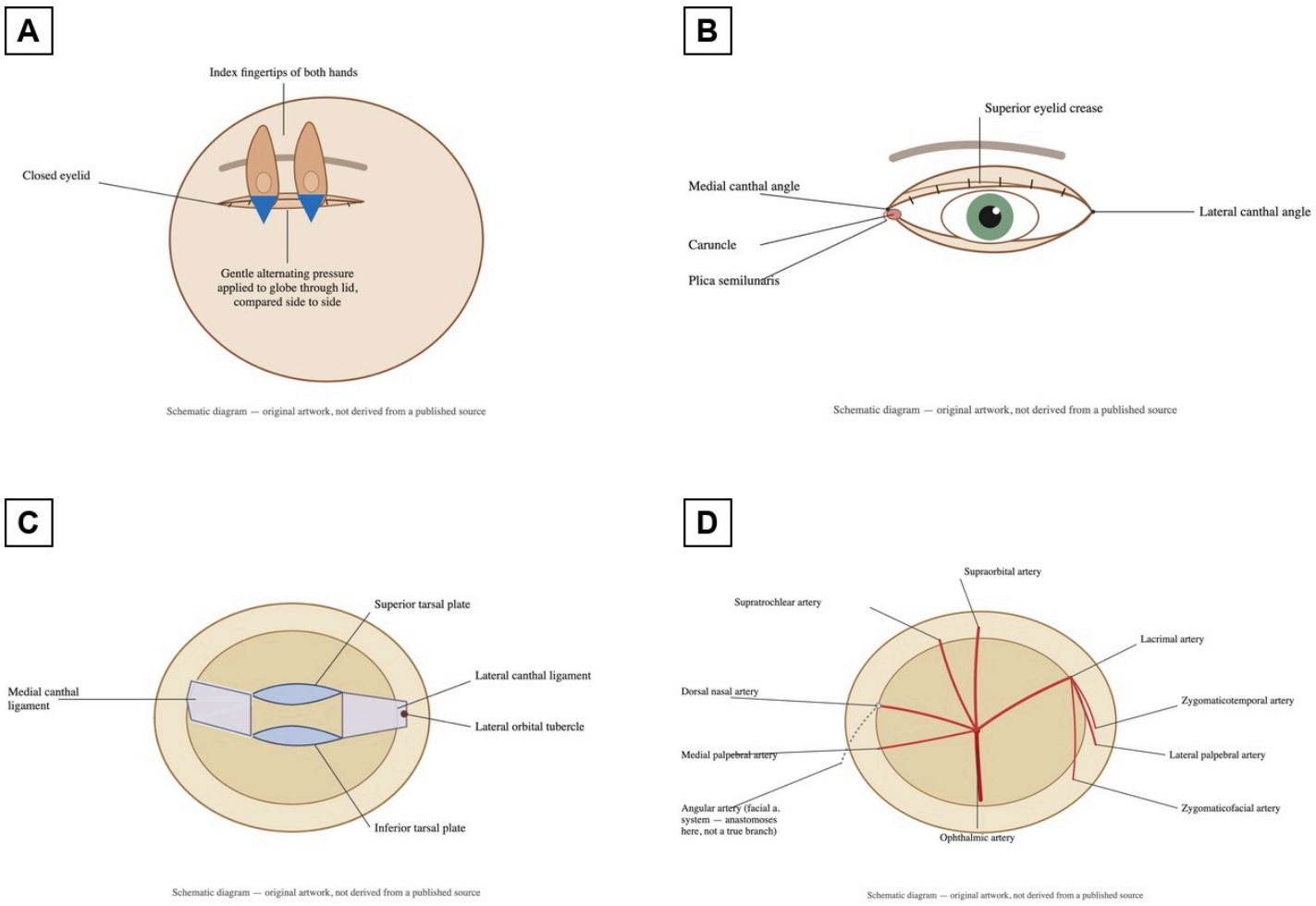


Figure 1

Relevant periorbital and orbital anatomy. (A) Fingertip palpation technique for bedside estimation of intraocular pressure, comparing resistance to gentle alternating digital pressure applied through the closed eyelid, side to side. (B) External anatomy of the eye, including the medial and lateral canthal angles, caruncle, and plica semilunaris. (C) Canthal tendon and tarsal plate anatomy, including the medial and lateral canthal ligaments and the superior and inferior tarsal plates. (D) Orbital vascular anatomy, including the ophthalmic artery and its terminal branches. Schematic diagrams; original artwork, not derived from a published source.

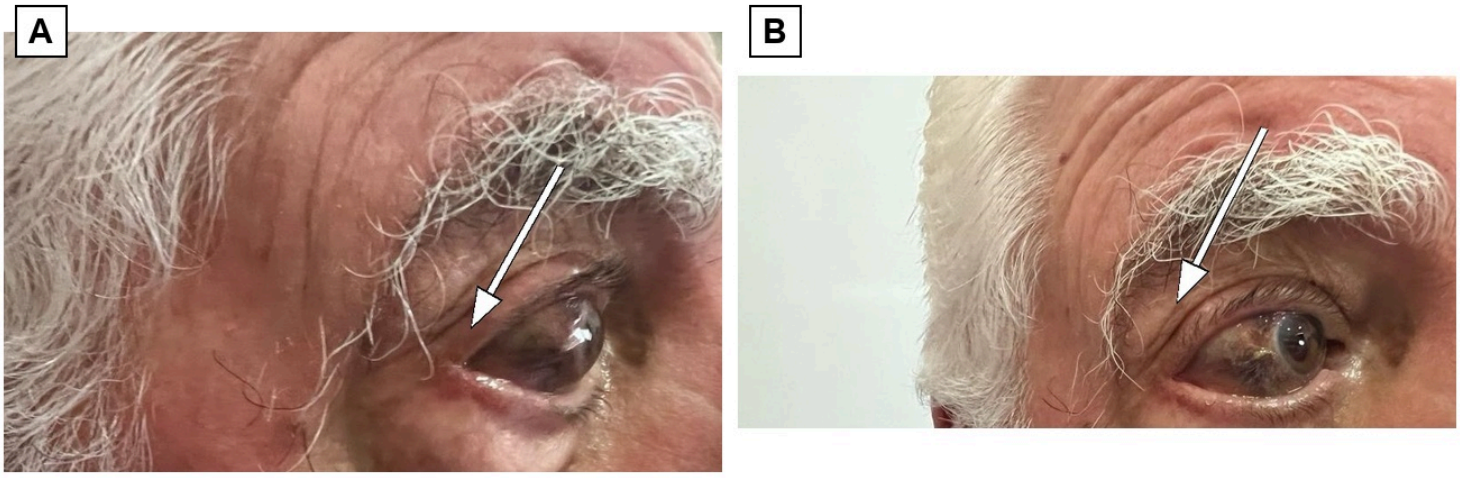


Figure 2

Right eye at 3-week follow-up after emergency lateral canthotomy and inferior cantholysis, performed in our emergency department for traumatic orbital compartment syndrome, and subsequent lens replacement surgery at the receiving eye centre. Both photographs were taken on 22 June 2023, when the patient returned to our department for review; visual acuity had improved to hand movement by this visit. Arrows mark the eyelid margin examined at this assessment. (A) and (B) Right eye photographed from two angles during this visit. Images cropped to the periorbital region to exclude facial features not relevant to the case and to limit patient identifiability, per journal policy.

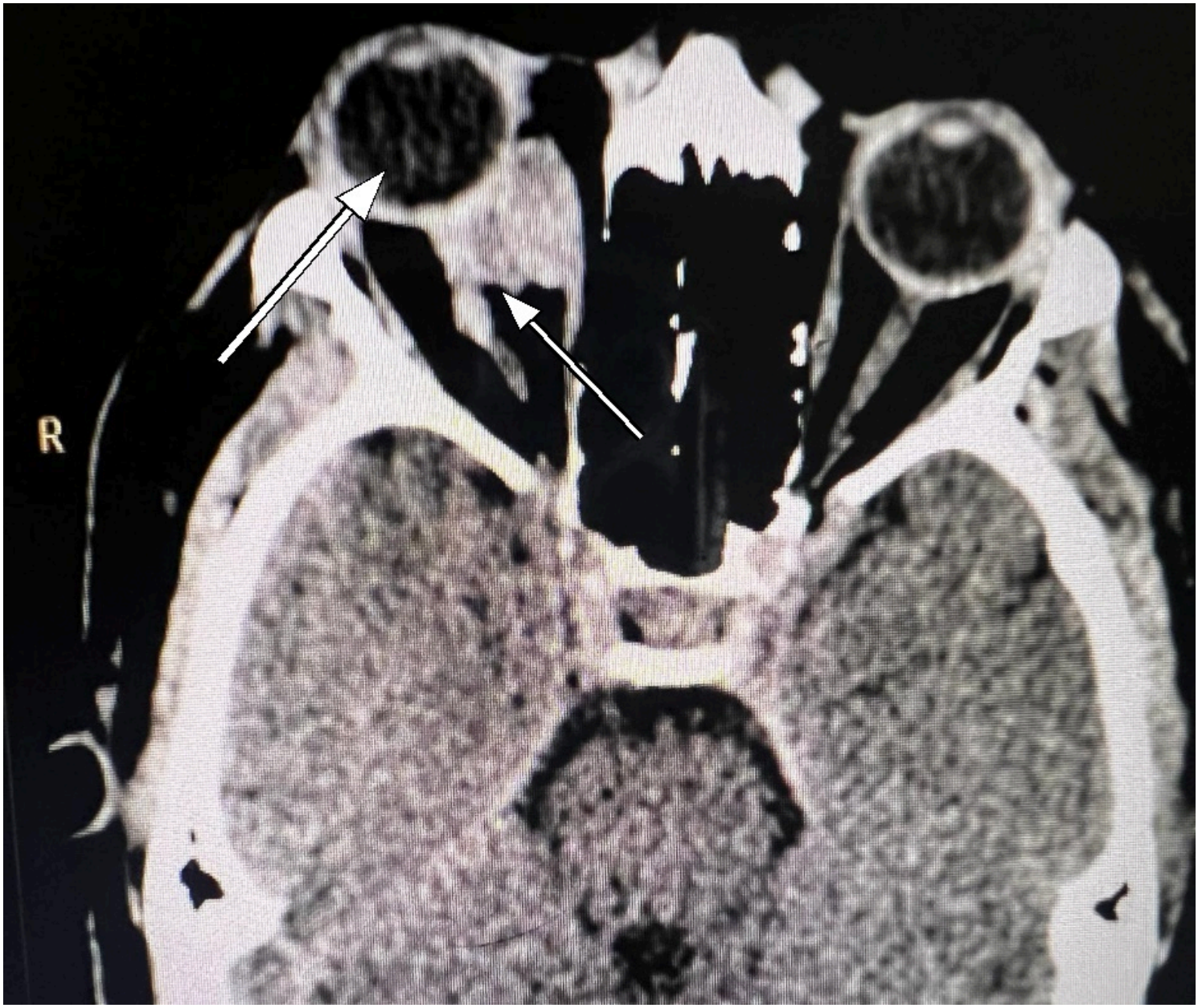


Figure 3

Axial computed tomography of the orbit at the level of the mid globe, obtained at the receiving eye centre after transfer, demonstrating right globe rupture and retrobulbar hematoma, corresponding to the traumatic orbital compartment syndrome diagnosed clinically in the emergency department. Arrows indicate the ruptured right globe and the adjacent retrobulbar hematoma. R, right.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Timeline.docx
- Carechecklist.pdf