Rotating wire brush ocular trauma in a fighter pilot

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Penetrating ocular injuries from rotating wire brush is a previously underreported still preventable risk of ocular trauma which poses serious threats for vision. We describe a case of an injury caused by rotational wire brush to a pilot of a high-performance fighter plane, with an excellent visual outcome, and a fully restored vision and functionality status. Despite the unpropitious expected visual outcome due to the severity of the trauma, proper management can restore the vision. This is the first case, reporting this type of injury, with a fully restored vision to maintain flying status in a high performance and demanding military environment.

Key words: Ocular trauma, penetrating eye injury, rotating wire brush injury

Open globe injuries are among the most severe ocular traumas often leading to sight threatening conditions. Penetrating ocular injuries from rotating wire brush is a previously underreported still preventable risk of ocular trauma, which poses serious threats for vision.[1,2] Rotating wire brushes are composed of fine wire bristles (length ~2025 mm), that can break off during use and can cause damage to speed and projectile. We describe a case of a penetrating eye injury caused by rotational wire brush to a fighter pilot, with an excellent visual outcome, and a fully restored vision and functionality status.

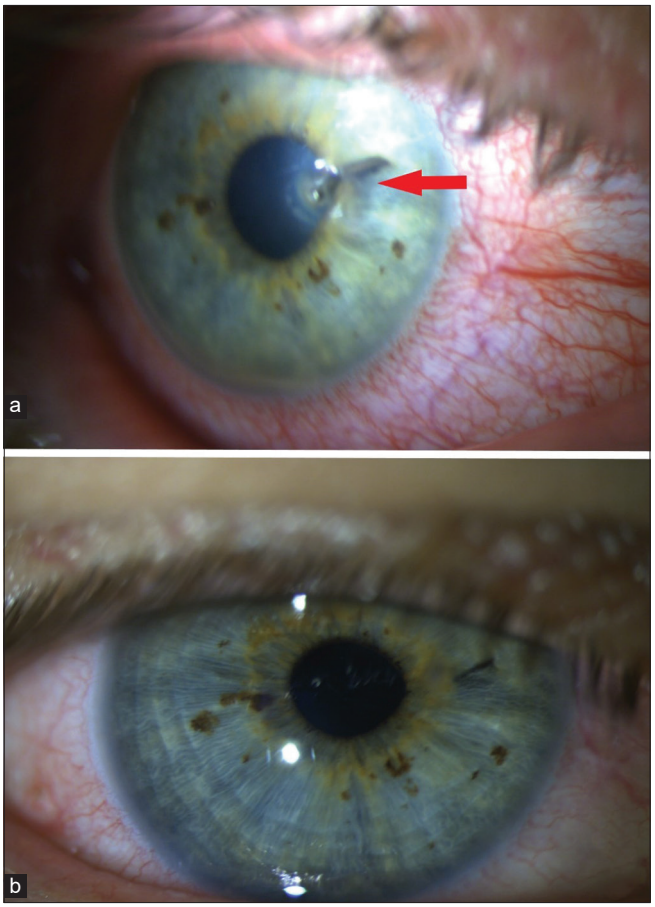

Figure 1: (a) Patient on admission with protruding wire edge about 1 mm from the cornea (red arrow), (b) One week after pars plana vitrectomy and cataract extraction

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Case Report

A 42-year-old fighter pilot had a right eye (OD) penetrating injury, while he was using a rotating wire brush without eye protection. Following an initial local hospital examination with an orbital computed tomography (CT) scan, anti-tetanic immunization, and topical and systemic antibiotic chemoprophylaxis, he was referred to our military hospital for further management 12 h after the incident.

On admission, visual acuity was 1 / 20 OD and 20 / 20 OS. Slit-lamp examination showed a metal wire perforating the cornea embedding in the iris. There was a protruding wire edge about 1 mm from the cornea; however, the corneal wound was Seidel negative [Fig. 1a]. Anterior segment examination revealed hypopyon and initiation of a traumatic cataract. Fundus could not be visualized. A dilated exam was not performed as the wire was engaged with the iris and we did not want to disrupt the anatomical structures or cause more harm by potentially moving the wire with the pupil dilation. According to Birmingham Eye Trauma Terminology system (BETTS) was classified as intraocular foreign body (IOFB) with an ocular trauma Score (OTS) of 2, with unpropitious expected visual outcome.[3,4] Orbital CT showed an approximately 22 mm, rippling, metallic foreign body penetrating the right globe without information about the exact endpoint of the wire at the globe-wall [Fig. 2 a and b]. B-scan was also inconclusive about the endpoint of the wire and did not reveal any retinal detachment. The patient immediately was led to surgery under general anesthesia and the IOFB was removed via gentle pull, guided from the trajectory information from computed tomography [Fig. 2c]. Cornea wound was self-sealed; however, a contact lens was placed on top. A combination of topical and systemic antibiotic chemoprophylaxis was initiated to reduce the high risk of post-traumatic endophthalmitis. Foreign body was sent to the lab for microbiology tests and found sterile. Three days later traumatic cataract was fully developed [Fig. 3b]. A new B-scan revealed the presence of either an organized thick vitreous hemorrhage or/and a retinal detachment at the area ipsilaterally to the entrance point quadrant. In the need of cataract extraction and the inconclusive but strongly suspicious B-scan findings, a combined procedure was decided [Fig. 3a]. The patient underwent a combined pars plana vitrectomy and phacoemulsification. As there was no zonule rapture and the system was stable a 3-piece IOL was placed with haptics sulcus and the optic captured through an anterior continuous curvilinear capsulorhexis (CCC). A retinal tear without retinal detachment was found ipsilaterally to the quadrant that was the entrance point at the point where the wire was attached to the retina, and was sealed with endolaser photocoagulation. One week later [Fig. 1b] the patient had a fully restored vision with visual acuity of 20 / 20 OD (with -0.50 sphere) and 20 / 20 OS (unaided) and six weeks after the event the fighter pilot return to active duty flight status, following a thorough examination from the Hellenic Air Force Center of Aviation Medicine.

Discussion

A literature review has shown that there is an average size of an IOFB of 3.5 mm (Range: 0.5-25 mm) in penetrating injuries, with

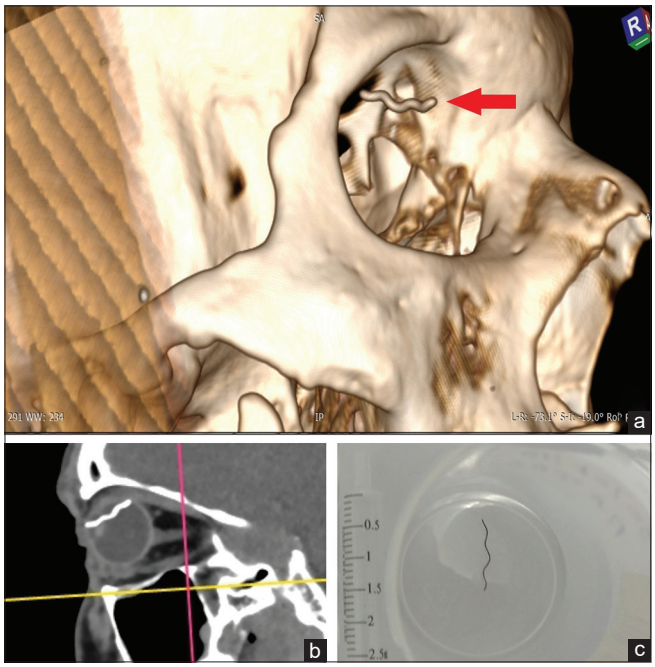

Figure 2: (a) Computed Tomographic (CT) scan (3D reconstruction) with the IOFB (red arrow), (b) IOFB trajectory CT scan. (c) Rotating wire brush bristle fragment

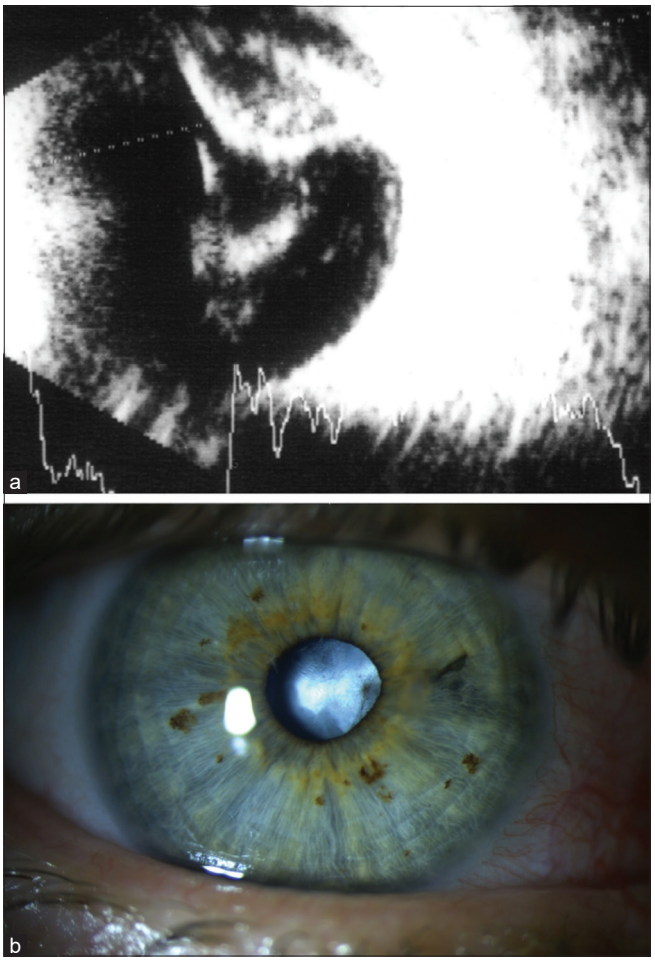

Figure 3: (a) The second B-scan three days after admission, (b) three days after IOFB removal a traumatic cataract was fully developed

our case having a size of 22 mm.[5] Foreign bodies resulting from the operation of power-driven tools are less commonly reported and only a few case series have described eye injuries caused by rotating wire brushes.[1-3,6-8] The usage of safety goggles is not always an adequate safety measure while using rotating wire brushes and the use of a full-face shield is recommended the popularity of equipment or tools that potentially produce high-speed foreign bodies increases.[8] The final outcome is largely dependent on a number of parameters, including the length of fragment the mechanism of injury and the affected tissues in the eye. In a retrospective series of cases over a 13 years period, Purtskhvanidz *et al*. reported that OTS may provide prognostic information in traumatic injuries by rotating wire brushes. This report describes a case that despite the initial poor prognosis, the final visual outcome was excellent.[2,4] According to OTS score, the estimated probability of follow-up visual acuity of 20 / 40 in 6 months was 15%.[4] A stepwise approach was implemented, aiming to restore the vision in this high-performance personnel, by planned interventions according to findings, preventing simultaneously the eye from possible infection and inflammation. Penetrating eye injuries caused by high-velocity projectiles are thought to be heat-sterilized and considered to carry a lower risk of infection. The benefits of prophylactic systemic antibiotics and the preferred route of administration have not been confirmed in randomized large-scale studies.[9,10] As the use of intravitreal antibiotics remains controversial our decision was to stay with topical and systemic chemoprophylaxis and close monitoring in an effort to avoid any potential toxicity of the intravitreal antibiotics since we had to deal with the specific type of personnel.[10] A more conservative two-step "less is more" approach was decided as there was no evidence of endophthalmitis or other retina pathology at the time of the first operation. Also, since there was also an obvious need for a cataract extraction, the primary intraocular lens placement during primary globe repair is not recommended as a significant risk factor for the development of endophthalmitis.[9,10]

Conclusion

To the best of our knowledge, this is the first case, reporting this type of injury with the involvement of almost all eye tissues in the anterior and posterior segment, with a fully restored vision of 20 / 20 to maintain flying status in a high performance and demanding military environment.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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