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Case report
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Joy or tragedy: firecracker-inflicted traumatic optic neuropathy

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Abstract

Background: Firecrackers are traditionally used as part of celebrations. However, they lead to significant ocular injuries. Traumatic optic neuropathy (TON) is among the blinding conditions caused by firecrackers, although it is either uncommon or under-reported.
Case presentation: During Hari Raya Aidilfitri 2022, a 4-year-old boy and a 29-year-old gentleman presented with blast injury by firecrackers. Visual acuity at presentation was hand movement and light perception (LP), respectively, both with marked relative afferent pupillary defect. Both patients were diagnosed with TON and were treated with high-dose intravenous methylprednisolone for 3 days. However, their visual recovery remained poor after treatment completion. One-month post-trauma, their best-corrected visual acuity was counting fingers and LP, respectively.
Conclusion: TON due to firecracker injury is potentially blinding and has poor visual outcomes with current treatment modalities. Awareness among the public and strict law enforcement is necessary to bring down the incidence of firecracker-related ocular morbidity and blindness.

Keywords: firecrackers, traumatic optic neuropathy

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Abstrak

Kegembiraan atau tragedi: traumatik optik neuropati akibat mercun

Latar belakang: Secara tradisional, mercun merupakan sebahagian daripada perayaan di Malaysia. Walau bagaimanapun, ia sering menyebabkan kecederaan okular yang signifikan. Meskipun traumatik optik neuropati (TON) akibat kecederaan mercun jarang berlaku atau kurang dilaporkan, ia boleh menyebabkan kebutaan.

Pembentangan kes: Semasa Hari Raya Aidilfitri 2022, seorang kanak-kanak lelaki berusia 4 tahun dan seorang lelaki berusia 29 tahun mengalami kecederaan letupan akibat mercun. Ketajaman penglihatan setiap pesakit semasa pemeriksaan adalah pada tahap pergerakan tangan dan persepsi cahaya, masing-masing, dengan kedua-duanya menunjukkan kecacatan pupilari aferen relatif yang ketara. Kedua-dua pesakit didiagnosis dengan TON dan telah dirawat dengan metilprednisolon intravena dos tinggi selama tiga hari. Walau bagaimanapun, pemulihan penglihatan mereka kekal lemah selepas rawatan selesai. Sebulan selepas trauma, ketajaman penglihatan terbaik yang diperbetulkan bagi kedua-dua pesakit adalah mengira jari dan persepsi cahaya, masing-masing.

Kesimpulan: TON akibat kecederaan mercun berpotensi menyebabkan kebutaan dan memberikan hasil penglihatan yang lemah dengan kaedah rawatan semasa. Kesedaran dalam kalangan masyarakat dan penguatkuasaan undang-undang yang tegas amat diperlukan bagi mengurangkan kejadian morbiditi dan kebutaan okular akibat mercun.

Kata kunci: mercun, traumatik optik neuropati

Introduction

Firecrackers are traditionally used as part of celebrations. However, they lead to significant ocular injuries. Traumatic optic neuropathy (TON) is among the blinding conditions caused by firecrackers, although it is either uncommon or under-reported.

Case report

Case 1

A 4-year-old boy was hit in the right eye by a shrapnel of firecracker while watching firecrackers as a bystander. At presentation, visual acuity in the right eye was hand movement (HM) with relative afferent pupillary defect (RAPD). B-scan ultrasound showed vitreous opacity suggestive of vitreous haemorrhage and a flat retina. He sustained TON with traumatic hyphaema, zonular dehiscence, vitreous haemorrhage, preretinal and subretinal haemorrhage, extensive commotio retinae, and Berlin's oedema, with Ocular Trauma Score (OTS) of 2. He completed intravenous methylprednisolone 100 mg TDS (10 mg/kg/dose) for 3 days, but RAPD persisted. At 1-month post-trauma, his best-corrected visual acuity (BCVA) was counting fingers (CF).

Case 2

A 29-year-old man sustained blast injury by firecracker in the left eye after lighting a firecracker. At presentation, visual acuity in his left eye was light perception (LP) with marked RAPD. B-scan ultrasound showed no vitreous opacity and a flat retina. He was diagnosed as TON with traumatic iridodialysis, hyphaema, and cataract, with OTS of 2 (Fig. 1). He completed intravenous methylprednisolone 250 mg QID for 3 days, but RAPD persisted. At 1-month post-trauma, his BCVA was LP (Fig. 2).

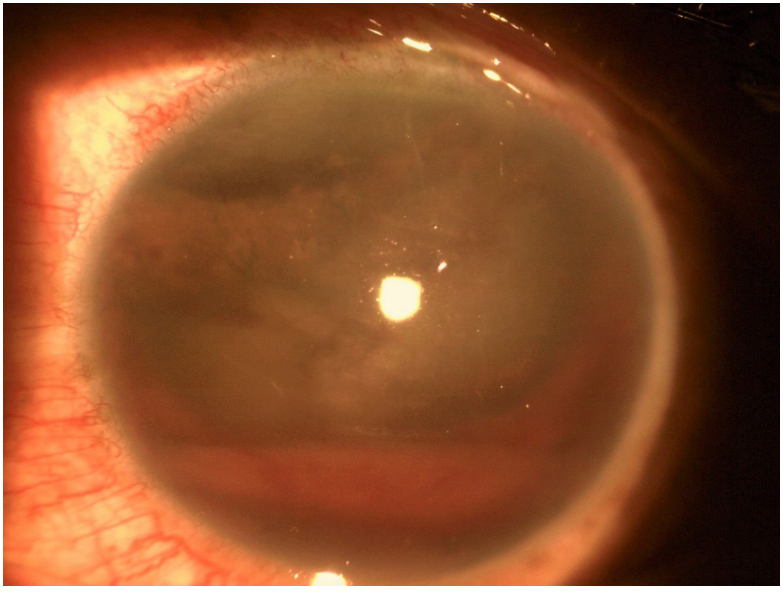

Fig. 1. Case 2 at presentation, showing left eye traumatic hyphaema, corneal oedema, and superior iridodialysis.

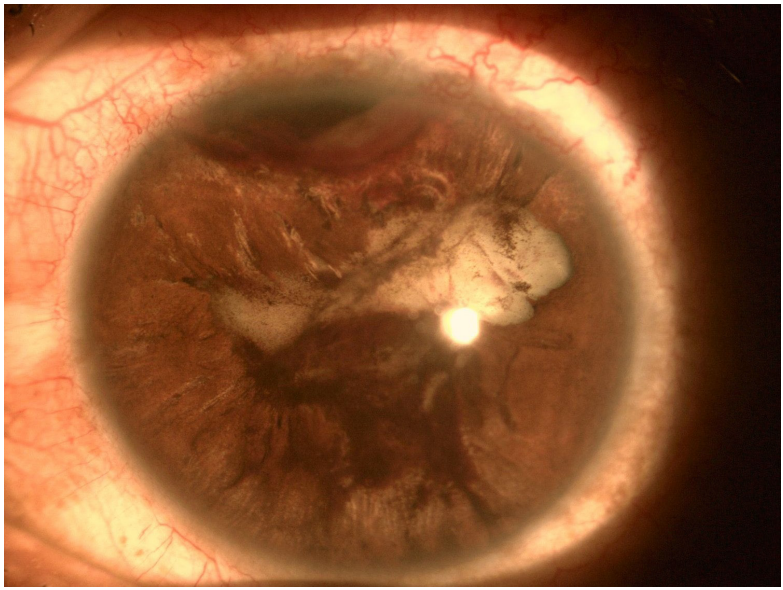

Fig. 2. Case 2 at 1-month post-trauma, showing resolved hyphaema, traumatic cataract, and superior iridodialysis in the left eye.

Discussion

TON is a vision-threatening injury to the optic nerve secondary to trauma. In the general population, TON is commonly caused by fall (26%), motor vehicle accidents (21%), and assault (21%).[1] TON is relatively uncommon compared to other types of ocular injuries caused by firecrackers. According to a retrospective review of firecracker-related ocular injuries at Harborview Medical Centre in the United States from 2003 to 2013, the most common ocular injuries were corneal abrasions (67%), hyphaema (42%), eyelid injuries (39%), and ruptured globes (17%), with TON accounting for only 3% of the cases.[2] Up to 89% of patients with fireworks injury have been reported to be male, with a median age of 24 years.[2]

TON can result from both direct and indirect trauma to the optic nerve. Direct trauma includes penetration by a foreign body or a displaced fracture fragment to the optic nerve, while indirect trauma involves damage from concussive forces transmitted to the head.[3] Various segments of the optic nerve may be affected, including the intraorbital, intracanalicular, and intracranial parts. Notably, the intracanalicular segment is most frequently injured.[4] Blunt trauma to the frontal region generates shock waves that travel posteriorly and the conical shape of the orbit funnels forces to the optic canal.

Optic nerve injury is categorized into primary and secondary types. Primary optic nerve injury involves immediate shearing of retinal ganglion cell axons, with over 80% of affected axons dying within a month. Conversely, secondary optic nerve injury is characterized by swelling of the optic nerve due to mechanical trauma.[5] Computed tomography scans are the preferred imaging modality to delineate fractures of the optic canal, sphenoid, and ethmoid bones as well as compression of the optic nerve by haematoma.

Methylprednisolone is the initial treatment of choice for TON due to its neuroprotective properties. It alleviates nerve fibre compression by reducing intraneural and extraneural oedema.[6] Baseline visual acuity is the most critical predictor of final outcomes.[7] There is a significant correlation between initial and final visual acuity, with patients presenting no light perception typically experiencing limited or no visual improvement. In our 2 reported cases, the patients presented with poor vision, hand movement in Case 1 and LP in Case 2, and did not improve despite high-dose intravenous methylprednisolone. Consequently, oral prednisolone was not administered, as it is beneficial only to those with visual improvement following intravenous treatment.[8]

Conclusion

TON often results in loss of permanent vision and, consequently, of quality of life for affected patients. Public education on firecracker safety and parental supervision during firecracker handling can significantly reduce the incident of ocular injuries. Stricter regulations on firecracker sales and usage, especially among minors, could also mitigate these injuries

Declarations

Informed consent for publication
The adult patient and the minor patient's guardian have provided informed consent for the publication of the clinical data and images contained in the case report.

Competing interests
None to declare.

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None to declare.

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None to declare.

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