Ocular and adnexal injuries in the Bali bombing, 12 October 2002

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Photograph courtesy Medical Journal of Australia[1]

Abstract

- The terrorist bombing incident in Bali caused serious morbidity and mortality by a combination of blast, burn and shrapnel injuries.
- Initial triage was carried out by five holidaying Australian doctors in trying and difficult conditions.
- A military aeromedical evacuation exercise using permanent and reservist medical personnel brought the survivors home.
- A follow-up survey of ophthalmological trainees in the Australian public hospital system found that 18 bomb blast victims had ocular and/or adnexal injuries.
- It appears that the current skills of triage and retrieval teams were adequate to detect eye injuries.
- Australian ophthalmologists can assist in providing training in eye trauma management for retrieval, aeromedical evacuation and accident and emergency teams. Maintaining these skills is essential in view of the possibility of future acts of terrorism.

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ON THE EVENING OF 12 OCTOBER, 2002, two bombs were exploded by terrorists outside a nightclub and bar in Kuta, Bali, killing more than 200 people and injuring many more. Eighty-eight of those killed and many of the injured were Australians. Initial triage and management was carried out by local medical teams, plus 5 Australian medical practitioners holidaying in Kuta or nearby.[1] Assistance was also provided by a number of Australian nurses holidaying in Bali, and volunteers — often family and friends of those injured.

Patients were admitted to the Sanglah Hospital and several other small clinics nearby, but these were poorly equipped, with few intravenous lines, fluids, bandages or other essential supplies. In an aeromedical evacuation codenamed "Operation Bali Assist", 5 Hercules C-130 aircraft from the Royal Australian Air Force with 34 Australian Permanent and Reserve military medical staff flew to Denpasar Airport, Bali, to assist with triage, stabilisation and resuscitation of the injured. An Aeromedical Staging Facility was set up in a hangar at the airport and over a period of 21 hours, 66 patients were evacuated from Bali to Darwin. Four RAAF evacuation flights from Darwin then transferred 35 patients to 4 capital cities over 16 hours, less than 72 hours after the terrorist bombing incident.[2] Qantas and civilian aeromedical retrieval teams transported the remaining casualties.

After the Bali bombing, I wished to determine whether:

- any eye injuries were overlooked in the original triage but were seen later in eye hospital clinics
- any improvement in eye trauma management teams is required for future retrievals
- an ophthalmologist should be a member of a retrieval team.

Method

All 100 ophthalmological trainees in Australia were surveyed by email in early December, 2002. These trainees were asked to question members of their departments and the relevant resource personnel in accident and emergency, trauma and burns units. Information was sought on the number and type of eye injuries, how many eye injuries were overlooked at initial triage in Bali, how long before such injuries were detected, and whether visual outcomes were compromised by inappropriate or delayed primary care. All returns were analysed.

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1: Ocular and adnexal injuries of survivors of the Bali bombing, 12 October 2002

No.	Age	Sex	Cause of injury	Nature of injury	Effective primary triage?	Outcome
1	30	M	blast	2 foreign bodies in eyelid, vitreous haemorrhage	Yes	Repatriated to Germany
2	20	M	blast	glass shards in neck, leading to left Horner's syndrome	Yes	Unchanged
3	26	M	burns	face and eyelid burns	Yes	Full recovery
4	34	F	burns/blast	left choroidal rupture	Yes	Visual acuity reduced
5, 6, 7, 8	20–30	M and F	burns	eyelid burns (4 patients), corneal abrasion (1 patient)	Yes	Full recovery
9	36	F	burns/blast	right globe rupture, leading to evisceration	Yes	Death
10	47	M	burns/blast	right and left corneal foreign bodies missed on triage: left corneal abrasion, iritis, blowout floor fracture	No	Full recovery
11	51	M	blast	periorbital bruising	Yes	Full recovery
12	36	M	burns/blast	missed left corneal foreign body	No	Full recovery
13	45	M	burns	eyelid burns, leading to cicatricial contracture	Yes	Full recovery
14	28	F	burns	eyelid burns, loss of lashes, right corneal ulcer	Yes	Full recovery
15	24	M	burns/blast	craniofacial fractures, leading to right cranial fourth nerve palsy	Yes	Repatriated to South Africa
16	16	M	blast	corneal abrasion	Yes	Full recovery
17	43	F	blast	corneal abrasion	Yes	Full recovery
18	48	M	blast	left corneal abrasion, traumatic iritis, blowout fracture	Yes	Full recovery

Results

The last returns were received in April, 2003. Fifty-one responses from 30 different Australian hospitals were received. In several cases, one trainee replied on behalf of a group, and responses were received from all the major hospitals.

18 ocular and/or adnexal injuries were reported (Box 1) caused by either burns, blast, or shrapnel injuries. Many other injured patients were examined by the ophthalmological registrars but had escaped ocular injury. Only 1 eye injury patient was referred to the Ophthalmology Department in Royal Darwin Hospital, presumably because many patients had only brief transit in Darwin. Most bomb victims had multiple soft tissue injuries from blast and burns, and some were seriously ill. Only 2 minor eye injuries were undetected before arrival in Australia. From the survey, it is apparent that there have been no significant visual sequelae from undiagnosed ocular injuries at initial triage in Bali.

Discussion

The results of this survey suggest that it is not necessary for an ophthalmologist to be a member of an aeromedical evacuation team unless he has also been trained in resuscitation and life-support measures and thereby can contribute usefully to retrieval.

A number of eye injuries may have been undetected by this survey. Some may have received treatment privately and not been treated in the public system. All the major trauma hospitals in Australia were included in the survey and it is unlikely that significant eye injuries have been overlooked. There was initial concern that the survey results may have been inflated if patients first seen at Royal Darwin Hospital were counted again when evacuated and treated in hospitals in their home, but only 1 patient with an eye injury was seen in the Royal Darwin Hospital.

The skills of the retrieval teams were quite adequate, despite the appalling conditions in which they worked after the disaster. The military aeromedical evacuation teams recommended that alliances with civilian critical care services needed improvement.[2] Australian ophthalmologists can assist in this by offering training in eye trauma management. Despite the success of this retrieval operation, the capability to react to similar tragedies must be enhanced and skills maintained in view of the possibility of future acts of terrorism. Recommendations for Eye Injury Triage are set out in Box 2.

2: Recommendation for triage of eye injuries

Ocular examination is required for all blast, burn or shrapnel victims, preferably using magnification, a torch, and staining with fluorescein dye after instilling local anaesthetic drops. In the absence of local anaesthetic drops, the injectable form is an effective topical anaesthetic.

The conscious patient

- Can the patient see? — Check each eye in turn.
- Is there eye pain or a foreign body sensation? – instil local anaesthetic drops, stain with fluorescein to check for foreign body, burn or abrasion, evert upper and lower eyelids.
- Are the pupils equal and reactive?
- Check for a relative afferent pupillary defect (RAPD) using the swinging flashlight test.
- Can the patient blink/close the eye normally? — If lid tissue is missing or if there is a 7th nerve palsy, marked lid oedema, **or other injuries which prevent eye closure,** instil antibiotic ointment or paraffin ointment and apply a clear plastic protective foodwrap ("Gladwrap") over the eye from cheek to brow with a little Vaseline or similar as "adhesive".
- If the patient is squeezing the eyelids and the eyes cannot be opened, instil topical anaesthetic drops. Lid retractors may be fashioned from a paper clip.

The unconscious patient

- Are the pupils equal and reactive? — check for RAPD.
- Check for corneal abrasion, burn, or foreign body. Evert all lids and use fluorescein.
- Check that the eyelids are shut and instil antibiotic ointment or paraffin ointment. Consider using protective clear plastic protective foodwrap if the eyes are open.

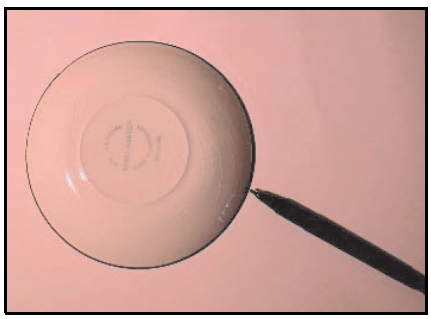
Perforating ocular injury

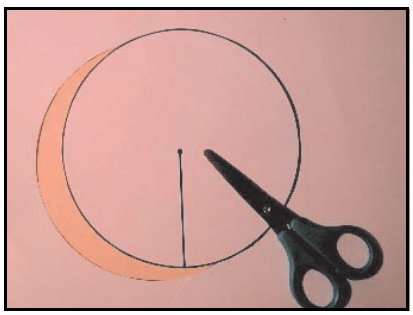
- Apply eye pad and eyeshield. If a plastic shield is unavailable, make a shield out of stiff paper and adhesive tape. A shield can be made by cutting a circle of stiff paper the size of a saucer, making one radial cut to the centre, overlapping the cut edges to form a cone, and securing the edges with adhesive tape or staples.
- Give intravenous antibiotics, analgesia, an anti-emetic and tetanus **antitoxin**.
- If aeromedical evacuation is required, evacuate the patient in an aircraft at a cabin pressure less than 1000 metres above sea level to avoid the risk of barotrauma and retinal ischaemia with expulsion of intraocular contents through the laceration due to expansion of intraocular air.

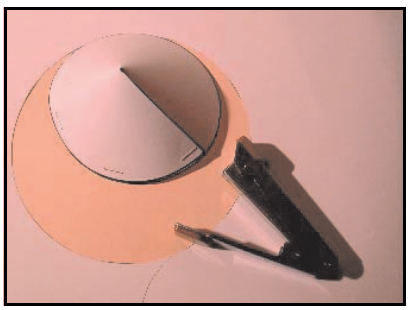
Examination kit: magnifying glass, fluorescein strips, local anaesthetic drops, torch and paper clips (which can be bent into shape to make eyelid retractors).

Patient, unable to close right eye, with protective plastic foodwrap cover.

How to make a cone: (1) mark out paper; (2) cut out circle of paper with one radial cut to centre; (3) overlap the cut edges and fasten.







Conflict of interest

None declared.

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