CRISIS

The Bali bombing: civilian aeromedical evacuation

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After the Bali bombing on 12 October 2002, many injured Australians required evacuation to Darwin, and then to burns units around Australia. Many patients were evacuated from Denpasar by Qantas, with assistance from staff of civilian medical retrieval services. The transport of patients from Darwin to specialist burns units involved a coordinated response of civilian and military services. Some issues in responding to such disasters were identified, and a national coordinating network could improve future responses. **MJA 2003; 179: 353-356**

ON SATURDAY EVENING, 12 October 2002, two bombs exploded in a crowded nightclub area at Kuta Beach, Bali. The explosions killed more than 180 people and injured several hundred others. Injuries were principally burns and shrapnel injuries. Local healthcare resources, which do not include a specialist burns capability, were rapidly overwhelmed.

Many of the injured were Australian citizens, who required evacuation to Australia. The military response has been described previously.[1]

Civilian evacuation flights directly from Bali

Activation

Early in the morning of Sunday, 13 October, Qantas Security asked Qantas medical staff to organise a medical team to fly to Bali to assist in evacuating injured people. Two doctors and three nurses, medical equipment from Qantas Aviation Health Services, and several members of Qantas Security travelled to Bali on a Boeing 767, departing Sydney at 17:00 EST on Sunday. During the day, NSW Health and the Medical Retrieval Unit of the Ambulance Service of New South Wales offered medical teams to fly to Bali to care for any patients who presented at the airport with injuries. Thus a team of four doctors and two paramedics drawn from CareFlight and the Sydney Aeromedical Retrieval Service was dispatched on a second Qantas Boeing 767 flight at 18:00. A consignment of medical equipment, including a large quantity of burns dressings, analgesic and intravenous fluids, was also transported.

When the first aircraft arrived in Denpasar, hundreds of passengers were queued at check-in, many with obvious

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burns and shrapnel injuries. A treatment area was set up within the departure lounge, and triage commenced. The medical personnel began cleaning and dressing wounds for people departing on the first flight to Sydney. The arrival of the second aircraft provided additional resources, and enabled medical personnel to accompany each Qantas flight that departed Denpasar.

First Qantas flight from Denpasar to Sydney

Triage: As soon as they arrived in Bali, a doctor and paramedic team from CareFlight transferred to the first aircraft, which was ready for departure. This team walked around the cabin with a flight attendant to estimate the number of injured passengers and the type of injuries. This initial assessment guided the decision on what equipment was to be taken on the flight, and what was to be left for subsequent flights.

After take-off, patients were triaged using the Homebush triage taxonomy[2] (Red, Immediate; Yellow, Urgent; Green, Not Urgent) and the CareFlight triage algorithm.[3] Although appropriately coloured tags were available, they were not used to indicate patient priority. Instead, they were positioned so that they protruded from the top of patients' seats, simply indicating the location of an injured passenger in the cabin. About 20 passengers who would require treatment were identified. To facilitate assessment, treatment, and observation, the cabin crew seated the injured passengers together. The pilot's rest cabin was used as a treatment room. Although narrow, the cabin has a recliner seat that allowed semi-supine positioning of patients, and the door provided privacy.

The doctor assessed individual patients, documenting injuries on the triage tag, and treatment to be instituted in flight. One of the uninjured passengers was a medical colleague of the treating doctor, and volunteered to assist, providing invaluable assistance in assessing patients and obtaining intravenous access.

As expected, given that the passengers were ambulant and had boarded by themselves, no critically injured patients were identified. Therefore, the triage system was modified to reflect the order of medical attention. Red priority was allocated to patients with burns, dehydration or multiple injuries, and those in severe pain. Yellow priority was allocated to stable patients with injuries that might deteriorate. Green priority was allocated to patients with emotional disturbance or minor injuries.

1: Summary of patient injuries on the first Qantas flight from Denpasar

Triage category (number of patients)	Injury types	Treatments required
Red (8)	Burns ranging from 20% to 30% (including facial), dehydration, lacerations, fractures, shrapnel injuries, blast injury to eye.	Intravenous fluid, analgesia, dressings, and antiemetics.
Yellow (6)	Depressed skull fracture, limb fractures, lacerations, chest and neck pain, abdominal pain, anxiety, blast injury to ear and eyes.	Bandaging, sedation, and observation.
Green (5)	Lacerations and emotional disturbance.	Assessment and support.

Treatment: All patients with burns were re-examined to obtain accurate estimates of burn area and intravenous fluid requirements. Those with significant burns (20%–30%) were managed with moist burn dressings, intravenous fluid therapy, and intravenous analgesia.

The injuries (Box 1) were consistent with previous reports from terrorist bombings,[4-6] but generally less severe, as the patients were ambulant. The patient with a depressed skull fracture had no neurological deficit and remained stable for the duration of the flight. Equipment was available to enable intubation, ventilation and administration of osmotic agents if the patient's condition had deteriorated.

The most common interventions were bandages, dressings and intravenous fluid. Giving sets for intravenous fluids were hung from overhead luggage bins with hooks made from coat hangers. The requirements for analgesics and anxiolytics were less than expected; many people were prepared to tolerate significant pain knowing they were safe and on their way home.

Morphine supplies had been left in Denpasar, so ketamine was used to provide analgesia during the flight. Unlike morphine, ketamine does not cause respiratory depression, an important consideration in a commercial aircraft, where the high altitude and resulting low cabin pressure render passengers relatively hypoxic. Although the dose was kept to less than 0.5mg/kg, some patients experienced transient dysphoric effects.

On arrival at Sydney (Kingsford-Smith) Airport, the aircraft were met by ambulance and medical personnel. Passengers with minor injuries were asked to refer themselves for further assessment to the medical teams at the airport or to their local hospitals and general practitioners.

Subsequent flights from Denpasar

When the second flight back to Sydney was ready for boarding, a doctor and paramedic did a quick walk-through of the area where passengers waited. As there were no severely injured people, the paramedic alone accompanied the flight back to Sydney. During transit, about 25 patients were identified with injuries, including minor burns and shrapnel wounds.

The medical personnel who remained in Denpasar screened passengers for the subsequent flights. A doctor was positioned at the check-in line. Many passengers attempted to conceal injuries, believing that they would be refused transport if their injuries were identified. Passengers with injuries were more readily identifiable when walking, as limps, bandages, slings, and undressed wounds were more difficult to conceal. These passengers, who required reassurance that they would still be allowed to travel, were asked to go to the treatment area. About 55 passengers who required medical interventions were identified in this way. These passengers principally required analgesia and wound dressings, and boarded subsequent flights.

A further five Sydney Aeromedical Retrieval Service doctors and paramedics were dispatched from Sydney on the Monday evening, allowing all additional flights to return to Sydney with medical personnel on board. In total, Qantas operated nine special evacuation flights, returning more than 4500 people to Australia. More than 2000 kg of medical supplies were also carried.

The response in Darwin

The most severely injured patients repatriated to Australia were evacuated from Bali on five Hercules C-130 military transport aircraft.[1] These flights transported 65 patients to Royal Darwin Hospital (RDH) for stabilisation and initial surgery. Fifty-three of these patients were listed as serious or critical.

The RDH disaster plan, which had revealed no operational deficiencies when recently tested for the East Timor conflict, was activated 16 hours before the arrival of the first C-130, allowing the intensive care unit, emergency department and an entire surgical floor to be essentially emptied and prepared. Many RDH staff volunteered for duty, and resources were pooled from the adjacent private hospital.

At 15:00 CST on Sunday, 13 October, the Commonwealth Department of Health and Ageing accepted an offer from the Royal Adelaide Hospital (RAH) of 10 staff to complement the resources of the RDH. The RAH teams (a burns surgical team of three, a critical care medical team of five doctors, and two critical care retrieval nurses) reached Darwin before the arrival of the first C-130 carrying injured patients at 01:30 on Monday. The most senior burns surgeon and the critical care teams were initially placed at Darwin airport. The patients, especially on the first C-130, had had minimal resuscitation only and were retriaged at Darwin airport by a four-person medical team comprising an RDH anaesthetist, an RAH intensivist, the RAH burns surgeon and a doctor from the Australian Defence Force (ADF).

Although only three patients on the first two C-130s were intubated, within a few hours of arriving at RDH many others required intubation and other critical care support. Patients were probably protected from airway swelling by the lack of fluid resuscitation provided in Bali and on the flight to Darwin. When effective fluid resuscitation was initiated at RDH, airway swelling and other problems

2: Critical care aeromedical evacuations from Darwin

Departure*	Aircraft	Team	Patients	Patients' homes	Destination
08:50 Mon	Lear 35 (2 stretchers)	Royal Adelaide Hospital	2	Melbourne; Melbourne	Adelaide
14:00 Mon	Lear 36 (1 stretcher)	Royal Adelaide Hospital	1	Sydney	Adelaide
17:30 Mon	Super Kingair (2 stretchers)	Royal Flying Doctor Service (QLD)	2	Sydney; New Zealand	Brisbane
18:00 Mon	Super Kingair (2 stretchers)	Royal Flying Doctor Service (QLD)	2	Brisbane; Sydney	Brisbane
19:00 Mon	Lear 35 (2 stretchers)	Royal Adelaide Hospital	2	Darwin; Perth	Adelaide
21:00 Mon	Westwind (2 stretchers)	CareFlight (NSW)	2	Melbourne; Brisbane	Sydney
23:30 Mon	Lear 36 (1 stretcher)	Royal Adelaide Hospital	1	Canada	Melbourne
01:00 Tues	Hercules C-130	Royal Australian Air Force	2	Perth; Perth	Perth
05:00 Tues	Citation	Medical Emergency Adult Retrieval Service (VIC)	1	Brisbane	Melbourne
03:00 Tues	Hercules C-130	Royal Australian Air Force/Royal Adelaide Hospital	1	Melbourne	Melbourne
17:50 Fri	Lear 35 (1 stretcher)	Royal Adelaide Hospital	1	South Africa	Adelaide

* Departure times are Australian Central Standard Time (UTC +09:30).

became apparent, necessitating admission to the intensive care unit.

The RAH staff assisted in the RDH intensive care unit, performing complex intubations and central line insertions, as well as more than 100 burns surgical procedures.

Secondary transports from Darwin

RDH does not have a burns unit or the capability to provide ongoing management for large numbers of severely injured patients, so, after the second C-130 arrived, a request was made to Emergency Management Australia, the federal organisation responsible for disaster coordination, training and research, for patients to be transported from RDH. Two critical patients were transported directly from Darwin Airport to RAH, after being assessed and stabilised at the airport before the 4-hour flight. Most of the secondary aeromedical evacuations occurred over the next 24 hours, although they continued intermittently for 5 days. The critical care patients could only be transported one or two to a plane, as medically equipped civilian aircraft do not have the capacity of the military aircraft. A summary of the critical care aeromedical evacuations from Darwin is included in Box 2. Box 3 shows a team preparing a patient for transport.

Patients were allocated to destinations on the basis of their stability when transport was available, their home state, and a desire to distribute unstabilised patients between aircraft. Seventeen critical patients were evacuated from Darwin, although many who were categorised as serious would have been classed as critical in normal circumstances.

RAH, RDH and ADF staff worked together to coordinate the use of civilian and military aircraft to transport the 17 critical and 37 serious patients to burns units in other states. Civilian–military coordination was facilitated by two RAH staff who held dual military and civilian positions. This enabled changes in transport allocation for a number of patients as their condition changed during Monday afternoon and evening.

Improving the response for future disasters

Although the ADF bore the major responsibility for evacuating victims of the bombing from hospitals in Denpasar to Darwin, most of the critical care transfers from Darwin to interstate centres were performed by civilian retrieval services. In conjunction with Qantas, many ambulant patients were also evacuated directly from Denpasar by civilian aeromedical teams.

Several issues became apparent in the coordination of the civilian aeromedical evacuation from Darwin. These were:
- Lack of knowledge by federal emergency coordinators of available civilian aeromedical resources, which led to delay in activation;
- Lack of a national coordination system for medical retrieval, so transport from Darwin was organised by personal contacts and offers of assistance rather than a systematic approach, resulting in ad hoc utilisation of services;
- Insufficient coordination between personnel organising the transports and the receiving burns centres, resulting in unequal distribution of patients to interstate burns units;
- Substantial delays while funding was found to charter jets for transporting critical patients.

3: A team from CareFlight Sydney preparing a patient for transport to Sydney

In Australia, most disaster planning is done at state level, and essentially all disaster response resources, with the exception of the ADF, are held at state level. Although the ADF has the capability to carry large numbers of patients, their aeromedical evacuation teams have little peacetime exposure to critical care transport and their equipment is limited. Some incidents require specialised medical or rescue responses that exist only in the civilian setting.[7] A mechanism is required for rapidly accessing these specialist state-based resources for incidents that overwhelm the resources of an individual state or occur outside Australia.

Medical retrieval resources are another highly specialised resource held only at state level. However, most state services do not have experience in the coordination and logistics required (or even the capability) for very long distance transport, so devolving overall responsibility to the states in situations like the Bali bombing is not practicable. Therefore, a national coordination system that is aware of individual service capabilities and that can tailor the response accordingly is required.

A possible model for a national retrieval network

In Australia, a national network coordinates specialist burns services in the event of a major burns incident. The burns network currently functions by direct liaison between the states' burns unit directors as required. The burns network can identify beds for burns victims in other states when the resources of one state are overwhelmed. However, there is no system for coordinating the transport of patients. A network of civilian retrieval providers with long distance capability, functioning in a similar manner to the burns network, could be established to coordinate responses to events such as the Bali bombing, which require distribution of casualties across states outside of usual referral patterns.

Such a national medical retrieval network would require no ongoing funding, as it is essentially an informal network of service directors. However, funding sources for aircraft charter and a streamlined mechanism for contacting federal and state officials are necessary if the network is to be able to mount rapid, coordinated responses.

Advantages of a national retrieval network include:
■ Coordination of patient transfers, in conjunction with other specialist services such as the burns network;
■ Systematic activation of civilian retrieval services, taking into account individual service capabilities;
■ A single access point for retrieval network activation by federal or state agencies, and a dedicated medical officer for liaison with the ADF, if required; and
■ Single-phone-call access to specialist medical retrieval advice, activation of appropriate specialist medical personnel, mobilisation of medical equipment and transport resources, and overall coordination of the medical response by personnel with many years of experience in long distance (interstate and international) critical care transport.

In events outside Australia where security is not in doubt, a civilian reconnaissance team sent by commercial or charter jet may be of considerable value while the slower, larger ADF aircraft are in transit. Civilian jet aircraft that can

transport teams of up to 10 medical personnel plus equipment could be rapidly mobilised to perform initial intelligence gathering, and resuscitate and prepare patients for transport before arrival of military transport aircraft.

A number of organisations have expressed interest in developing a national retrieval network, including the Australasian College for Emergency Medicine and the two largest state-based retrieval services with international capability. Implementation of such a network should result in more timely and better coordinated utilisation of civilian retrieval resources in any future mass casualty incident.

Competing interests

None identified.

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