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Case Study

A Challenging Penetrating Trauma Case



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A B S T R A C T

We present the prehospital management of a 23-year-old Australian Aboriginal man with an isolated knife stab wound to the posterior right chest. The lead author attended to the prehospital management of this young man during tenure as a registrar in retrieval medicine for CareFlight Medical Services (CMS) in North Queensland, Australia. The case is noteworthy because it involved a combination of a life-threatening injury with a superimposed iatrogenic injury. The case will be of interest to physicians and clinicians in prehospital medicine as well as those in low-volume emergency departments or facilities in which major trauma may present infrequently.

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CareFlight Medical Services (CMS) is an Australian air medical charity established in 1986. Their mission statement is to save lives, speed recovery, and serve the community by providing the highest standard of rapid critical care response.

Services are split into statewide provision and encompass the use of helicopters, airplanes, and medi-jets to bring a hospital level of care to the critically ill and injured. The crew onboard include pilots, aircrew, medical teams, and paramedics with coordinators in land-based centers all working closely together to ensure that patients receive the best care as soon as possible. They care for severely injured patients who need emergency treatment at the scene and transport seriously ill patients who need to be moved to the hospital. Presently, CareFlight air medical teams care for over 5,000 patients annually.

CareFlight holds teaching accreditation with the Australian critical care colleges of anesthesia, intensive care, and emergency medicine. Rigorous biannual training plus weekly case review and audit take place to ensure CareFlight doctors and nurses are continually trained and updated in prehospital and transport medicine. Further state-of-the-art education at designated training centers includes underwater escape training and winch training to ensure all-around team safety.

CareFlight is a leader in innovation. The practice of flying critical care physicians to the seriously ill and injured, introducing night

vision goggle technology for safer night flight, and conducting a clinical trial to investigate the benefits of early physician intervention for patients with head injuries all represent Australian “firsts.”

The Queensland Townsville team, in particular, is mandatorily composed of a pilot, an air medical officer, and a rescue medical officer. There is 1 doctor and 1 advanced paramedic for every single mission. Further secondary teams wait at base in the event of a second task being issued, and a separate team is also on call for the Learjet.

The aircraft used at Townsville (Rescue 521) is a Bell 412 EP model with a PT6T-3D engine, with a secondary craft available for maintenance periods. The company also operates with fixed wing aircraft at other bases and the Learjet 45 for longer missions. The entire team is based air side at Townsville airport in 2 designated hangars. The area served by the Townsville team encompasses 1.853 million km² and 6,793 km of coastline.

There are 2 main bases (Cairns and Townsville) operating with Rio Tinto—sponsored aircraft, with other missions performed by the Royal Automobile Club of Queensland CareFlight Rescue aircraft (Sikorsky S-76), which operates 6 helicopters out of Bundaberg, Gladstone, Roma, Sunshine Coast, Gold Coast, and Toowoomba bases.

Further missions may be undertaken to repatriate Australian citizens or in other circumstances from nearby islands such as Papa New Guinea or the Solomon Islands. The geography of the state is vast and varied from the sparsely populated upper poles of the Cape York Peninsula and the Torres Strait through the tropic of

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Table 1
Plan for Transfer

Airway/breathing	Cuffed oral endotracheal tube, peripheral oxygen saturations 98%, FiO ₂ = 1.0, CO ₂ 35–40 mm Hg, good air entry bilaterally and bilateral chest drains Tactile compliance revealed it much easier to ventilate the patient manually via a bag valve tube, so this method was continued for the remainder of the transport	Plan: continue manual ventilation using 100% oxygen Caution with drains and endotracheal tube during transfer
Circulation	Noninvasive blood pressure 90/80, heart rate 110 beats/min sinus tachycardia, cold peripherally, radial pulse palpable, intravenous fluids (2,000 mL) to replace estimated loss, space blanket applied	Plan: continue fluid resuscitation, monitor pulse throughout mission Expedite to major cardiothoracic capable trauma center (only 20 minutes away)

FiO₂ = fraction of inspired oxygen.

Capricorn to urban Brisbane. It includes tropical islands, sandy beaches, flat river plains, elevated terrain, dry deserts, rich agricultural belts, and densely populated urban areas. A unique geographic feature of the state is the Great Barrier Reef, which presents its very own unique pathology.

The variety of patient population and presentation is extensive, ranging from a standard myocardial infarct with a 3-hour flight time to the nearest percutaneous coronary angiography-capable unit to tropical medicine involving deadly Irukandji jellyfish stings and coastal Taipan snakebites.

Case Report

The initial report received from the Queensland retrieval services coordination center just before midnight was brief and succinct—“Priority 1: (specific location deleted here for patient confidentiality)—young male, intoxicated, stabbed in back. Cardiovascular/respiratory stable.”

The patient was located on a small tropical island of the Great Barrier Reef, 20 minutes by helicopter from the Careflight Medical Services helipad. The island has a troubled and tumultuous history and is marred by extensive violence, suicide, and social disadvantage. In 1999, *The Guinness Book of Records* named it the most violent place on earth outside a combat zone based on the high rate of per capita violent injury.

Upon scene arrival and after ensuring scene safety, we exited the aircraft; entered a small, ill-equipped clinic room; and rapidly assessed the patient to be much worse than anticipated. He was unresponsive with a partially obstructed airway and asymmetric chest movement. Oxygen was applied with a nonbreathing face mask with reservoir; the decision was made that urgent intubation was necessary to maintain a patent airway and further manage a clearly life-threatening penetrating chest wound. The team promptly set about to perform a “kit dump” and prepare drugs for rapid sequence intubation in accordance with the well-honed standard operating procedures (SOPs) used by the CMS. (Kit dump is the term used by the CMS to describe the urgent setup of the standard SOP intubation and backup equipment for securing a definitive airway. In this well-drilled process, the doctor, paramedic, or even the rescue medical officer can prepare a clean, organized area where a standard equipment setup [such as the laryngoscope and bougie] can be laid out in a set format. This allows for conformity, and every team member understands the process and location of equipment in a standard manner. CMS has well-practiced routines for advanced interventions, and a preintubation drill is mandated before all anesthesia or airway procedures. In this process, all equipment [ventilator and so on] is double-checked and prepared, with the precise location known to team members for use in an emergency.

Upon assessment of breathing, the patient was found to have reduced air entry on the right hemithorax (side of injury) with dullness to percussion. He had good air entry of the left hemithorax with a bubbling chest drain on the left (uninjured side). The bedside nurse confirmed that the last remaining chest drain in the

clinic had been placed on the incorrect side by a medical officer inexperienced in trauma management.

Subsequent assessment of circulation revealed signs of circulatory shock with a pulse rate of 110 beats/min despite a systolic blood pressure of 110 mm Hg. Using a standard “rapid sequence induction” following the CMS SOP, the patient’s trachea was intubated approximately 1 hour after injury. It was a Cormack and Lehane Class 1 visualization using a size 8.0 cuffed oral endotracheal tube and was secured at 21 cm at the lips. There did not appear to be any gross hemodynamic instability through this time. Air entry was confirmed bilaterally, albeit very poor on his right side, where a hemothorax was suspected.

After intubation, we were concerned with frequent “high-pressure” alarms from our portable transport ventilator. Subsequently, the patient was removed from the ventilator in a timely manner and hand ventilated via a bag valve tube. This improved his ventilation (SaO₂ = 98%, end-tidal carbon dioxide = 35–40 mm Hg); however, it was not immediately recognized that the high ventilator pressures originated from a massive hemothorax that had filled the right side of the chest.

Seven minutes after intubation, the right chest was prepared; through a single incision, a 32F intercostal drain was inserted in the lateral chest wall. Two thousand milliliters of blood immediately filled the collection bag to capacity. The drain was clamped, and clinical staff were directed to place an additional 16-G intravenous cannula and bolus crystalloid because we had no immediate access to blood. CMS routinely has ready access to blood, but it had inadvertently not been packed before departure on this transport.

The primary survey continued, with the intention of expediting our departure from the island (Table 1).

The patient was packaged for transfer and in-flight treatment planned (Fig. 1).

After a reasonably uneventful transport, we arrived and transferred care over to a “Red Blanket Team” in the trauma resuscitation room.

[The ‘Red Blanket Team’ is an emergency code activated in the recipient hospital to mobilize specialist teams, massive transfusion policies, and operating theatres for the imminent arrival of a critically ill patient.]

The laboratory results are provided in Table 2 and Figure 2.

This author’s clinical role technically ended here, but her professional interest did not. Subsequent follow-up noted that the patient spent an additional 2.5 hours in the resuscitation room before admission to the operating room. In the resuscitation room, he had 8 units of blood transfused, with close observation for ongoing bleeding and otherwise conservative management. He later underwent a right thoracotomy, which revealed bleeding intercostal vessels. After appropriate surgical management, the patient improved, was extubated on postoperative day 3 in the intensive care unit, and reportedly continued to recover.

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