

NOTABLE CASES

Massive prehospital transfusion in multiple blunt trauma

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A 15-year-old male passenger in a motor vehicle accident was transfused 15 units of blood products and 8.5 litres of polygeline while still trapped in the wreckage. This and other advanced interventions at the scene contributed to the patient's survival. This first case report of massive prehospital transfusion highlights some of the advantages of senior physician staffed emergency medical services in the prehospital phase of trauma management. (MJA 1999; 170: 23-25)

Blood transfusion is a vital component of resuscitation in haemorrhagic shock.¹ It is not usually available in the prehospital environment due to limited availability and exclusion from the protocols of Australian ambulance services. NRMA CareFlight/NSW Medical Retrieval Service is a physician-staffed medical rescue and retrieval service operating from a base in western Sydney. Medical teams, consisting of doctors with specialist qualifications in anaesthesia, emergency medicine or intensive care medicine, or advanced trainees, and paramedic ambulance officers, are dispatched to accident scenes by road ambulance or helicopter. The scope of operations of the service has been described elsewhere.² Four units of type O, Rh negative, packed red blood cells are routinely carried to all incident scenes. We present the first published case of massive prehospital transfusion of blood products for multiple trauma. This case highlights the advantages of physician-staffed emergency medical services in prehospital trauma care.

Case history

In July 1997, a previously well 15-year-old boy was a back-seat passenger in a motor vehicle which left the road in the upper Blue Mountains in New South Wales and collided with a telegraph pole. The point of impact was between the front and rear doors on the driver's side, killing the driver instantly as the pole intruded into the passenger compartment by about 50 centimetres (Figure). The patient was directly behind the driver. The medical team was dispatched by helicopter 28 minutes after the accident, arriving on the scene 52 minutes after the injury.

The patient was trapped in a sitting position with his head protruding through the rear window. Access was limited to the head, neck, arms and part of the left chest. Observations were: conscious, with Glasgow Coma Score, 12; systolic blood pressure, 70 mmHg; respiratory rate, 40 breaths per



The motor vehicle involved in the crash. The 15-year-old boy was sitting immediately behind the driver.

minute; and heart rate, 140 beats per minute. Owing to poor peripheral perfusion, oxygen saturation by pulse oximetry could not be determined. Two 16-gauge peripheral cannulas had already been inserted by an ambulance paramedic, through which the patient had received six litres of polygeline, and a cervical collar had been placed.

As the patient was tachypnoeic, his oxygen saturation could not be measured, and he was likely to be trapped for an extended period, he was orally intubated with the assistance of suxamethonium-induced muscle relaxation. Cervical spine immobilisation was maintained by manual inline immobilisation. No induction agent was used because of the patient's profoundly hypovolaemic state and entrapment in a seated position. Tube position was confirmed by capnography and the patient was ventilated with 100% oxygen. Simultaneously, volume resuscitation was continued with four units of uncrossmatched packed red blood cells and a further one litre of polygeline over the following 15 minutes. Systolic blood pressure improved to 110 mmHg and the heart rate decreased to 100 beats per minute. As ongoing haemorrhage was suspected, further blood products were requested from a nearby small, non-trauma-service hospital; these were delivered by police vehicle. A further four units

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of uncrossmatched packed red blood cells and one litre of polygeline were administered over the next 25 minutes.

Sodium bicarbonate (100 mmol) was prophylactically administered intravenously before release of abdominal and pelvic compression 110 minutes after injury. Systolic blood pressure fell to 80 mmHg immediately following release, and resuscitation was continued with four units of uncrossmatched packed red blood cells, 500 mL of polygeline and three units of fresh frozen plasma.

Full assessment was only possible after extrication, and revealed a distended abdomen, a clinically unstable pelvic fracture and a compound fracture of the right femur with profuse venous haemorrhage. Reassessment of the chest revealed a marked decrease in expansion of the left side of the chest, and a 28-French intercostal catheter was inserted in the mid-axillary line. A small amount of blood was returned and breath sounds were subsequently symmetrical.

The patient was then transported by helicopter to the nearest trauma service hospital. Transport time was 12 minutes (the same journey by road would have taken about 50 minutes), arriving 132 minutes after injury.

On arrival at Nepean Hospital, the patient was transported directly to the operating theatre. The blood pressure could not be recorded, and only the carotid pulse was palpable. An oesophageal probe recorded a temperature of 29.5°C; heart rate was 80 beats per minute. Results of initial investigations are recorded in the Table.

Operative findings included a ruptured spleen, mesenteric tears, extensive retroperitoneal haematoma, diastasis of the pubic symphyseal and left sacroiliac joints (both by about 5 cm), a Gustilo grade IIIa fracture of the right femur, and closed mid-shaft fractures of the right tibia and fibula. Intraoperative fluids administered were 56 units of packed red blood cells, 19 units of fresh frozen plasma, 16 units of platelets, six litres of polygeline, four litres of crystalloid solution and 1.5 litres of blood via cell-saver.

Subsequent imaging revealed a small subarachnoid haemorrhage, and fractures of the left inferior pubic ramus and acetabulum, and of the left side of the sacrum. Sacroiliac joint widening was also noted on the right side. The Injury Severity Score (which is calculated from the three highest injury scores in predetermined regions of the body), calculated with the Abbreviated Injury Score, 1990 edition, was 43 (a score of 16 or greater from a maximum 75 indicates severe injury).³⁻⁵ The probability of survival by TRISS methodology (which combines the Revised Trauma Score [in this case, calculated from the first recorded prehospital data], the Injury Severity Score, the patient's age, and whether the injury was blunt or penetrating) was 0.165.³⁻⁵

The total intensive care unit stay was 88 days, with ventilation required for 50 days. Complications included necrosis of the rectus abdominis muscles requiring excision, acute

tubular necrosis requiring haemodialysis for 33 days, hepatic failure, gangrenous cholecystitis, a subphrenic abscess, sepsis requiring inotropic support, and adult respiratory distress syndrome.

The patient was discharged to the rehabilitation unit on Day 221, neurologically intact apart from left leg neuropraxia.

Discussion

There is no consistent definition of massive transfusion; it has been variously described as replacement exceeding two times the estimated blood volume,⁶ more than 10 units transfused in 24 hours,⁷ or 20 or more units transfused in total.⁸ We are unaware of any previously published case reports of

massive prehospital transfusion by any of these definitions.

There are no human studies evaluating the efficacy of transfusion in the prehospital setting, and the role of volume replacement remains controversial in this context. In uncontrolled haemorrhage associated with penetrating trauma, there is evidence that prehospital resuscitation to normotension with crystalloid solutions may decrease survival.⁹ This has been assumed to be due to increased haemorrhage, but evidence from animal models of uncontrolled haemorrhagic shock indicate that haemodilution is also a major contributor to mortality

and that early blood administration results in less acidosis and improved survival.¹⁰⁻¹² There are no human studies examining this issue in blunt-trauma patients. Volume replacement to normotension with use of packed red blood cells after two litres of crystalloid infusion remains the current recommendation in blunt trauma.¹

Coagulopathy is common after massive transfusion and is associated with a high mortality rate, suggesting that an aggressive approach to clotting factor and platelet replacement is also warranted.⁶

One study has examined the safety of prehospital transfusion of uncrossmatched O-negative packed red blood cells.¹³ Of 112 patients who received prehospital transfusions for trauma, no adverse events directly related to the transfusion were documented.

The survival rate following massive in-hospital transfusion for blunt trauma varies between 0 and 52%,^{6,8} with most survivors having excellent outcomes, three-quarters ultimately returning to employment. Predictors of increased mortality include shock on admission, closed head injury, age, acidosis, hypothermia, and clinical coagulopathy.^{8,14}

Our patient was markedly hypothermic on arrival at the trauma centre. Contributing factors were the low ambient temperature of 7°C at the scene, hypovolaemia, and rapid infusion of large volumes of cold fluids. Blood, unlike most crystalloid and colloid solutions, must be kept refrigerated and rewarmed immediately before use. Traditional methods

Relevant laboratory findings (normal ranges) on admission for 15-year-old male patient injured in motor vehicle accident

Haemoglobin (g/dL)	5.7 (13.5-18)
Platelets (10 ⁹ /L)	48 (150-400)
International normalised ratio of prothrombin time	3.2 (0.8-1.3)
Activated partial thromboplastin time (s)	> 150 (23-35)
pH	6.80 (7.35-7.45)
HCO ₃ (mmol/L)	12.5 (22.0-33.0)
Pco ₂ (mmHg)	53.1 (35.0-45.0)
Po ₂ (mmHg)	184.5 (83.3-100.0)
Base excess	-17.3 (-2 to +2)

of prehospital fluid warming, such as placing the fluid bags under the axilla of the rescuers or on the bonnets of vehicles, are inadequate with rapid infusion of large volumes, and no practical technique currently exists to rapidly warm blood at the roadside. Inline microwave warming of fluids may eventually provide a portable means of rapidly warming blood at high flow rates.^{15,16}

Conclusion

Blood transfusion in the prehospital phase of trauma management can be lifesaving, particularly where rapid access to definitive care is not possible due to distance or entrapment. This incident highlights the value of dispatching senior physician staffed emergency medical services equipped with packed red blood cells to hypovolaemic blunt-trauma patients where the patient is more than 30 minutes from a trauma centre because of either distance or entrapment.

Acknowledgements

We would like to thank the members of the NSW Ambulance, Police and Fire services whose efficient and well coordinated actions at the accident scene significantly contributed to the patient's survival.

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(Received 7 May, accepted 6 Oct 1998)



Book Review

Mind over matter

Abnormal illness behaviour. Issy Pilowsky. Chichester: John Wiley & Sons 1997 (xi + 265 pp., \$85.00). ISBN: 0 471 965731

With the long-overdue emphasis on communication skills in medical education now being specifically addressed in the graduate medical programs, the publication of this scholarly and eminently readable book on abnormal illness behaviour is opportune. It is to Pilowsky's credit that he makes both the clinician and educated layman question prior concepts and biases surrounding such nosology as hypochondriasis, hysteria, somatisation, and that dreaded term "malingering".

Pilowsky discusses the resistance to a psychological approach to abnormal illness behaviour seen in many patients, therapists and, indeed, many families interviewed in diverse clinical settings. He addresses the consultation-liaison issues particularly well in relation to chronic pain and chronic multisystem disease, emphasising the importance of the content and structure of the doctor-patient and doctor-relative interview. The occupational health and medicolegal implications of overuse syndrome, chronic fatigue syndrome and other "illness

affirming" syndromes are also highlighted in this comprehensive book.

I was impressed by the five topics emphasised as ingredients in the "explanatory therapy" used to help patients understand the relationship between their emotions and their physical symptoms. Judging by Pilowsky's critically argued theoretical and practical commentaries, including many useful case histories, this is an important theme. The five ingredients include provision of accurate information, helping a patient to understand his selective perception on anticipated events, unlearning the focusing on certain bodily sensations, clarification of misunderstandings in doctor-patient communications, and the need to repeat the transmission of information in digestible amounts.

Unfortunately, while Pilowsky's "wish list" for the treatment of abnormal illness behaviour includes many attainable goals between doctor and patient, the development of such "explanatory therapy" treatment programs in mixed specialty units or abnormal illness behaviour units may be an unattainable goal in Australia given the current economic rationalism prevailing in our healthcare system.

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