Uncross-matched red blood cells save lives

John R Hess

Haemorrhage is the second leading cause of death among patients with severe traumatic injury (Sauaia et al, 1995). It is also their most preventable cause of death, since blood loss can frequently be stopped and lost blood replaced. However, timing is critical. Eleven per cent of the red blood cells (RBC) used in acute trauma care are used in the first hour before cross-matched blood is available (Como et al, 2004). Using group O RBC in the first hour is associated with the survival of more than half of the most severely injured patients who reach a trauma centre alive.

Concerns about the emergency use of uncross-matched group O RBC are:

1. The safety of 'universal donor' blood in patients with preformed antibodies
2. The safety of any blood compared to possible alternative treatments
3. The need for RBC in the early phases of resuscitation
4. The possibility of alloimmunizing recipients to the Rhesus (Rh) factor D and other blood antigens.

Experience at the R Adams Cowley Shock Trauma Center of the University of Maryland Medical Center, Baltimore, MD, USA and other published information is reviewed to address these concerns.

NUMBERS OF INJURED PATIENTS TRANSFUSED

One out of every 100 Americans is admitted to a hospital each year for injury (about 2.7 million admissions annually) and about 200 000 of those patients received blood (Vamvakas, 1996). More than 1.5 million units of RBC are used to treat the victims of injury – about 12–15% of all RBC used. Each year, 93 000 Americans die from traumatic injury.

The R Adams Cowley Shock Trauma Center is the oldest and largest institution in the USA specializing in the care of life-threatening acute trauma and is the primary adult referral centre for the nation's largest integrated trauma care system. In 2000, about 7200 patients were admitted to the Center, including 5645 patients admitted directly from the scene of injury. Because this latter group represents 'fresh' trauma cases, the main consumers of blood products, their patterns of blood use were analysed (Como et al, 2004).

Only 9% of directly admitted trauma patients received any blood product, and 22% of those transfused received two units of RBC or less. Most uncross-matched group O RBC were given to seriously injured (mean injury severity score = 34) young men (mean age 33 years, 72% males) who went on to receive more than 20 units of RBC. Fifty-five per cent of such patients survived. Those who received only a few units of RBC included those presenting *in extremis* who died before more blood could be given, as well as those who presented with fatal injuries but were stabilized with blood products to become organ donors.

THE SAFETY OF 'UNIVERSAL DONOR' RBC IN PATIENTS WITH PREFORMED ANTIBODIES

About 12 people per year die in the USA of acute haemolytic transfusion reactions. In England and North Wales, 3 people died of acute haemolytic reactions in 2 years (1986–1987) (Williamson et al, 1999). All of these acute haemolytic reactions were caused by ABO blood group incompatibility and therefore were preventable by giving group O RBC. Preformed antibodies to minor antigens are rare in young trauma patients and rarely cause fatal reactions.

THE SAFETY OF BLOOD COMPARED TO POSSIBLE ALTERNATIVE TREATMENTS

Most trauma patients do not need blood and do well with modest volumes of saline or colloid solutions. In modern trauma centres with readily available and rapid imaging technology, the number of patients who receive blood unnecessarily is falling. Alternative oxygen carriers are under development but have yet to be proven safe and effective.

Given modern screening and processing techniques, blood is extremely safe, but it does cause mortality and morbidity. However, even the highest estimates of blood-related mortality from large retrospective studies are an order of magni-

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tude lower than the proportion of severe trauma patients that blood appears to save.

THE NEED FOR RBC IN THE EARLY PHASES OF RESUSCITATION

It is possible to resuscitate young individuals with large volumes of asanguineous solutions. This method was widely used during the Vietnam War. Even after the replacement of 1.5 blood volumes, there are often enough RBC to support oxygen transport. However, these patients do become haemodilute and coagulopathic. It is now recognized that immediate resuscitation to maintain blood pressure in the normal range is not required for most trauma patients. However, about 100 of the most severely injured patients seen each year in a large trauma centre appear to benefit from a different approach consisting of 'damage-control' surgery, early use of blood products to limit coagulopathy and staged reconstruction. Only a single small study (Rotondo et al, 1993) supports this concept, but it has become the standard of care in American trauma centres because alternative approaches are associated with very high mortality.

KEY POINTS

- 11% of red cells used in the first hour before cross-match is available are group O, and are associated with survival of over half of seriously injured patients who reach a trauma centre alive.
- Only 9% of trauma patients admitted directly from the scene of injury get blood or blood products, and 22% of those get 2 units or less of red cells.
- ABO incompatibility causes 12 deaths per year in the US and is preventable by using group O blood.
- Even the highest estimates of blood-related mortality are an order of magnitude lower than the proportion of severe trauma patients that blood appears to save.

ALLOIMMUNIZING RECIPIENTS TO RH FACTOR D AND OTHER BLOOD ANTIGENS

In the US, one person in seven is Rh negative. Using Rh-positive blood for all males and women over 50 years of age, 10 Rh-negative individuals were exposed to Rh-positive RBC in the course of care and alloimmunized one. The appearance of the alloantibody occurred 1 month after exposure when the patient was recovered. No Rh-negative women of child-bearing age were exposed despite maintaining only 2 Rh-negative RBC units in the trauma centre.

CONCLUSIONS

Trauma care physicians and surgeons are sensitive to the issues concerning blood safety and have found ways to restrict its use to a small fraction of trauma patients. In this care, uncross-matched group O RBC play a life-saving role for about 85 patients a year in the author's centre. HM

Conflict of interest: none

Como JJ, Dutton RP, Scalea TM, Edelman BB, Hess JR (2004) Blood transfusion rates in the care of acute trauma. *Transfusion* **44:** 809–13

Rotondo MF, Schwab CW, McGonigal MD et al (1993) 'Damage control': an approach for improved survival in exsanguinating penetrating abdominal injury. *J Trauma* **35**(3): 375–82

Sauaia A, Moore FA, Moore EE, Moser KS, Brennan R, Read RA, Pons PT (1995) Epidemiology of trauma deaths: a reassessment. *J Trauma* **38:** 185–93

Vamvakas EC (1996) Epidemiology of red blood cell utilization. *Transfus Med Rev* **10:** 44–61

Williamson LM, Lowe S, Love EM et al (1999) Serious hazards of transfusion (SHOT) initiative: analysis of the first two annual reports. *Br Med J* **319**(7201): 16–19