T activation haemolysis and death after blood transfusion

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SUMMARY A 30 week gestation infant developed necrotising enterocolitis associated with *Clostridium perfringens* septicaemia at 3 weeks of age. He responded to treatment with intravenous fluids, antibiotics, and blood, but his blood haemolysed. Because of anaemia further blood was given, but, within minutes he died.

Examination of his red cells showed an increase in T activation.

The T antigen is present in an occult form on all human cell surfaces. It may be shown by receptor destroying enzymes—for example, neuraminidase—which strips N-acetyl-neuraminic acid from the red cell surface, a process known as T activation. This can occur during anaerobic infections, particularly those caused by clostridium species. T activation can be detected using the peanut lectin test:¹ a saline extract of the peanut (*Arachis hypogea*) strongly agglutinates T activated red cells. The test can be carried out rapidly on slides at room temperature. The T antibody (anti-T) is a naturally occurring IgM antibody in adult sera, though it is not usually present in the serum of newborn infants and young children. If T activation occurs in neonates, transfusion of plasma products containing anti-T may cause or exacerbate severe or fatal haemolysis.

Case report

The infant was the second of twins delivered by

emergency lower segment caesarean section at 30 weeks' gestation for an antepartum haemorrhage due to placenta praevia. Birth weight was 1580 g. He required intensive resuscitation and developed idiopathic respiratory distress syndrome which necessitated mechanical ventilation for four days. He had an umbilical artery catheter for eight days.

By the third week of life he was making good progress and gaining weight on nasogastric feeds. There was a sudden deterioration on day 20 when he passed a bloody stool. Necrotising enterocolitis was confirmed by x-ray and *Clostridium perfringens* was isolated from cultures of blood, stool, and skin. Haemoglobin concentration was 11.5 g/dl and spherocytosis was seen on the blood film. He was initially treated with intravenous fluids, 5% albumin solution (plasma protein fraction), antibiotics, and mechanical ventilation, and when given fresh frozen plasma and red cells in optimal additive. He had improved by the next day, but there were signs of increasing haemolysis; in 12 hours, his haemoglobin concentration fell from 12.7 g/dl to 8.8 g/dl with severe spherocytosis and his serum bilirubin concentration rose from 100 to 230 µmol/l. He developed gross haemoglobinuria. A transfusion of plasma reduced blood was started, but within minutes he collapsed and resuscitation was unsuccessful. Necropsy confirmed the diagnosis of necrotising enterocolitis affecting the colon and terminal ileum without perforation.

Repeat examination of the blood used for transfusion showed no incompatibility with the infant's

Table Relation between clinical course and anti-T titre in blood products

Day	Time (hrs)	Clinical event	Anti-T titre of blood product* given	Haemoglobin concentration (g/dl)	Serum bilirubin concentration (µmol/l)	T-Cell status*
20	0900	Necrotising enterocolitis diagnosed	18 ml plasma protein fraction (O)	11.5		Negative
	1930			9.3		Weak positive
	1945		15 ml fresh frozen plasma (1/8)			
			21 ml red cells in optimal additive (1/4)			
21	0800	Clinically improved		12.7	100	Strong positive
	2000	Increasing haemolysis		8.8	230	
22	0100		Plasma reduced blood (1/16)			Strong positive
	0105	Collapse death				

*T cell status: T activation of infant's red cells shown by testing with peanut lectin; *tests done by two hour incubation in tubes v strongly T activated cells.

blood and the direct antiglobulin test (Coombs) remained negative. Using the peanut lectin test, however, increasingly strong T activation of the infant's red cells was shown. The Table summarises the clinical course and shows the titre of anti-T in the various blood products used.

Discussion

Did this infant die from acute haemolysis due to T antibody in the donor blood? T activation *in vivo* is uncommon and usually of no clinical importance, though it interferes with blood grouping tests. It has, however, rarely been associated with complement mediated haemolysis in infants, either spontaneously or through blood transfusion. Seger *et al* in 1979 stressed the potential hazards of blood and exchange transfusion in patients with necrotising enterocolitis caused by clostridia.² They suggested that the T antigen titre should be checked in all such cases and if positive, that the blood products be avoided. Washed red cells, suspended in plasma protein fraction, should be used.³ A subsequent study reported T activation in 16 children with severe anaerobic infection, including eight with necrotising enterocolitis.⁴ Novak found T activation in four of 20 consecutive cases of necrotising enterocolitis, but usually associated with more extensive disease and septicaemia.⁵ Severe haemolysis occurred in two infants who had previously received products containing plasma. Other authors have also described fatal haemolysis exacerbated by blood transfusion in infants with Gram negative sepsis and T activated red cells.⁶

Weak T activation was detected in our patient within 12 hours of the onset of necrotising enterocolitis and clostridial septicaemia. The reaction

became more strongly positive after the first blood transfusion, but clinical haemolysis did not occur until 24 hours later. Within minutes of starting the second transfusion the infant collapsed and died.

In spite of earlier reports we had previously been unaware of the potential hazards of blood transfusion in patients with necrotising enterocolitis. T activation can be detected quickly and easily with peanut lectin, and we suggest that this should be done before blood transfusion in all infants with necrotising enterocolitis or severe sepsis due to anaerobic organisms. If T activation is confirmed then blood and plasma products containing T antigen must be avoided.

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