27 Paediatric Cases

Author: Helen New

Definition:

Paediatric cases comprise all those occurring in patients under 18 years of age. This chapter analyses the data on paediatric cases from the other chapters in this annual report. All the cases are also included in the data in their respective chapters. All children <18 years of age are included and have been subdivided by age groups: neonates ≤28 days; infants >28 days and <1 year old; and children ≥1 year to <16 years.

Table 27.1: Summary of paediatric cases 2012

Category of case	No ≤28 days	No > 28 days to <1 year	No 1 to <16 years	No 16 to <18 years	Total paediatric cases
Incorrect blood component transfused (IBCT)	8	4	22	3	**37**
Avoidable, delayed or undertransfusion (ADU)	5	1	6	1	**13**
Handling and storage errors (HSE)	3	4	6	3	**16**
Anti-D related	0	0	1	7	**8**
Acute transfusion reactions (ATR)	2	2	22	2	**28**
Alloimmunisation (Allo)	0	0	0	1	**1**
Transfusion-related acute lung injury (TRALI)	0	0	1	0	**1**
Transfusion-associated dyspnoea (TAD)	0	0	0	1	**1**
Transfusion-associated graft vs host disease (TA-GvHD)	1	0	0	0	**1**
Transfusion-transmitted infections (TTI)	0	0	1	0	**1**
Unclassifiable complications of transfusion (UCT)	2	0	0	1	**3**
Total	**21**	**11**	**59**	**19**	**110**
Near miss (NM)	40	10	26	8	**84**
Right blood right patient (RBRP)	6	1	2	0	**9**

Note: There were no paediatric cases from the other chapters, so those headings are omitted from table. Near miss and RBRP numbers are shown separately.

General trends

The overall number of paediatric reports is similar to the last three years, and appears to have plateaued since 2009 (see analysis in SHOT 2011 report). For 2012, paediatric cases were 110/1645 (6.7%) of total SHOT reports, and 203/2767 (7.3%) if NM and RBRP are included. For 2012, the main difference was a striking reduction in the number of ATR reports, to 28 (25.5% of paediatric reports) from ≥ 48 for the last 2 years, partly due to the withdrawal of several mild ones as the definition has changed. Following from this, the proportion of error-related reports (IBCT, HSE, ADU and anti-D) increased to 67.3% (74/110) of paediatric reports (50.4%, 60/119, in 2011). A total of 26/74 (35.1%) errors originated primarily in the laboratory (6 wrong blood component transfused, 15 specific requirements not met, 3 handling and storage errors, 1 avoidable, delayed or undertransfused, 1 anti-D), a similar number to 2011. Transfusion of an incorrect blood component remained a significant proportion of paediatric reports, at 33.6% (37/110) for 2012, and this percentage is higher for paediatric than for total reports (Figure 27.1).

There was a fatal case of transfusion-associated graft versus host disease (TA-GvHD), discussed in detail in Chapter 20, with significant implications for fetal transfusion practice in urgent situations. No further reports to SHOT of suspected transfusion-associated necrotising enterocolitis (NEC) were received.

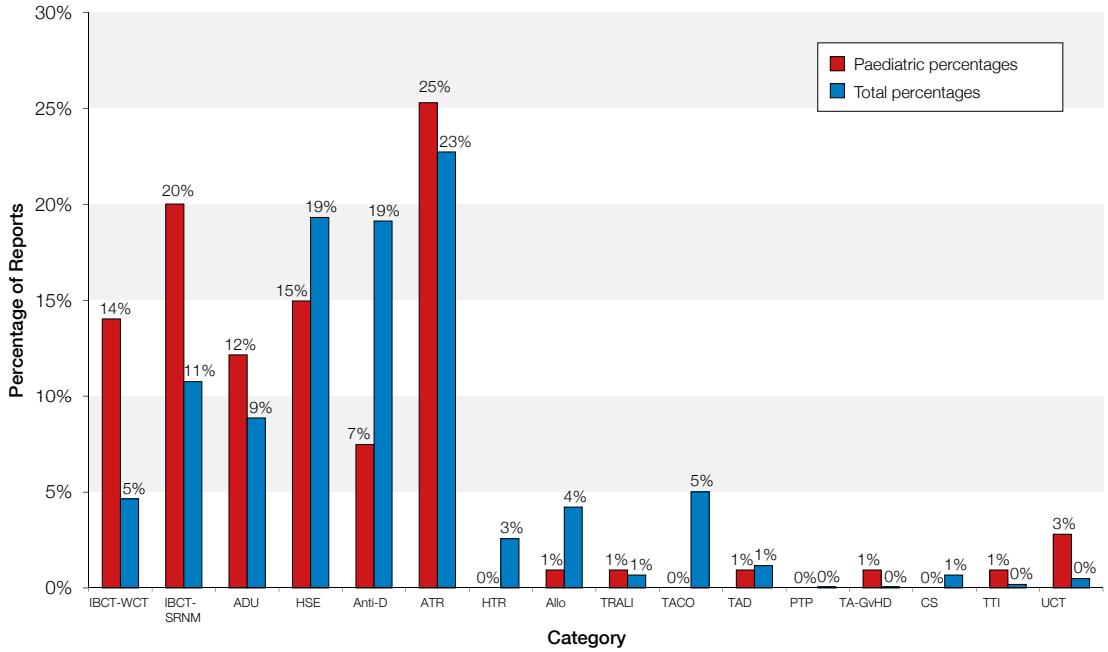


Figure 27.1: Percentages of paediatric and total reports in each category

Deaths and major morbidity

Deaths due to transfusion n=1 (TA-GvHD)

There were 5 other paediatric patients reported who died unrelated to the transfusion. Two neonates died following, but probably not due to, delay in provision of blood; two 1 month old infants given components of the wrong group both died; a newborn transfused with non-irradiated blood following an intrauterine transfusion also died, but of other causes.

Major morbidity n=8

One infant was overtransfused to an Hb of 270 g/L and required transfer to intensive care. One child with sickle cell anaemia developed infection with parvovirus and there were 6 severe acute transfusion reactions.

ERROR-RELATED REPORTS n=74

Incorrect blood component transfused (IBCT) n=37

Category of case	No ≤28 days	No > 28 days to <1 year	No 1 to <16 years	No 16 to <18 years	Total paediatric cases
IBCT wrong component transfused (IBCT WCT)	**6**	**4**	**5**	**0**	**15**
IBCT WCT Clinical	*5*	*1*	*3*	*0*	***9***
IBCT WCT Laboratory	*1*	*3*	*2*	*0*	***6***
Specific requirements not met (SRNM)	**2**	**0**	**17**	**3**	**22**
Irradiated	*2*	*0*	*6*	*1*	***9***
CMV negative	*0*	*0*	*1*	*1*	***2***
MB-FFP	*0*	*0*	*8*	*0*	***8***
Others	*0*	*0*	*2*	*1*	***3***
Total	**8**	**4**	**22**	**3**	**37**

MB: Methylene blue-treated; CMV: cytomegalovirus.

Table 27.2: Breakdown of incorrect blood component transfusion reports

IBCT-wrong component transfused (WCT) n=15

IBCT-WCT clinical error n=9

There were 5 reports where the incorrect component was given for fetal/neonatal transfusions. Three of these were the use of non-irradiated neonatal paedipacks for fetal transfusion rather than the specific intrauterine transfusion (IUT) component. This occurred in urgent clinical situations as a result of complex communication difficulties between the several specialist units involved in each case and a lack of understanding of the availability of IUT components from the Blood Services at short notice. While neonatal paedipacks may be appropriate components to choose in a life-threatening emergency, this use of components other than IUT red cells should be specified by local protocols (see recommendations below). The other two reports involved use of obstetric emergency adult O RhD negative blood for neonatal resuscitation. One was a case of poor communication: the midwife thought that the blood was being requested for the mother, not the baby.

There were 4 bedside errors in older infants and children. A 2 month infant was given a paedipack labelled for another patient. A 1 year old child in paediatric intensive care (PICU) needing emergency extracorporeal membrane oxygenation (ECMO) was given red cells intended for another patient; the identity band was missing and the checking procedure not carried out properly. A 14 year old haemopoietic stem cell transplant (HSCT) patient was given group O platelets post transplant when they should have had group A according to the donor group; the HSCT protocol had not been communicated to the laboratory. A 15 year old with thalassaemia major was given group A red cells instead of group O (see Chapter 9 for incorrect blood component transfused and Chapter 8 for the root cause analysis).

IBCT-WCT laboratory error n=6

A neonate requiring an exchange transfusion was given irradiated, CMV negative standard red cells rather than neonatal exchange units as the laboratory biomedical scientist (BMS) did not know how to request the appropriate component.

Case 1: Provision of incorrect red cells for neonatal exchange transfusion

A 1 day old neonate diagnosed with haemolytic disease of the newborn due to ABO incompatibility (mother group O RhD negative, baby group A RhD positive) required an exchange transfusion for rising bilirubin levels. The BMS ordered 2 units of group A RhD positive CMV negative, irradiated standard red cells without realising either that exchange transfusion units should have been requested or that group A was not compatible with the maternal group. Following the exchange, the bilirubin level had improved although was still high.

There were 4 cases where the wrong component was selected. One was related to the age of the patient: a 1 month infant in A&E, blood group A, was given group A blood without checking the maternal record as it was thought that the baby was 1 year old. A 1 month RhD negative male infant was given RhD positive blood, a 2 year old child post HSCT was given group O (his original group) platelets instead of group A (donor group) post engraftment. Finally, a 15 yr old, group A, with a ruptured hepatic artery following major trauma was given 4 units group AB solvent-detergent FFP (SD-FFP) then needed more FFP. Whilst awaiting the order, he was given 2 units of group A and 2 of group O SD-FFP (therefore incompatible) in preference to standard non pathogen-inactivated FFP of the correct group which would have been appropriate for an emergency.

There was one testing error resulting in the issue of SD-FFP of the incorrect group to an infant.

Case 2: Failure to follow standard operating procedures led to transfusion of ABO incompatible SD-FFP

A 1 month old preterm female infant was transferred urgently with suspected bowel perforation. Only one valid patient sample was received and tested by the laboratory due to mislabelling of the second. The patient grouped as O RhD negative and was given group O SD-FFP on the basis of clinical urgency. On subsequent testing of a further sample mixed field reactions were obtained. Investigation revealed the patient had received multiple group O red cell transfusions at another hospital and her true group was AB RhD positive. Local policy when a single sample has been received was to use the laboratory information management system to permit the issue of group O red cells and group AB plasma only and this was not followed.

Early communication between the transferring and receiving hospital laboratories would have helped to prevent the transfusion of the incorrect group. As this case was an infant less than 4 months of age, information on maternal group and antibody status, infant group and any prior transfusion should have been requested.

IBCT – specific requirements not met (SRNM) n=22

The number of SRNM cases increased from 15 in 2011. Most of these errors, 15/22, originated primarily in the laboratory and 7 were categorised as clinical, although many of the reports demonstrated missed opportunities for detection or prevention at several steps including checking against the prescription chart or specific requirements form. There were 9 reports where irradiated components were not given and note in addition the three non-irradiated paedipacks given for IUTs included as part of the IBCT chapter (Chapter 9). Two were neonates, both following IUT, and in only one case was the laboratory informed of the previous IUT. There were no reports of adverse outcome including for one patient multiply transfused with non-irradiated blood (Case 3).

Case 3: Repeated transfusion of non-irradiated blood to an oncology patient

A 2 year old oncology patient was treated with cladribine (a purine analogue) and given non-irradiated red cells on 19 occasions over a 7 month period. The error came to light when the shared care hospital checked the specific requirements having received conflicting discharge letters from the oncology centre.

There were 8 cases of laboratory failure to provide appropriate pathogen-inactivated plasma, either methylene blue-treated (MB) (7 cases; 1 cryoprecipitate, the others FFP), or SD-FFP (1 case). Some reports commented that the BMS failed to notice the date of birth of the patient and there was no flag on the computer system.

Two patients with sickle cell disease were given inappropriate components. In one case the date of birth was misread and the child was given an uncrossmatched neonatal paedipack, and the other patient was not fully phenotyped and was given a unit of red cells that was not fully matched for the complete Rh phenotype. A 17 yr old with thalassaemia major was given C^w positive red cells despite having a historic anti-C^w. Two children were erroneously given CMV unscreened blood (prior to the changes in policy recommended in 2012 by SaBTO[47]).

Avoidable, delayed or undertransfusion n=13

There were 5 cases of delay in provision of urgent blood, including to 3 newborn babies. One of these infants was born pale and died following an undiagnosed placental abruption. The on-call BMS could not be contacted due to bleep failure but it was thought unlikely that this delay affected the outcome. A 12 year old had some delay in surgery in theatre because three separate mislabelled samples had been sent to the laboratory, including the first from the preadmission clinic. Emergency O RhD negative blood was used while awaiting group-specific blood. A 14 year old had a major haemorrhage in theatre which contributed to a cardiac arrest, and the blood was not immediately available as the portering staff had not transferred it from main blood refrigerator to theatre.

Three paediatric patients were unnecessarily transfused: two neonates, one with platelets and the other with FFP. The platelet count had been reported as 13 x10^9/L, but platelet clumps on the film had been missed, making the count invalid. The FFP was transfused on the basis of an erroneous INR result of 4.4, whereas the true result on retesting the sample was 1.2. A 17 year old was transfused on the basis of another patient's results following a miscommunication and lack of checks.

Five children aged 8 months to 3 years were transfused excessive volumes, 4 of which were due to erroneous prescription, and 1 where 195 mL were prescribed for a 1 year old but the whole unit of 272 mL was given. A 3 year old with haemorrhage from a chest drain and Hb of 79 g/L was prescribed 2 adult units of blood and the post-transfusion Hb was 179 g/L. A 1 year old was overtransfused to a Hb of 270 g/L, resulting in admission to intensive care (Case 4).

Case 4: Massive over transfusion of 1 year old child

The child (weighing 10 kg) with a gastrostomy inserted a few days previously was brought into A&E, pale but alert, following an episode of vomiting blood. His Hb was 98 g/L. He was wrongly diagnosed as having an acute arterial bleed, a major haemorrhage alert was put out and O RhD negative blood requested. The blood was incorrectly prescribed in units rather than mL/kg and he was given a total of 4 units (1122 mL), the first 3 given at a rate of a unit per 20 minutes, and subsequently continuing to receive the 4th unit despite normalisation of his heart rate and blood pressure. He was taken to theatre, found to have no evidence of fresh bleeding in his stomach, and a Hb of 270 g/L. Attempted venesection was difficult and only removed 40 mL blood. He required transfer to a paediatric intensive care unit and made a full recovery.

This case illustrates incorrect prescription by units not mL (he should have only been prescribed 20 mL/kg blood in the first instance) and lack of appropriate clinical reassessment in the emergency situation, allowing continuing over-transfusion.

Handling and storage errors (HSE) n=16

Four of the HSE reports involved problems with pumps or 3-way taps such that blood was either given in an inappropriate volume, rate, or into a saline bag and not the patient. Most of the other reports, including cold chain errors, technical transfusion errors and excessive time to transfuse were unrelated to the recipient being a child and are included in Chapter 14 (Handling and Storage Errors).

Anti-D n=8

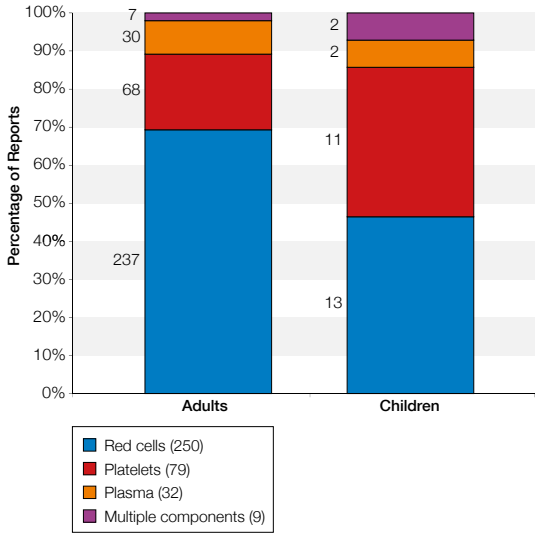
These cases are covered in more detail in the anti-D chapter (Chapter 15). From the paediatric point of view, there was a report of an RhD negative 4 year old girl with acute lymphoblastic leukaemia who was not given anti-D Ig to prevent possible sensitisation following transfusion of a unit of RhD positive platelets.

TRANSFUSION REACTIONS n=36

Acute transfusion reactions (ATR) n=28

The number of acute transfusion reactions has fallen markedly since the 48 in 2011, particularly due to a drop in reports of allergic and febrile reactions to platelets from 26 to 11 (all apheresis platelets). This is partly due to the change in definition (see Chapter 16) and withdrawal of mild cases this year. Paediatric ATRs made up 7.5% (28/372) of all ATR reports and as before had a lower proportion of reactions to red cells than for adults (Fig 27.2a). The paediatric ATRs were classified according to the updated SHOT definitions[23] (see also Chapter 16) and of the 27 that could be classified, 6 (22.2%) were severe and 21 (77.8%) were moderate.

a. Comparison of proportions of adult and paediatric ATRs due to different components.



b. Percentages of reaction types for each component for paediatric reports.

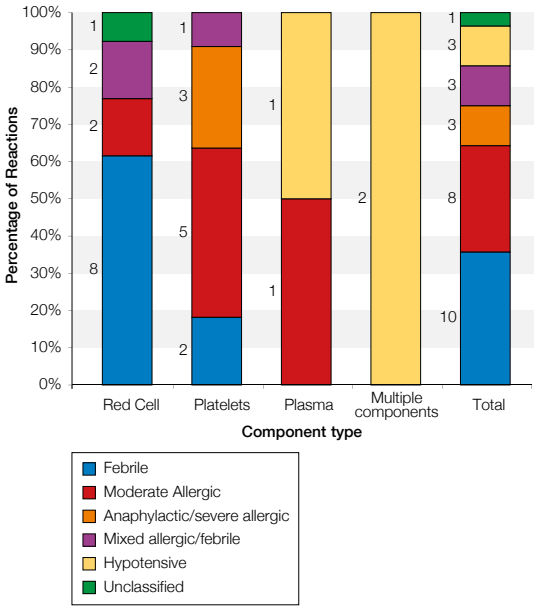


Figure 27.2: Paediatric ATR reports

Despite the fall in the number of reactions to platelets, these remain the most common cause of allergic reaction reports in children, and the only three cases of severe allergic/anaphylactic reactions were to platelets (Fig 27.2b, Table 27.3). There were 4 cases with reactions to plasma (3 FFP, 1 cryoprecipitate), two of which were combined transfusions with FFP and platelets. As one of the FFP transfusions was, in error, with non pathogen-inactivated standard plasma alone (to a 15 yr old), there were only 3 reports of reactions to MB-plasma: two to MB-FFP and one to MB-cryoprecipitate. The MB-plasma reactions were all severe hypotensive reactions which could also be associated with the underlying clinical conditions. Two were in neonates undergoing cardiac surgery and the third was a 13 month old with meningococcal sepsis who also received and reacted to SD-FFP (see also Chapter 16, Acute Transfusion Reactions).

Reaction	Red cells	Platelets	Plasma	Mixed	Total
Febrile	8	2	0	0	**10**
Moderate allergic	2	5	1	0	**8**
Anaphylactic/severe allergic	0	3	0	0	**3**
Mixed febrile and allergic	2	1	0	0	**3**
Hypotensive	0	0	1	2	**3**
Unclassified	1	0	0	0	**1**
Total	**13**	**11**	**2 (1 FFP, 1 cryo)**	**2 (FFP + plts)**	**28**

Table 27.3: Type of reaction for each component for paediatric reports classified as in ATR chapter (Chapter 16)

Case 5: Severe ATR to multiple components in a child with meningococcal sepsis

A 13 month old child with disseminated intravascular coagulation secondary to meningococcal sepsis was given platelets and FFP to support insertion of central lines. The child reacted to SD-FFP, then to MB-FFP, to IgA-deficient FFP and also to platelets, including platelets suspended in platelet additive solution. He reacted with severe hypotension, requiring fluids and increasing doses of noradrenaline. There were no reactions to red cells and IgA levels were normal. This case illustrates the great difficulty in treating patients who react to all plasma components.

Alloimmunisation n=1

There was a single case, a 17 year old renal patient who developed anti-Lu^{a} post transfusion.

Transfusion-related acute lung injury (TRALI) n=1

There was a report of suspected TRALI in a 3 year old oncology patient who became breathless an hour into the transfusion and who had bilateral ground-glass opacification throughout the lung fields on the chest X-ray. The case was classified as possible TRALI as although the clinical picture was consistent, the donor was negative for HLA and HNA antibodies.

Transfusion-associated dyspnoea (TAD) n=1

A 17 year old developed pulmonary oedema during platelet transfusion in association with cardiac surgery (see Chapter 26, TAD).

Transfusion–associated graft versus host disease (TA-GvHD) n=1

A neonate was born with TA-GvHD following emergency intrauterine transfusion using maternal blood. The case and its implications for recommendations are discussed fully in Chapter 20 (TA-GvHD).

Transfusion-transmitted infections (TTI) n=1

A 9 year old with sickle cell disease developed parvovirus related to red cell transfusion (see Chapter 21, TTI).

Unclassifiable complications of transfusion (UCT) n=3

There were 3 reports of unclassified cases, as discussed in Chapter 23 (UCT). One was a neonate, reported as having possible mechanical haemolysis, but this is considered unlikely.

COMMENTARY

There were several examples of transfusion to fetuses or neonates using blood that was not the optimal specific component that could have been provided by the Blood Services. Most of these occurred in urgent or emergency situations and sometimes it is appropriate to provide a suitable alternative in a life-threatening emergency.

Learning point

- Some of the cases illustrate a need for improved local protocols and communication to ensure clear pathways for urgent provision of blood which is appropriate for neonatal and fetal recipients (see also Chapter 20 – TA-GvHD)

There were several cases where irradiated components were not given. Clinicians should be familiar with irradiation guidelines[48] including knowledge about the individual immunosuppressive drugs for which irradiation is recommended.

Two cases of significant overtransfusion following prescription in units, not mL/kg illustrate ongoing problems with paediatric blood prescription by medical staff. One of these occurred during an emergency situation and was compounded by lack of appropriate clinical reassessment.

Learning point

- Prescribing of blood components for children should be done in mL/kg with particular care to ensure appropriate volumes are transfused[27]

Recommendations

- Hospital transfusion teams and clinical specialists should review local protocols and communication pathways for emergency provision of blood for fetal and neonatal transfusion

Action: Hospital Transfusion Teams, British Maternal and Fetal Medicine Society (see also Chapter 20: TA-GvHD for further details)

- Appropriate paediatric transfusion volumes and prescriptions should be the focus of ongoing education in hospitals, particularly in situations of emergency transfusion, such as accident and emergency departments

Action: Hospital Transfusion Teams, Accident and Emergency Department Leads

Recommendations from previous years are available in the Annual SHOT Report 2012 Supplement located on the SHOT website, www.shotuk.org under SHOT Annual Reports and Summaries, Report, Summary and Supplement 2012