8. Inappropriate and Unnecessary Transfusion (I&U)

Definition

- Inappropriate and unnecessary transfusions are those given on the basis of erroneous, spurious or incorrectly documented laboratory results for haemoglobin, platelets and coagulation tests.
- Transfusions given as a result of poor understanding and knowledge of transfusion medicine, such that the decision to transfuse puts the patient at significant risk or is actually harmful.
- Under-transfusion or delayed transfusion resulting in poorer patient outcome.

DATA SUMMARY

Total number of cases	**92**	*Implicated components*		*Mortality/morbidity*	
		Red cells	**68**	Deaths due to transfusion	**0**
		FFP	**7**	Deaths in which reaction was implicated	**1**
		Platelets	**11**	Deaths in which reaction possibly contributed	**1**
		Cryoprecipitate	**4**	Major morbidity	**2**
		Red cells and platelets	**2**		

Gender		*Age*		*Emergency vs. routine and core hours vs. out of core hours*		*Where transfusion took place*	
Male	**35**	18 years+	**77**	Emergency	**28**	ED	**1**
Female	**55**	16 years+ to 18 years	**2**	Routine	**54**	Theatre	**1**
Unknown	**2**	1 year+ to 16 years	**7**	Not known	**10**	ITU/NNU/HDU/Recovery	**6**
		28 days+ to 1 year	**2**				
		Birth to 28 days	**4**	In core hours	**13**	Wards	**9**
				Out of core hours	**8**	Outpatient/day unit	**1**
		Total	**92**	Not known/applicable	**71**	Not known	**74**

There were 92 reports of inappropriate and unnecessary transfusion concerning 94 patients. One report concerned an identical prescription error affecting 3 neonates.

Emergency vs. routine

In 28 cases the event took place in an emergency setting and in 54 cases in a routine or elective setting; in 10 cases this information was not available.

Age of the patients

There were 77 patients over 18 years old and 15 paediatric cases (one involving 3 neonates, see above): 2 between 16 and 18 years of age, 7 between 1 and 16 years, 2 between 28 days and 1 year, and 4 between birth and 28 days.

Gender

There were 35 male and 55 female patients. In 2 cases the gender of the patient was not documented.

Core hours vs. out of hours
and
Where the transfusion took place

These two sections were very poorly answered again this year: 76% did not specify the time of transfusion and 85% did not specify where the transfusion took place. The new Dendrite web-based SHOT reporting system should rectify this problem.

Mortality

There were 2 deaths in this group where the transfusion of red cells possibly or probably contributed to the death. As the patients died very soon after receiving the red cells, full investigations were not performed.

Case 1

Unnecessary transfusion based on Hb result for a different patient

A patient with disseminated carcinoma was admitted and a sample for FBC was taken by a member of nursing staff. The hospital policy for positive ID of the patient was not followed and the sample tube was labelled with a different patient's details. (The report does not state whether a transfusion sample was mislabelled at the same time, only that both patients were group O D positive.) The patient's true Hb was 10.9 g/dL and there was no indication of bleeding or haemolysis. The incorrect patient's Hb was 6.0 g/dL and based on this a 3-unit transfusion was prescribed without querying the surprisingly low result. The patient suffered acute pulmonary complications during the first unit with a drop in pO_2, and the transfusion was stopped. A CXR post transfusion may have indicated TACO or TRALI. The patient deteriorated rapidly and died. The report stated that the death was considered to be possibly related to transfusion.

This patient did not require transfusion. Although he was suffering from carcinoma, the exact cause of death of the patient when it occurred is unclear. It seems likely that the administration of the red cells played a part by contributing to respiratory compromise.

Case 2

Request from BMS for repeat sample not heeded

Following abdominal surgery a patient fell in the ward and fractured her femur. Her most recent previous Hb was 15.9 g/dL. On testing a new FBC sample the BMS called the ward, gave an Hb of 6.1 g/dL, and requested another sample as he thought the result was incorrect. However, the result was passed to the medical team on the ward round by a nurse who did not mention the need to repeat the test. On the basis of the erroneous result, even though clinically there was not extensive bleeding, a 4-unit red cell transfusion was ordered by the consultant, and all 4 units were given without further review. The patient's Hb was 20.2 g/dL before surgery on the following day, and the anaesthetist was aware of this. The patient developed cardiac failure and died. This was thought to be probably related to the excessive transfusion.

This case reveals a number of omissions and errors of judgement. The crucial message to repeat the test was not passed on, but at the same time the doctors on the ward round did not, from a clinical perspective, assess the results to be inaccurate. No clinical assessment seems to have been made, nor basic observations. In any patient it is very rarely appropriate to transfuse 4 units of red cells back to back without review and repeat sampling – perhaps only in cases of massive active haemorrhage. It is possible the outcome might have been different had venesection been carried out once the very high Hb was discovered.

There are 5 cases this year in which requests for repeat samples, made by the haematology laboratory BMS, were ignored. In addition there is a case in which non-validated haematology results were viewed on the computer system and acted upon, while the lab was in the process of checking it for a clot. There seems little point in informing a clinical team of an erroneous result, verbally or electronically, when there is a risk of communication failure. The laboratory should call to request the repeat, stating that there is a clot or other problem with the sample, but without giving the meaningless result.

Major Morbidity

There was one patient that required venesection post transfusion.

Case 3

Entire adult unit of red cells given to infant

A request was made for top-up transfusion for a sick 1-year-old child with an Hb of 9.0 g/dL. A dose of 110 mL was calculated and prescribed. An adult unit of blood was issued but nursing staff did not see the volume prescribed and transfused the entire unit of blood (230 mL). This transfusion took place between midnight and 08.00. The error was detected by laboratory staff when the patient's post-transfusion Hb was 19 g/dL. The child required venesection.

The reporting hospital stated that the prescription chart could be improved to allow clearer prescription for paediatric blood transfusion volumes. However, it is essential that all staff working in paediatrics are aware of the principles of paediatric prescribing, based on body weight or surface area, whether administering blood components or pharmaceutical agents.

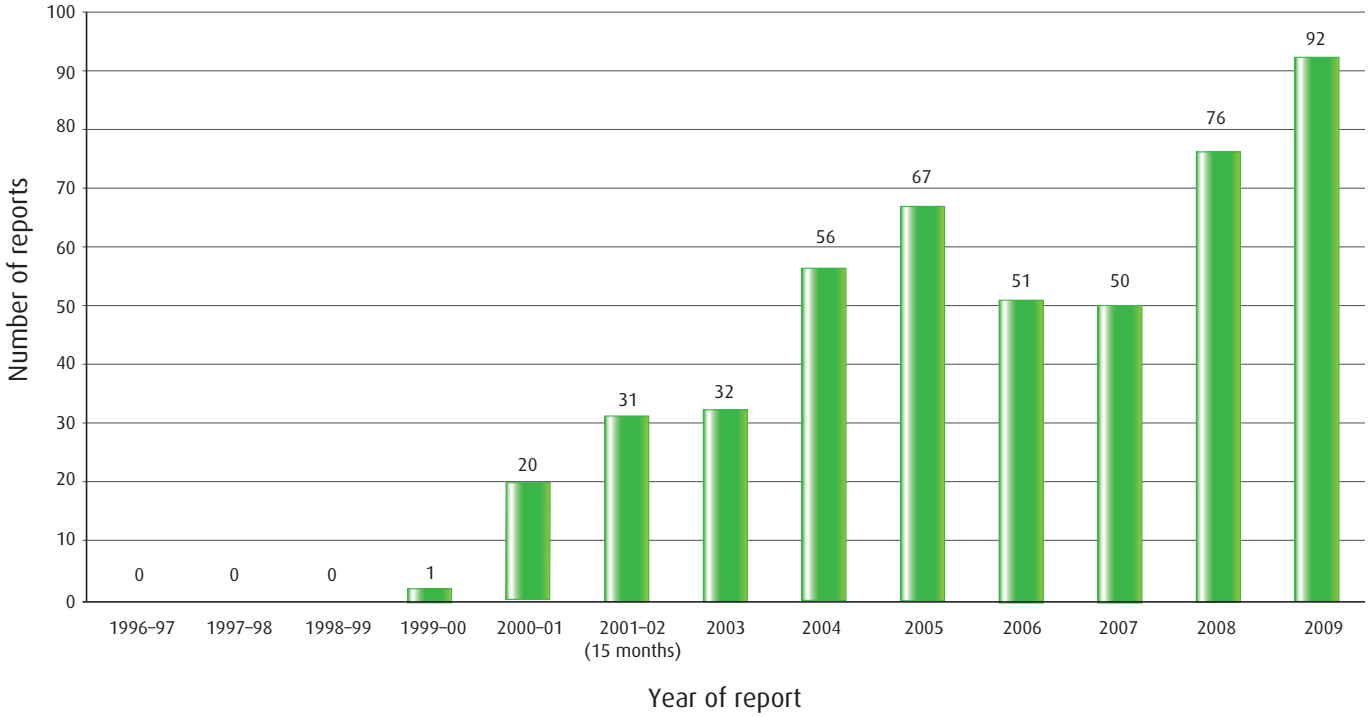
Case 4 below describes the delayed and/or under-transfusion of a very anaemic neonate. It was thought that the prolonged anaemia may have contributed to long-term morbidity in this infant.

Case 4

Delay in transfusing very anaemic neonate has long term consequences

A baby was delivered by CS and appeared unwell. There had been a massive transplacental haemorrhage and the infant's Hb was 4 g/dL. The clinicians did not know this result until 2 hours post delivery. There was then a further delay of 4 hours before the baby was transfused, owing to misunderstandings and communication failures between clinicians, portering staff and the transfusion laboratory. The team did not seem to know that neonatal 'flying squad' blood was available, nor did they ask for emergency blood even though the child was deteriorating. Blood was not prescribed. A sample was eventually sent but there were portering delays both in taking the sample and collecting the units. The total delay before transfusion commenced was over 4 hours. The baby became very sick and was transferred to a tertiary centre. There was long-term morbidity with developmental delay which may have been in part due to the prolonged period of extreme anaemia.

Figure 8
Cases of inappropriate and unnecessary transfusion 1996–2009



Broad breakdown of where primary errors occurred *n* = 92

As in previous years, most cases of inappropriate and unnecessary transfusion were the result of errors of judgement, lack of knowledge or lack of procedural awareness among medical staff (56 cases across all categories). These errors were made predominantly by junior doctors, but include those made by locums, staff-grade doctors and some consultants. In 7 of these cases the doctor had been informed that a result was unreliable (due to short sample, clots in sample or platelet clumping) and a repeat sample had been requested. This includes unverified results being accessible via the computer system. In 1 case standard FFP was requested instead of SD-FFP (Octaplas®) for a plasma exchange in a patient with TTP.

A further 18 cases were of 'clinical' origin, although exactly who was responsible is unclear from the case report (doctor, nurse, possibly phlebotomist). Ten of these are phlebotomy-related problems (diluted or drip arm samples) but it is not known who took the samples. There is 1 case of confusion about which component type was to be transfused, and 1 of confusion as to whether or not a prophylactic platelet transfusion was to be given (it should not have been, as the count was 89 x 10^9/L). In 5 cases there were communication failures between the laboratory and the clinical teams regarding the need to repeat inadequate (short, clotted, clumped) samples, as above. There were 2 cases of under-transfusion owing to multifactorial clinical errors, including communication and knowledge.

In 10 cases there was clear responsibility for the error in a member of the nursing staff, 4 of these involving transfusing blood to an infant or small child at a volume and/or rate which was much greater than that prescribed (Case 3, above). There was 1 case of an excessive rate of transfusion of red cells to an adult. The fatal case (Case 2, above) was multifactorial but the mislabelled Hb sample had been taken by a member of nursing staff. Four further cases involved incorrect verbal relay of Hb results, and misinterpretation of instructions in notes.

Hospital haematology laboratories were responsible for 8 cases of inappropriate or unnecessary transfusion by issuing incorrect results to clinicians before checking for clots, platelet clumping or short sample errors. There were 3 analyser errors; 1 involved 'flushback' in the machine and 2 were unexplained.

Transfusions based on wrong Hb, platelet or coagulation result *n* = 53

Transfusion based on wrong haemoglobin result *n* = 45

There were 45 cases in which a patient was transfused with red cells on the basis of erroneous or spurious results as shown below. One of these (Case 2, above) probably contributed to the death of the patient.

Table 25
Transfusion based on wrong haemoglobin result

Clinical causes of falsely low Hb value	Cases
Falsely low Hb due to phlebotomy from drip arm, or 'diluted sample'	8
Transfusion based on an old Hb result although a more recent result was available	5
Faulty sample (clotted, short, etc.) – lab requested repeat but request ignored and wrong result used	6
Hb result belonged to another patient (including WBIT for Hb sample)	7
Blood gas machine Hb used	4
Erroneous result from POCT Hb estimation device	3
Unauthorised results viewed from ward and acted upon	1
Substitution of WCC for Hb (transcription error)	1
Verbal miscommunication of results	1
Haematology laboratory causes of falsely low Hb value	
Hb lab analyser error ('flushback' in 1 case, underestimating Hb in 2 cases)	3
Short sample but lab issued result	2
Clotted sample not spotted by lab and results issued	1
Other	
Unknown cause of erroneous count	3
TOTAL	**45**

There are 4 cases of a doctor inappropriately using the Hb estimation from a blood gas machine as a basis for a decision to transfuse. In the case below an adequate clinical assessment of a stable patient did not take place, and the junior doctor used 'flying squad' blood on the Hb result from a blood gas machine alone.

Case 5

Blood gas analyser Hb used as trigger for emergency transfusion

An Hb of 5.0 g/dL obtained from an ED blood gas machine on a middle-aged female patient who was asymptomatic and not actively bleeding. One unit of O D negative red cells was already transfused when the laboratory result became available which was 8.9 g/dL. A further unit of O D negative blood was wasted due to inappropriate storage.

The reporter goes on to suggest review of the blood gas machine calibration, which, although essential, would still not mean that the Hb results obtained would be accurate enough to use as POCT for Hb levels. These instruments produce a calculated Hb result, which for many reasons may be inaccurate. They should not be used as a reliable measure of Hb.

There are, as ever, a number of cases of transfusion based on 'drip arm' or otherwise diluted specimens. In general a proper attempt to evaluate the clinical picture in relation to the Hb result, and comparison with previous results in the light of clinical events, should have alerted the prescribing clinician to the possibility of an erroneous result. Likewise in the 5 cases of genuine laboratory error an alert clinician might have queried the result.

Case 6

Dilute (possible drip arm) sample not queried, resulting in unnecessary transfusion

An elderly female patient arrived in the ED by ambulance suffering from shortness of breath and tachycardia. Intravenous fluid was administered and samples taken for laboratory tests. The Hb was 6.9 g/dL on that sample. The patient was admitted and the ward transfused 2 units of red cells overnight. At noon the next day the Hb was found to be 16.8 g/dL.

Case 7

Preoperative Hb from 'drip arm' results in unnecessary transfusion

A pre-surgery sample in a patient for total hip replacement following a fractured neck of femur was 6.2 g/dL and the junior doctor prescribed 2 units of red cells. A repeat Hb check immediately before surgery showed an Hb of 13.9 g/dL. It transpired that the earlier sample had been taken from above the IV infusion.

Transfusion based on spurious thrombocytopenia *n* = 8

In 4 of these cases of spurious low platelet count due to clumping the laboratory BMS had told the clinicians that there was platelet clumping, but nevertheless the 'count' had been given. In one of these the count was available on the computer system as a non-validated result, annotated with the message 'platelet clumping'. The inference from these accounts is that clinicians do not necessarily know what 'platelet clumping' means, nor the implication for interpretation of the platelet count, nor the action to take to validate the count – by film examination or citrate sample. Once again, it would be preferable if the spurious count was removed from the computer system, and not given at all, or else if the message 'platelet count normal' could be added.

Table 26
Causes of falsely low platelet count

Causes of falsely low platelet count	Cases
Transfusion of platelets based on falsely low count due to platelet clumping	5
Platelets transfused on basis of low platelet count due to clot in sample (lab errors)	2
Platelets transfused to patient on basis of a different patient's platelet count	1
TOTAL	**8**

Case 8

Erroneously low platelet count due to clumping in EDTA missed by lab

A middle-aged patient on the medical admissions ward with a viral illness had a platelet count of 67 x 10^9/L reported by the haematology laboratory. The patient had no bleeding, bruising or purpura. Advice was sought from a haematology consultant and platelets were advised and transfused. A repeat platelet count was 43 x 10^9/L. Blood films of both samples showed platelet clumping. The actual count was normal, with no indication for the platelets.

In this case the haematology laboratory staff should have checked the count and a blood film as the results were unexpectedly so low, and perhaps requested a citrate sample. All labs should have protocols in place for validation of out-of-range results.

Inappropriate and unnecessary transfusion based on poor basic knowledge, incorrect decision making or poor prescribing *n* = 37

The inappropriate and unnecessary transfusions reported in this category comprise cases where the excessive volumes transfused posed a potential or actual risk to the patient, rather than inappropriate on the basis of compliance with national guidelines or protocols.

Over-transfusion of small infants and children has been discussed in previous SHOT reports, and continues as an issue in 2009. One case required venesection (Case 3, above). Staff looking after and treating children must be appropriately trained in paediatrics and be fully cognisant of paediatric prescribing practices.

Table 27
Categories of poor knowledge or prescribing

Categories of poor knowledge or prescribing (excluding use of erroneous Hb)	Cases
Excessive volume/rate of red cells transfused to infant or child	8
Excessive red cell transfusion resulting in Hb above normal range	7
Transfusion of red cells for chronic iron deficiency anaemia	5
Inappropriate and excessive transfusion of patient with pernicious anaemia	1
Excessive cryo given due to lack of knowledge of pooled cryo packs	4
Incorrect component requested and/or given	4
FFP transfused to patient with normal coagulation screen	2
Transfusion of prophylactic platelets when count far in excess of trigger (FBC not checked)	1
Use of FFP to correct FXII deficiency coagulopathy	1
Use of 'least incompatible' units when no longer in emergency setting	1
Excessive quantities of platelets given (4 pools) to elevate count	1
Excessive rate of red cell transfusion in adult	1
Inappropriate night-time transfusion in a stable patient	1
TOTAL	**37**

Junior doctors require knowledge of the appropriate dose of red cells to correct Hb to safe levels in adults, taking account of the size of the patient, whether there is active ongoing blood loss, and comorbidities. Poor clinical assessment of the patient and the degree of blood loss continues to be a cause of over-transfusion.

Case 9

Over-transfusion of stable patient with upper GI bleed

An elderly patient had coffee-ground haematemesis and melaena, and a crossmatch request for 4 units of red cells was made. The Hb dropped but was at no time lower than 10.7 g/dL and the patient remained cardiovascularly stable throughout. All 4 units of red cells were transfused resulting in a post-transfusion Hb of 16.2 g/dL.

The junior doctor who prescribed the blood was perhaps inexperienced in assessing bleeding patients and worried by the visible blood loss. Trusts should utilise the guidance available from the Scottish Intercollegiate Guidelines Network,[26] and local protocols and training should reflect this.

Case 10

Over-transfusion following liver biopsy

A patient was admitted for a liver biopsy and became hypotensive 2 hours after the procedure. The Hb was 7.7 g/dL (pre-procedure Hb not given) and the patient was transfused 2 units on 3 separate occasions over the next 3 days. In total 6 units of red cells were administered. No monitoring of the patient's laboratory parameters took place. A subsequent Hb was 17.1 g/dL. The patient died and no further clinical details or test results are available.

Insufficient details are available to comment, though the death of the patient was due to underlying causes and not related to the over-transfusion.

There have been 5 reports this year of inappropriate transfusion of young female patients with chronic iron deficiency, 4 from the same reporting organisation, all female, aged 24, 25, 29 and 37. The final case involved an elective preoperative patient of over 70. This highlights a major clinical concern regarding appropriate management of such patients, who should not be exposed to the small but real risks of transfusion unless symptoms are severe or there is acute-on-chronic bleeding. It is an educational issue as important in primary care as in the hospital setting.

Case 11

GP demands that iron-deficient woman is transfused despite advice to contrary

A young woman with iron deficiency anaemia, Hb 5.5 g/dL, due to longstanding menorrhagia was sent to the ED by her GP. She was reluctant to have a blood transfusion and went home with a supply of iron tablets. The GP was not satisfied and sent her back. The transfusion practitioner discussed the patient's concerns with her and then requested the GP to reconsider the alternative options. The patient was sent back again, this time with a letter instructing that transfusion was needed. The request was not discussed at any point with a haematology consultant, and the patient was eventually, reluctantly, transfused.

Case 12

GP sends iron-deficient woman to the ED where junior doctors decide to transfuse

A GP detected an Hb of 6.6 g/dL in a young woman with chronic menorrhagia and referred the patient to the ED. The junior doctor there asked advice of the locum SpR who said to go ahead and transfuse, but the case was not discussed with a haematologist.

The 2 cases above were referred for transfusion by GPs, and no senior physician or haematologist was involved in the decision. It seems wholly inappropriate for referrals to the ED to be made demanding transfusion in any circumstances, but especially so in these cases of chronic iron deficiency anaemia.[27]

Under-transfusion *n* = 2

There were 2 cases reported which broadly fitted this category. One relating to delay in transfusing a neonate with extreme anaemia has been included in the major morbidity section at the start of this chapter (Case 4). The second, below, relates to an inappropriately low Hb in a patient following red cell exchange.

Case 13

Patient left with too low Hb following red cell exchange for sickle cell disease

A patient with HbSS required red cell exchange prior to routine surgery. The procedure was completed and the patient discharged. She went to the canteen where she collapsed and was admitted to the ED. Laboratory tests did not reveal any other possible cause except for the Hb of 8.6 g/dL, which, if it was mostly Hb A, was low for a patient previously with mostly Hb S. The patient was given 3 more units and made a full recovery.

COMMENTARY

In total there were 12 cases in which spurious results were acted upon and the patient given blood components inappropriately despite the haematology laboratory having either verbally, or via a message on an unverified result on the computer system, informed the team that a repeat sample was required. It is worrying in these cases that the result is given at all, when it is known to be incorrect; and that clinicians still think it may be valid. There appears to be a lack of understanding among doctors of the implications when they are informed that there was a clot, or that platelet clumping is present – perhaps they believe that the resulting inaccuracy is only marginal.

In common with last year, most cases of inappropriate and unnecessary transfusion are due to lack of knowledge of the staff involved (often junior doctors), or inability to apply knowledge meaningfully to a real clinical situation. Clinical assessment of patients is limited, and the clinical picture, including results, is not viewed as a whole. It may be that junior doctors lack sufficient experience to make reliable clinical judgements, and this in turn may relate to the reduced hours they work under the European Working Time Directive.[16] They are reaching middle-grade level, where such decisions are required of them having seen very few comparable clinical scenarios.

RECOMMENDATIONS

- Staff working with paediatric patients must be trained and familiar with paediatric prescribing regimens and dose calculation for children. A specially designed prescription chart for paediatrics may assist this.

  Action: Risk management boards, HTCs, HTTs

- Junior doctors must not be expected to clinically evaluate potentially bleeding patients if they are insufficiently experienced. Senior colleagues need to be involved in the decision to transfuse and the evaluation of patients with unexpected results. Doctors need to differentiate chronic anaemia from acute blood loss. BMS requests for repeat samples must be heeded.

  Action: Royal Colleges

- Blood gas machines must not be used for Hb estimation unless they are designed and calibrated to produce accurate, reproducible results with external quality assessment in place. (See also recommendation on page 54.)

  Action: POCT teams, manufacturers

- Haematology laboratories need protocols for dealing with out-of-range results, including trending and delta checks, films, and asking the haematologist. Potentially erroneous results should not be communicated to clinicians either verbally or as unverified results on the computer system. New samples should be requested, with an explanation, but the incorrect result should not be given.

  Action: HTCs