7. Inappropriate and Unnecessary Transfusion (I & U)

Definition

- Transfusions given on the basis of erroneous, spurious, or incorrectly documented laboratory testing 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 was actually harmful.
- Undertransfusion or delayed transfusion resulting in poorer patient outcome.

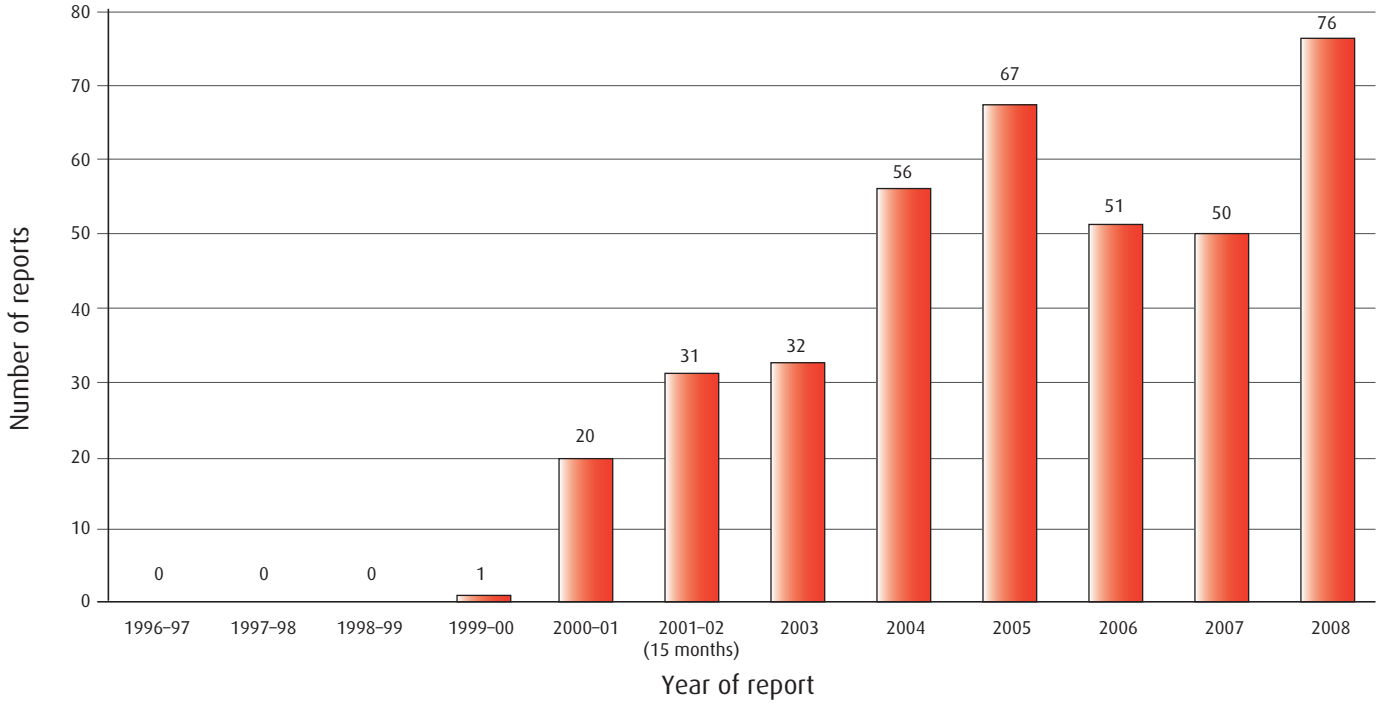
DATA SUMMARY

Total number of cases	**76**	*Implicated Components*		*Mortality / morbidity*	
		Red cells	**60**	Deaths due to transfusion	**0**
		FFP	**5**	Deaths in which reaction was contributory	**2**
		Platelets	**6**	Major morbidity	**1**
		Other *(specify)*	**2**		
		Unknown	**3**		

Gender		*Age*		*Emergency vs. routine and core hours vs. out of core hours*		*Where transfusion took place*	
Male	**27**	16 years+ to 18 years	**2**	Emergency	**26**	ED	**1**
Female	**49**	1 year+ to 16 years	**2**	Routine	**44**	Theatre	**1**
Unknown		28 days+ to 1 year	**3**	Not known	**6**	ITU/NNU/HDU/Recovery	**1**
		Birth to 28 days	**0**			Wards	**9**
				In core hours	**7**	Community	**0**
		Total	**7**	Out of core hours	**8**	Other	**2**
				Not known/applicable	**61**	Not known	**62**

There were 76 cases of inappropriate and unnecessary transfusion in 2008 compared with 50 in the 2007 report (Figure 7). This follows the trend since 2000 for an increased number of reports in this category each year. Of these, 48 were reported to SHOT only through the SABRE website, while 26 were reported to MHRA as serious adverse events (SAE) and 2 were reported as serious adverse reactions (SARs). In fact none of the SAEs were reportable to MHRA as even the laboratory-related errors were related to the haematology laboratory rather than the transfusion laboratory.

Figure 7
Cases of inappropriate and unnecessary transfusion 1996–2008



As previously, the final responsibility in the vast majority of these cases lies with medical staff, who assess the patient both clinically and in the light of laboratory results, make the decision to transfuse, and decide upon the component, dose and rate of transfusion. In effective teams a form of friendly surveillance of others' decisions and actions means that there should be supportive input from nursing and biomedical staff, which may highlight problems and prevent errors – but ultimately the knowledge and experience of the doctor is the most important factor, and with that rests the final responsibility for the decision.

Emergency vs. routine: In 26 cases the event took place in an emergency setting and in 44 cases in a routine or elective setting; in 6 cases this information was unknown or unavailable.

Age of patients: There were 2 children between 16 and 18 years of age, 2 between 1 and 16, and 3 between 4 weeks and 1 year.

Gender: There were 49 female and 27 male patients.

In core hours versus out of hours
and
Where the transfusion took place

Both of these last two sections of the questionnaire were very poorly answered with over 80% of respondents leaving the section blank. Therefore no inferences can be made. The new web-based data gathering system for SHOT, to be implemented later this year, will undoubtedly rectify this problem.

Mortality
There were no deaths caused directly by the component transfusion. There were 2 deaths in which the transfusion, or lack of transfusion, probably contributed to the death of the patient. Both patients suffered from gastrointestinal bleeding, in differing circumstances (see cases 6 and 7 below).

Major morbidity
There was 1 case in which the polycythaemia resulting from inappropriate overtransfusion necessitated venesection (see Case 10 below).

Transfusions based on wrong Hb, platelet or coagulation result *n* = 38

Transfusion based on wrong haemoglobin result *n* = 36

There were 36 cases in which a patient was transfused with red cells on the basis of an erroneous or spurious result, as shown in Table 34 below.

Table 34
Erroneous Hb results

Cause of falsely low Hb value	Cases
Falsely low Hb due to phlebotomy from drip arm	10
Transfusion based on an old Hb result although a much more recent result was available	5
Results switched with those from another patient	5
Results incorrectly transcribed in notes	4
Stasis in a syringe during difficult phlebotomy	4
Verbal miscommunication of results	2
Unknown cause of incorrect result	6
TOTAL	**36**

Case 1

Transfusion and multiple investigations based on a drip arm haemoglobin

A patient was admitted with dizziness and collapse and a history of CVA. The patient's haemoglobin was 11.4 g/dL on admission but had dropped to 6.9 g/dL the next day. The FBC was not repeated and the patient was transfused 2 units of red cells even though there was no evidence of any blood loss. In addition various investigations were requested post transfusion, including abdominal ultrasound and haemolysis screen. An inpatient referral was made to a consultant haematologist who assessed the patient and questioned the validity of the Hb result; the FBC that the consultant then requested showed a haemoglobin of 13.1g/dL, and he also found the sample had been taken from the same arm as the drip.

Case 2

Transfusion based on a year-old haemoglobin

Two units of blood were requested for an orthopaedic trauma case because of low Hb prior to theatre. The blood was provided and administered on the 20th/21st of the month. A phone call to the laboratory on the 21st to confirm the preoperative Hb alerted the staff to the fact that the samples sent on the 19th for full blood count and coagulation screen had clotted and could not be analysed. A previous result from exactly the same date a year earlier had an Hb of 9.7g/dL and this was the result that was acted upon. The postoperative Hb was 13.9 g/dL.

In these cases the clinical picture and the results were discrepant, but this was not discerned by the doctors looking after the patients, who prescribed blood components on the basis of the results alone, without reference to the history, signs and symptoms.

Case 3

Lack of communication between shifts in SCBU results in baby being transfused twice

A 2-month-old premature baby had a haemoglobin on the 8th of 9.9 g/dL requiring top-up, and the team on duty that day in SCBU prescribed and gave 60 mL of red cells. On the 11th another team in SCBU noted the low Hb from the 8th, made a decision to transfuse, and prescribed and gave 70 mL of red cells. No tick had been placed on the treatment chart, the prescription sheet had not been filed in the correct place, and the notes were not checked for recent transfusions. Thus the patient was accidentally transfused twice.

This case highlights the problems that can result from the shorter working hours and lack of overlap between medical and nursing teams on specialist units. A detailed handover had not taken place, a box on a treatment chart had not been ticked, and a prescription sheet had not been filed. This baby therefore received the elective top-up transfusion twice, 3 days apart, on the basis of the Hb from a single day. Worryingly, the decision to transfuse was also made twice, despite the fact that one would expect a different clinical picture on the 2 occasions.

Platelet transfusion based on spurious pancytopenia *n* = 1

Case 4

Spurious pancytopenia results in unnecessary hospital admission and prophylactic platelet transfusion

A patient was bled for an FBC by a GP practice nurse after presenting with arthralgia and a rash. The results showed a pancytopenia, with Hb 9.2 g/dL, WCC 0.4 x 10^9/L and platelets 7 x 10^9/L. The sample was examined and no clot was present, and it was re-tested producing the same result. The patient, who appeared well, was admitted to a medical admissions ward out of hours, where an admitting junior doctor telephoned an on-call haematologist who advised isolation because of neutropenia, and a platelet transfusion. The patient was reviewed by the haematologist in the morning and found to be well, apyrexial, with no purpura or petechiae, and a repeat FBC showed an Hb of 13.4 g/dL, WCC 8.2 x 10^9/L and platelets 351 x 10^9/L.

Learning points

- Junior doctors need to use their clinical acumen and knowledge when prescribing therapies, and need to be prepared to question results that do not fit the clinical picture.
- Handover and documentation of interventions are paramount in areas where teams are working in shifts without continuity of daytime staff.

Transfusion based on misheard coagulation result *n* = 1

A doctor telephoned for the results of a clotting screen and misheard the results, leading him to prescribe FFP for coagulopathy, when in fact the results were normal.

Inappropriate and unnecessary transfusion based on a haematology or coagulation laboratory error *n* = 10

There were 10 cases in which errors either in the routine haematology laboratory or the coagulation laboratory were the basic cause of the administration of inappropriate transfusion. In 4 of these cases platelet clumping was present in the patient sample but this was not reported on from the laboratory because the film was not examined in time prior to the decision to transfuse. In 1 of these cases platelet clumping was reported to the clinicians, but owing to a failure of verbal communication the cardiologists (who had been in discussion with a haematology trainee) still went ahead and ordered platelet cover for an angiogram procedure.

In 2 cases there was an error because there was a clot present in the full blood count sample resulting in a spuriously low haemoglobin. In 3 cases the sample was of small size owing to difficult phlebotomy. This was not detected in the laboratory as a possible cause of erroneous results and the low MCHC that was also present was not noted. In 1 case a BMS erroneously entered a fibrinogen result manually into the computer moving the decimal point so that the fibrinogen concentration looked lower by a factor of 10. The patient was subsequently transfused with cryoprecipitate unnecessarily.

Table 35
Haematology or coagulation laboratory errors

Category of haematology or coagulation laboratory error	Cases
Platelet clumping on FBC (EDTA) sample	4
Clot in FBC sample	2
Small or short sample	3
Transcription error of fibrinogen result	1
TOTAL	**10**

Case 5
Short sample gives spurious result leading to 3 unit transfusion
A woman requesting a termination of pregnancy had samples for blood count and group & save taken by a phlebotomist. A small sample was taken into a paediatric bottle because of poor venous access. The Hb was reported as 6.3g/dL. The woman was admitted that night for transfusion of 3 units of red cells prior to operation the following day. No repeat FBC was taken before transfusion, and no tests were requested to investigate cause of anaemia. Two days later FBC was reported as 15.6g/dL, suggesting that the previous FBC had been erroneous and that transfusion had been unnecessary.

In Case 5 the following errors and causes may be identified:

- collection of an inadequate sample for FBC
- failure of haematology laboratory to indicate that this sample was inadequate and to request a repeat
- lack of medical assessment of patient, and unquestioning acceptance of results
- clinical decision to transfuse in a non-urgent situation, without a clinical assessment or consideration of the cause of anaemia.

These cases highlight the responsibility of the laboratory to ensure that the material they are offered for testing fulfils their requirements. In addition those taking samples should be aware of the effects of short samples and platelet clumping, and must be vigilant and circumspect about results.

Inappropriate and unnecessary transfusion based on erroneous POCT result *n* = 3

Two of these cases involve near patient testing equipment for full blood count that was performed in satellite laboratories by medical staff. In both cases transfusion was based on the erroneous full blood count from the point of care testing (POCT) equipment before confirmatory haemoglobin was available. There was a third case in which a patient was over-transfused because a junior doctor relied on the haemoglobin results from a blood gas machine. This should not have been used and was not designed to be used as a source of accurate haemoglobin estimation.

Transfusions based on poor basic knowledge and prescribing *n* = 25

Of the 25 cases in which there was evidence of poor knowledge and understanding of transfusion medicine and of correct prescribing of blood components, 4 were related to nurses and 21 to junior doctors reflecting the fact that it is a medical role to make the decision to transfuse and to prescribe blood components. The breakdown of subcategories is shown below in Table 36.

Table 36
Poor knowledge and prescribing

Categories of poor knowledge and prescribing	Cases
Overestimation of rate and volume of blood loss	7 (one fatality)
Wrong basic component given for indication, e.g. FFP instead of platelets	4
Transfused despite documented decision to the contrary (includes one JW)	3
Small patient prescribed inappropriately large volume	2
Inappropriate use of flying squad blood	2
Slow response to serious blood loss, undertransfusion	1 (one fatality)
Confusion over correct dose/number of units of cryoprecipitate	1
Lack of understanding of transfusion triggers in sickle cell disease	1
Inappropriate use of FFP to correct mildly abnormal INR that was in fact normal	1
Inappropriately rapid transfusion through two cannulae in elective case	1
Mistaken diagnosis of anaemia due to acute GI bleed when in reality the condition was one of chronic anaemia and menorrhagia not requiring urgent transfusion	1
TOTAL	**24**

There were 2 fatalities related to transfusion in this group. The first involved undertransfusion of an elderly patient with a low haemoglobin and a high INR who was suffering from atrial fibrillation.

Case 6
Inadequate management of acute bleeding associated with high INR on warfarin

An elderly lady on warfarin for AF was admitted with bleeding PR. She was found to have Hb 6.8g/dL and an INR of 7.2. She was given vitamin K 2mg IV and 3 units of FFP were requested. All 3 units were taken from the refrigerator at the same time and were transfused over 3 hours. This report was initiated as it was believed that storage requirements for FFP had not been met. Soon after completion of the third unit the patient developed an itchy, erythematous rash and was given IV chlorpheniramine and hydrocortisone. Six hours later the patient was found collapsed and resuscitation was unsuccessful. Postmortem examination showed fresh blood in the bowel and cause of death was given as haemorrhage from large bowel. In spite of blood results on admission and persistent hypotension, this patient received no intravenous therapy apart from the FFP and no blood transfusion was given, although 4 units were crossmatched on admission.

This patient was inadequately managed and collapsed and died from the gastrointestinal haemorrhage with which she had been admitted during this episode. This is the first case reported to SHOT where undertransfusion was main thrust of the report, although inappropriate transfusion FFP and a mild allergic transfusion reaction were also part of the story. This patient was not adequately assessed or monitored clinically, and did not undergo appropriate management of her high INR or her acute blood loss.

The second fatality related to massive overtransfusion of a patient who presented with coffee ground vomiting and possible melaena. The patient was transfused on the basis of the story given rather than the clinical features and the FBC sample was delayed due to difficult venous access. Subsequent samples were tested revealing Hb sequentially of 16.6g/dL, 18.3g/dL and 20.8g/dL over a period of 24 hours. The elderly patient subsequently died.

Case 7
Over-estimation of blood loss from GI bleeding leads to massive overtransfusion

An elderly inpatient had a coffee ground vomit at 02.00 and some melaena. Intravenous fluids were given and blood samples taken showing a Hb of 14.3g/dL at 04.30. Her Hb the day previously had been 14.7 g/dL. Observations were initially stable, but at 05.50 the BP was unrecordable and 2 units of red cells given. At 06.10 after another haematemesis a further 2 units were transfused. A BMS asked for repeat samples, which were not sent due to difficult venous access. After a further 2 hours BP was stable, and 2 further units of red cells were given. Hb results were not reviewed until 17.00 when the Hb was Hb16.6g/dL. At 22.30 Hb was 18.3g/L, the next day at 15.00 Hb was 20.8g/L. and the following day at 18.30 the patient died.

This case highlights the difficulties that junior doctors may have in assessing the actual degree of bleeding/haemorrhage in a patient, which may be at variance with the history given by the patient or other staff. Clinical assessment of severity of bleeding is notoriously difficult and requires experience of similar situations and a calm approach. A degree of unfamiliarity with the situation, and possible anxiety over the signs may mean that a careful clinical examination and scrutiny of the laboratory results does not take place in a timely fashion.

There were an additional 5 cases in which an actively bleeding patient was given unnecessary quantities of red cells due to the erroneous assessment by the junior doctors that there was life threatening bleeding. In all cases the haemoglobin had been normal at the time the clinical judgement was made, and once the results came back from the laboratory this was apparent. In all cases the post-transfusion haemoglobin was above the upper limit of the normal range. In 1 case a diagnosis of anaemia due to acute GI bleeding was made by junior doctor in a lady who was actually suffering from chronic anaemia due to menorrhagia.

Case 8

Overestimation of blood loss from acute GI bleed

A patient was admitted to the ED with GI bleed. The Hb was 12.1g/dL on admission. Two units of emergency blood were given, followed by a further 6 units of crossmatched blood over the next 12 hours. The Hb was not checked until all 8 units had been transfused, by which time the Hb was 18.5g/dL.

Case 9

Unnecessary transfusion based on obviously erroneous result

A patient was admitted to the ED and samples were sent for FBC and crossmatch. A Hb result of 2.7 g/dL was telephoned and the BMS advised to repeat the FBC as the result was suspect. However, this was not done and the patient was transfused 2 units of red cells. On admission to the ward a further FBC was checked, showing Hb 13.7 g/dL. However, 4 further units had already been prescribed and given, resulting in a post-transfusion Hb of 18.8 g/dL.

Case 10

Overtransfusion and subsequent venesection of a 1-year-old under shared care

A small 1-year-old undergoing shared care attended her DGH for a top-up transfusion of 2 paediatric units of red cells as recommended by the tertiary referral centre. This was written on the prescription sheet as 2 units and did not state the volume to be given. As she had not previously been transfused at the DGH, and being over 1 year old, the laboratory supplied adult red cell packs. Four days post transfusion her Hb was high and the error was discovered. The Hb continued to rise so the patient was venesected.

Case 11

Confusion over correct adult dose of cryoprecipitate

A patient was given 10 packs of pooled cryoprecipitate rather than the recommended 2 packs. This was due to the order being placed in 'old units'.

COMMENTARY

As in previous years, the majority of these cases involve insufficient knowledge and experience of junior doctors, and inadequate engagement with other staff to obtain help.

The scenarios described above include examples of:

- Insufficient care with basic tasks such as phlebotomy technique and communication, verbally or in writing, of results.
- Lack of clinical acumen when weighing up the clinical picture with the (apparent) laboratory results.
- Lack of a supportive team structure in which input from medical, nursing and biomedical staff is mutually supportive and identifies errors.
- Inadequate knowledge of blood components and their appropriate use in clinical situations, especially the interpretation of the clinical and laboratory signs of coagulopathy.
- Inexperience in assessing blood loss in a bleeding patient, compounded by unwillingness to seek the opinion of more senior or experienced colleagues.

RECOMMENDATIONS

- Trainee doctors in all hospital specialities must receive sufficient transfusion medicine education to be comfortable and safe in the clinical and laboratory assessment of anaemic and bleeding patients, and to be able to use blood components optimally to manage them.

  Action: NBTC

- A culture shift in the clinical arena is required so that when a doctor feels unable to handle a clinical scenario, requesting and obtaining appropriate help is easy, and negative judgement is avoided.

  Action: Trust CEOs