

In 1 case platelets were given instead of FFP. In this example the platelets were collected erroneously by the porter instead of FFP and the bedside check did not detect this discrepancy. The report also suggests that the transfusion of FFP was not clinically indicated.

Case 17

Porter collected platelets instead of FFP

An 8-week-old female child with severe metabolic disorder and sepsis required blood component support. Both platelets and FFP were available in blood bank. The porter was asked to collect FFP but took platelets. Nurses performing the bedside check did not notice the error and transfused the platelets resulting in the platelet count rising from 90 to 126 x 10⁹/L.

The case above raised the issue as to whether non-clinical staff can safely be trained to collect different components which are superficially similar. It is perhaps unreasonable to expect non-clinical staff to be responsible for making this differentiation.

WRONG BLOOD IN TUBE ERRORS n = 7

In these cases an incorrect patient was bled either for haemoglobin estimation or for a group and save/crossmatch sample and all cases resulted in incorrect or inappropriate transfusion. One case resulted in ABO-incompatible transfusion and another in D-incompatible transfusion. Four cases resulted in the wrong patient being transfused as the haemoglobin was actually that of another patient. There was 1 case in which a D group was actually that of another patient but was in fact compatible.

Case 1

Phlebotomy error results in ABO-incompatible transfusion

An 83-year-old female patient who was previously unknown to the hospital had a routine sample sent requesting a crossmatch of 2 units of red cells. The sample grouped as A D positive and two compatible units were issued and transfused to the patient. The patient suffered no transfusion reaction and was discharged home. She was readmitted 6 weeks later for recurrent anaemia. A sample sent requesting a further 2 unit crossmatch, grouped as O D positive' this was confirmed on a repeat sample. It appears that on the initial admission the patient received 2 units of incompatible (A D positive) blood as a result of a phlebotomy error.

Case 2

D-incompatible blood given as a result of a phlebotomy error

A 58-year-old male patient was grouped as O D negative and transfused 2 units of O D negative blood. Six weeks later a second sample was grouped as O D positive. A third sample was taken to confirm the patient's blood group as O D positive.

In 4 of these cases the phlebotomy had definitely been carried by a junior hospital doctor and in a fifth case this was probably the case although it is not entirely clear from the report.

In all these cases the recipients were adults.

INAPPROPRIATE or UNNECESSARY TRANSFUSION n = 50

There were 50 cases in this category, of which 37 were reported to SHOT only and 13 were reported to MHRA via SABRE. In fact none of these cases were reportable to MHRA, as even the laboratory-related errors were related to the haematology laboratory rather than the transfusion laboratory.

In 47 of the 50 cases the junior doctor was at the root of the problem, although in 6 of these cases this was not categorically stated in the report but was implied by the narrative. However, this still leaves 41 out of 50 cases where a junior doctor was directly implicated in an inappropriate or unnecessary transfusion.

[There are 2 cases which have been included in the blood administration section as they concerned nursing staff transfusing a greater quantity of blood than was prescribed. They are less apposite here as the main theme in this section is poor decision making rather than error.]

Three cases involved patients under 4 weeks old at the time of the inappropriate transfusion. An additional one was under a year old. Four further cases were in patients between 1 and 16 years old; in 1 case the patient was 18 years old.

In 17 cases recipients were male and in 31 cases female (in 2 cases gender was not recorded).

Eighteen cases were emergencies, 27 were routine, 3 were unknown and 2 were unrecorded.

Transfusions based on wrong haemoglobin result n = 28

Table 10
Inappropriate transfusion based on incorrect haemoglobin value

Cause of falsely low Hb value	Cases
Falsely low Hb due to phlebotomy from drip arm	5
Hb from massively haemodiluted patient	1
Erroneously low Hb from Hemacue/point of care testing/blood gas analyser	4
White cell count mistaken for Hb	6
Transcription error from telephoned Hb result	4
Albumin value misinterpreted as Hb	1
Hb value misread from computer screen	1
Poor sampling technique resulting in clots, stasis in syringe, etc.	6
TOTAL	28

Drip arm (and haemodilution) n = 6

There were 5 cases reported in which an inappropriate decision to transfuse was based on a falsely low haemoglobin level because the sample was taken from a drip arm. In an additional sixth case the patient was described as 'haemodilute', apparently resulting in a falsely low Hb estimation.

Case 1

Falsely low Hb from a drip arm results in unnecessary transfusion

A patient had a full blood count (FBC) performed at night and was found to have a Hb of 5.5 g/dL. 4 units of red cells were ordered and issued and 1 unit was transfused. A further sample was sent later the same morning and found to have a Hb of 11.1 g/dL. No further units were transfused, and the original sample was rechecked and the result of 5.5 g/dL confirmed. On investigation, it emerged that the original sample was taken from a drip arm and was therefore diluted. The patient suffered no immediate harm.

In many of these cases there was a lack of engagement by the junior doctor with the results. Taking stock of the change in haemoglobin from the previous sample and evaluation of the clinical condition of the patient might have prevented some of these unnecessary transfusions.

Erroneous Hb result from POCT equipment n = 4

These cases include results from blood gas analyser and Hemacue™ devices – a result not of malfunctioning of the equipment but of poor training and unfamiliarity. There were 4 cases in this group relating to erroneous haemoglobin. [Two further POCT errors are reported separately as they apply to platelet and international normalised ration (INR) results.]

Case 2

Hb of 3 g/dL not queried by medical staff

A 74-year-old male patient in recovery post hip replacement was drowsy, hypotensive and tachycardic. A haemoglobin estimation from a blood gas analyser was 3 g/dL. A FBC sample was sent to the laboratory, but in the interim 1 unit of 'flying squad' (uncrossmatched group O D negative) blood was commenced. The new Hb result from the laboratory was 11.2 g/dL and recovery staff informed of this result advised medical staff to discontinue the transfusion. The patient suffered no apparent ill effects as a result of the over-transfusion or uncrossmatched unit.

Unnecessary transfusion based on transposed Hb and white cell count (WCC) results n = 6

This category comprises 6 cases in which as a result of misreading of laboratory reports or miswriting of results, the white cell count was taken to be the haemoglobin. The patient was thus transfused on the basis of what was apparently a low haemoglobin but which was actually the white cell count.

Case 3

White cell count mistaken for Hb resulting in unnecessary transfusion

A 70-year-old woman presented in ED looking very pale and had fainted at home. Full blood count run on a POCT analyser in ED showed a WBC of $7.9 \times 10^9/L$, which was mistaken for the Hb, and a 2 unit transfusion was prescribed. The error was identified when the post-transfusion Hb was 16.3 g/dL. The patient was informed of the error, but she stated that she was happy as she felt much better.

Transcription errors n = 6

There were a further 6 cases of transcription errors. Four of these involved telephoned results written down in the ward. In 2 cases the source of the alleged telephoned result could not be traced. In a further case an albumin of 6 g/L was incorrectly supposed to be the patient's haemoglobin and the patient was transfused unnecessarily. In the fourth case the haemoglobin result was written in the wrong set of notes and a patient who did not require transfusion was given red cells in error.

There is also an incident in which the decision to transfuse a patient, made on a ward round and jotted in junior doctor's notebook, was later transcribed into a wrong patient's notes. In the final case a doctor admitted she had misread the results from a computer screen and ordered blood for a patient who did not need it.

Case 4

Danger of poorly documented telephoned results

Routine blood tests were performed on a 64-year-old male patient on ITU following an emergency laparotomy during which 3 units of packed cells had been given. Biochemistry results were phoned to ICU, and an albumin of 6 g/L reported, but a nurse documented this result as a Hb of 6 g/dL. Four units of blood were then transfused on the basis of this result. In fact the pre-transfusion (preoperative) Hb had been 10.4 g/dL, and post transfusion it was 17.6 g/dL.

Poor sampling technique leading to erroneously low haemoglobin level n = 6

Case 5

Difficult phlebotomy results in falsely low Hb

A sample was taken with great difficulty from an elderly female patient with a hip fracture, giving a Hb of 3.6 g/dL. The BMS phoning the result stated that it was a very small sample and that it should be repeated. This was communicated to a second doctor, but, finding the patient to be tachycardic and pale, he prescribed 3 units of red cells. Later another doctor also prescribed 3 more units, plus FFP and platelets. On review the patient had signs of pulmonary oedema and was therefore given frusemide. A repeat Hb taken a few hours later was 12.6 g/dL.

This case is typical of this group in which difficulties in phlebotomy encountered by junior doctors resulted in haemodilute samples, partially clotted samples or samples that were in a syringe for such a long time that settling of the red cells took place.

Inappropriate or unnecessary transfusion of FFP and platelets based on POCT results n = 2

Case 6

FFP transfused on basis of erroneous INR even though repeat lab test result was available

An 84-year-old man admitted postoperatively with a retinal bleed was tested using a point-of-care coagulation device on the ward. An INR of 6.1 was recorded and a venous sample was sent to the laboratory for confirmation. Four units of FFP were requested urgently and prescribed, and subsequently a normal INR of 1.1 from the venous sample was recorded in the patient's medical notes. The FFP was nevertheless transfused inappropriately 9 hours later despite normal coagulation screen and no evidence of active bleeding.

Case 7

Bizarre results from ED not queried

A 76-year-old female patient was admitted with a dislocated knee. FBC processed POCT equipment in ED, produced a platelet count of $67 \times 10^9/L$. The accompanying Hb was 24 g/dL. The anaesthetic junior doctor ordered some platelets, and did not discuss the peculiar results with the haematology team. The BMS did not query the request in the light of Trust protocols for platelet transfusion. The junior non-specialist doctor prescribed the platelets to run over 2 hours. A normal count was later obtained from the main laboratory.

In the cases above, as in the previous ones, there appears to be a failure to query the veracity of the results based on the clinical picture, or to view the results as a whole, including WCC, platelets and indices as well as accompanying chemistry results. All of these may appear very abnormal in a situation such as Case 7. Full evaluation of the patient is essential and there must always be awareness that results can be incorrect.

Haematology and coagulation laboratory errors (i.e. not transfusion laboratory) n = 3

In 2 cases a patient prone to platelet clumping in ethylenediaminetetraacetic acid (EDTA) was transfused platelets unnecessarily on account of this. In both cases the laboratory had issued a report showing a low platelet count. In 1 case the caveat was added to – that there was clumping and that a citrated sample should be sent to check the platelet count more accurately. However, the junior doctor still prescribed platelet prophylaxis on the basis of this erroneously low count.

In another case an INR was performed on a partially clotted sample and this was not spotted in the laboratory. The patient was therefore given FFP unnecessarily on the basis of her erroneously high INR result.

BMS staff in the hospital transfusion laboratory should certainly feel able to query requests, but frequently results such as these are from separate laboratories, geographically separate from the transfusion laboratory, and the results cannot be easily checked.

Transfusions based on poor basic knowledge and prescribing n = 17

Inappropriate transfusion based on lack of knowledge or understanding n = 4

These are cases in which there is some confusion or lack of certainty among junior doctors as to what exactly they need to order or what their patient really requires. In 1 case platelets and cryoprecipitate were ordered when the patient really needed FFP. In another case a doctor seemed unclear as to the reasoning behind asking for a group and save, or asking for crossmatch. Having requested the latter, the doctor was uncertain as to whether this led to transfusion.

Case 8

Junior doctor uncertain of implications of group and save (G and S) or crossmatch

After some instructions from her consultant, a junior doctor requested an urgent '2 unit crossmatch' on an 85-year-old female patient with a suspected bowel perforation admitted at 05.00. The Hb was not available. Later the laboratory rang the admitting ward to tell them the blood was ready, and the nurse contacted the doctor to inform her and to remind her that the blood had to be prescribed. The doctor was very busy so the ward sent a support carer to meet her to complete the documentation. The nurse commenced the transfusion at 07.05. At 09.00 the patient's consultant stopped the transfusion as he knew the Hb was 13.9 g/dL. The intention had been to request an urgent G and S to cover a possible bleed but the patient was not to be transfused until further results were available. The junior doctor was confused between a 'crossmatch' and 'group and save' request.

In the case below a patient was given platelets unnecessarily, owing to lack of familiarity with the guidelines for platelet transfusion prior to insertion of a Hickman line. This resulted in the junior non-specialist doctor transfusing platelets against the advice of the haematology consultant.

Case 9

Disagreement about necessity of prophylactic platelets

A 47-year-old man with acute lymphoblastic leukaemia (ALL) was booked for insertion of a Hickman line. Platelet cover was on standby and the consultant haematologist instructed that platelets were not to be given if the count was $> 50 \times 10^9/L$. The platelet count was $57 \times 10^9/L$, but the radiologist would not insert the Hickman line without platelets being transfused prior to the procedure. The patient was returned to the ward where the junior non-specialist doctor prescribed the platelets against the consultant's advice and outside of national guidelines. The patient returned to X-Ray where the line was inserted.

Finally there is a case in which there was inappropriate use of emergency group O D negative blood when in fact the patient was crossmatched and blood was available for them in the same refrigerator. There had clearly been lack of communication or handover regarding what components were available for the patient, and the patient was taken to theatre without the personnel involved checking the status of laboratory requests.

Case 10

Emergency blood given in haste by a junior doctor

A 28-year-old man required a repair to an arterial laceration in the antecubital fossa. A surgical junior doctor demanded 2 units of O D negative emergency blood. In fact the patient's group was known and 4 units had been crossmatched and were already available in the same refrigerator.

Excessive volume of components prescribed (or given) n = 13

In this group of cases excessive quantities of components were given as a result of lack of communication, and insufficient knowledge and experience of the junior doctors who required guidance for prescribing appropriately. There were no incorrect or misleading laboratory results influencing decision making.

Two cases (Cases 11 and 12) resulted in severe life-threatening transfusion-associated circulatory overload (TACO), while a third (Case 13) resulted in dangerously high haemoglobin levels requiring venesection.

There are 13 cases in which doctors (junior and senior) prescribed excessive volumes of components often because of miscalculation of the required dose for the patient. Omitting to check the baseline haemoglobin or to monitor Hb following transfusion was a contributory factor in several cases. In 2 of these cases there was major morbidity with serious risk to life caused by TACO. In 2 additional cases excessive volumes (in excess of what was prescribed) were given to patients by nursing staff. These are not included in the totals here and are discussed on pages 42 and 43, as they are administration errors not decision making or prescription errors.

Table 11

Excessive transfusion of components n = 13 [+2]

Inappropriate/unnecessary transfusion with correct results available	Cases
Excessive red cells prescribed Hb not checked	5
Excessive red cells prescribed for small patient	5
Excessive volume of FFP prescribed	1
Excessive volume of cryoprecipitate given	1
Excessive volume of platelets transfused	1
<i>[Excessive volume red cells given (not prescribed) see administration errors]</i>	<i>[2]</i>

Case 11

Involvement of too many personnel in decision to transfuse

A 20-month-old girl on regular dialysis for end stage renal failure attended for routine haemodialysis and her father reported that she had been unwell. A consultant commenced dialysis urgently and, as the Hb was 5.0 g/dL, requested 2 units of blood to be given during dialysis. The dialysis was completed before the blood was ready so a decision was made by a second consultant to give 250 mL of blood slowly over 6 hours. This message was conveyed between the dialysis unit nurse and the ward nurse by the patient's father. The notes were later collected and a third and fourth nurse set up the transfusion. Observations were done by the fourth nurse. No pre-transfusion observations were done. At 5, 20 and 35 minutes into the transfusion the patient was hypertensive, tachypnoeic and irritable; her oxygen saturations were unrecordable. The nurse thought this was normal for the patient. The transfusion was completed in 1 hour (not 6) and a fifth nurse then realised that the patient's extremities were blue. A sixth nurse administered oxygen while an anaesthetist was called who performed emergency intubation. The patient was transferred to paediatric ITU where she underwent sedation, high-frequency oscillatory ventilation and haemofiltration. The patient made a full recovery.

The transfusion of this child involved two consultants, the father of the patient and 6 nurses. Owing to changes of plan and no single person taking charge of the management of the patient, the child was transfused too late, when she was already off dialysis, and much too fast, causing life threatening TACO. The transfusion had also initially been prescribed over 6 hours, which is outside guidelines (which state a maximum of 4 hours). Nurses need to be assigned to specific patients and maintain responsibility for and control over all nursing tasks associated with that patient's care. Handover must be effective and structured, and a patient's care should not be taken over by new staff on an *ad hoc* basis. Lack of continuity of care has been an increasing problem in medical care in recent years, as the European working time directive has required shorter days and the implementation of shift systems for junior doctors. As a result, detailed handover between doctors as they change shift is essential, as well as full documentation in the medical notes regarding treatment decisions and including instructions for planned interventions.

Case 12

Misunderstanding and lack of knowledge leads to excessive preoperative platelet transfusion

An 81-year-old man was preoperatively transfused with 4 units of platelets within a 4 hour period. The patient developed cardiac failure, the operation was cancelled, and medical intervention was necessary. In fact the orthopaedic specialist trainee doctor had written in the notes 'Arrange 4 units of platelets'. The junior non-specialist doctor assumed this meant to order and transfuse 4 units of platelets prior to surgery. When ordering, the junior non-specialist doctor was advised by a BMS to seek a haematology opinion as the order appeared inappropriate. This advice was not sought.

This case is somewhat akin to Case 8 (above) in that a junior doctor, unfamiliar with the transfusion process and the jargon that goes with it, had not grasped the fact that blood components ordered to cover surgery are not necessarily transfused beforehand. The senior doctors (consultant and specialist trainee doctor) assumed a level of knowledge which the junior non-specialist doctor just did not have.

In the following case a patient with chronic iron deficiency anaemia was massively over transfused over a period of 3 months. The cause of his iron deficiency was not given in the report.

Case 13

Repeated transfusions for iron deficiency resulting in Hb of 22 g/dL

Four units were requested for an 85-year-old male patient with chronic iron deficiency anaemia. Between 29/01, when his Hb was 6.3 g/dL, and 23/04, 24 units of packed cells were transfused on 8 separate occasions, 2 or 4 at a time, with no Hb check. On 09/05 the Hb was 22 g/dL. In addition platelets were $98 \times 10^9/L$, INR 1.5, APTR 1.4 and fibrinogen $> 8 \text{ g/L}$. The patient was subsequently venesectioned and by 24/05 Hb was 15.3 g/dL and platelets $307 \times 10^9/L$.

This patient subsequently required venesection. This case shows once again a lack of understanding by successive junior doctors seeing the patient: they did not realise that the Hb should be monitored before prescribing further transfusion. The decision to transfuse was not reviewed, and the junior doctors seeing the patient regularly on the day ward or in outpatients did not sufficiently understand the nature of the condition, or the purpose of the treatment, to question the appropriateness of continuing regular transfusion. Once again this raises issues of continuity of care, documentation of decisions and instructions for handover.

In the following 2 cases the size of the patient was not taken into account when the transfusion was prescribed. One was a very small adult and the other a 2-year-old child.

Case 14

Small anaemic patient over transfused

A 79-year-old female patient with CMV colitis weighing 41.5kg had a Hb of 6.7 g/dL. She was given a 4 unit red cell transfusion resulting in a post-transfusion Hb of 18.1 g/dL.

Case 15

Junior doctor unfamiliar with paediatric prescribing protocols

A 2-year-old girl was admitted with peritonism, possibly due to ruptured appendix (later found to be a ruptured kidney tumour). Hb was 6.7 g/dL and the surgical team decided to transfuse, writing a dose of 15 mL/kg in the notes. The junior non-specialist doctor wrote up 2 units and the child was given 2 adult bags over 6 hours. Hb was 18.6 g/dL post transfusion.

In the case below there was a combination of a possibly erroneously low haemoglobin result combined with a small patient, and an excessive volume of red cells was prescribed and transfused without any further checking. Junior doctors need to be aware of transfusion algorithms based on a mL/kg calculation for smaller patients. They also need to realise that there are very few instances, except where there is active haemorrhage, in which 4 units of red cells need to be given so rapidly. The patient below, with a Hb of 7.3 g/dL, only required a single unit.

Case 16

Small adult patient with low Hb

An 18-year-old male patient weighing 35kg, with a probable chest infection, received a 4 unit red cell transfusion based on an Hb result of 7.3 g/dL. The doctor prescribed 2 units of red cells. The patient was then referred to a medical team and another junior doctor prescribed a further 2 units of red cells making a total of 4 units. Post transfusion the Hb was 18.4 g/dL. Both samples were rechecked and correct. Investigation revealed that the initial sample was taken by a junior doctor in ED using a syringe during a difficult cannulation. The red cells may have settled in the syringe before the sample tubes were filled, giving an inaccurate result. No IV fluids were in progress at the time. No adverse reaction or ill effects were noted from the transfusion.

The final case reveals not only a lack of awareness of national guidelines on reversal of warfarin⁴ but also poor clinical acumen leading to high volume fluid transfusion, which is clearly in itself potentially dangerous.

Case 17

A case of TACO after use of FFP to reverse warfarinisation

A 61-year-old male patient with an INR of 6.0 required warfarin reversal prior to elective surgery. He was given Vitamin K 5 mg and 4 units of FFP over 160 minutes. Without any further INR being performed he then received another 3 units over 45 minutes, at which point he became unwell with rigors, chills, wheeze and a temperature of 38.3°C. His oxygen saturation on air was 80%. He was managed with diuretics and oxygen. The planned surgery was performed the following day.