Avoidable, Delayed or Under/ Overtransfusion (ADU), and Incidents Related to Prothrombin Complex Concentrate (PCC) n=236

10

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Key SHOT messages

- Every minute counts:
  - 81 factors contributing to delayed transfusion were identified in 34 major haemorrhage protocol (MHP) activations
  - Delayed transfusion was compounded by delay at multiple steps
  - Poor and delayed recognition of major gastrointestinal bleeding in elderly people particularly when admitted for another cause contributes to morbidity and mortality
- Transfusion at night may be necessary and should not be delayed where there is a clear and urgent indication
- Trade names and abbreviations may cause confusion, delay and inappropriate treatment – avoid them
- Second victims: support for staff involved in a serious incident is essential
- Do not waste O D-negative units: policies for use of group O red cells should be updated to permit O D-positive units to be used in emergencies in female patients >50 years of age and in males >18 years of age
- Anticoagulants are dangerous: staff need training about indications for and use of prothrombin complex concentrate

Overview of ADU cases

- **Delayed transfusions n=112** (of these, 3 also involved avoidable O D-negative transfusions)
- **Avoidable transfusions n=106** (of these, 1 was also a delayed transfusion). Of note, there were 15 cases of transfusion-associated circulatory overload (TACO) who received avoidable transfusions which contributed to their overload, see Table 10b.2 (numbers counted in TACO)
- **Under or overtransfusion n=15**
- **Cases related to PCC n=9** (of these, 6 were delayed transfusions, and are included in the numbers of the relevant section)

Near miss (NM) cases n=12 (not included in the total 236 above)

Six unnecessary transfusions were avoided. Notable cases are shown below.

- One report noted failure of the label printer in the laboratory so that for 18 hours all forms and labels were hand written with potential for delay in transfusion
- A cardiac operation was nearly delayed due to miscommunication as staff waited for confirmation for blood availability when it was available

- A major haemorrhage call was made giving the wrong patient details but detected before components were released
- Excessive amounts of blood components were requested for two separate infants but the errors in prescription were detected prior to transfusion

Reclassification of cases

Several cases were reclassified after expert review, details of which can be found in the supplementary information on the SHOT website (www.shotuk.org).

Deaths n=9

Altogether 21 deaths were recorded, 12 reported as unrelated to transfusion, and 9 where the transfusion event played a part.

There were 6 deaths that were 'possibly related' and 2 'probably related' to delayed transfusion.

One death was recorded as 'unrelated' to the transfusion incident (delay and potentially unsafe use of group O) but this death was identified elsewhere in the report as due to bleeding so this one is included, as the delay may have contributed.

One death was 'possibly related' to overtransfusion.

Major morbidity n=0

There were no ADU cases reported in 2018 that resulted in major morbidity.

IT cases for ADU chapter n=18

Further details of the IT-related reports can be found in the supplementary information on the SHOT website www.shotuk.org.

Delayed Transfusions n=112

10a

Definition:

Where a transfusion of blood/blood component was clinically indicated but was not undertaken or was significantly delayed or non-availability of blood components led to a delay with impact on patient care (not restricted to emergency transfusion).

There were 112 reports of delayed transfusions in 2018 versus 95 in 2017. This total includes 6 cases where prothrombin complex concentrate (PCC) infusions were delayed.

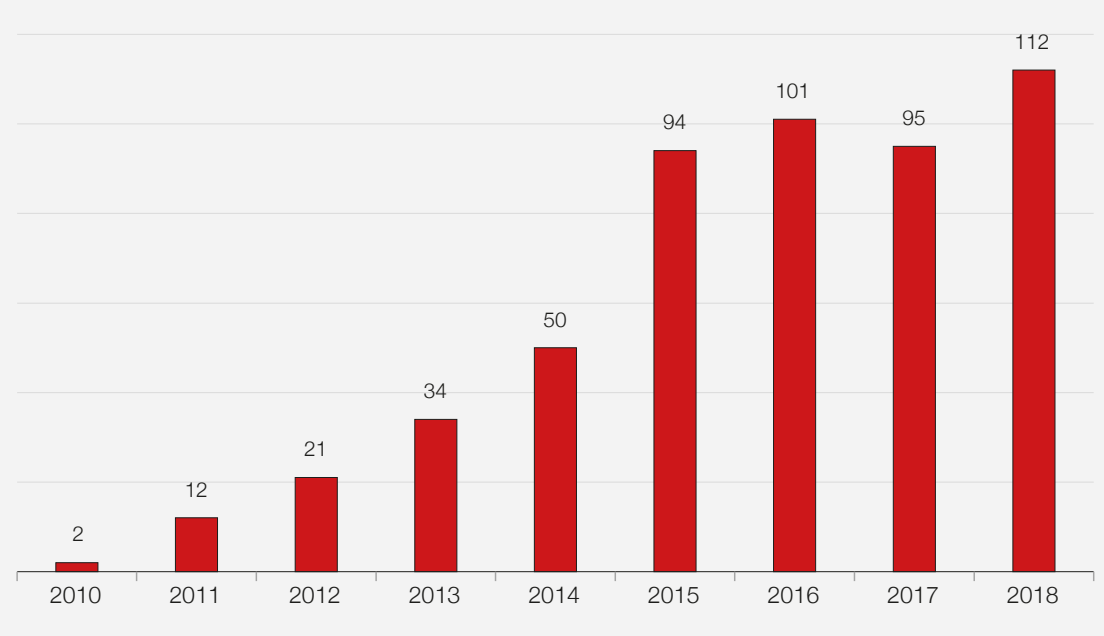


Figure 10a.1: Delayed transfusion reports by year 2010-2018

In 13 cases delays were experienced during MHP activation and in a further 6 cases with major haemorrhage but without MHP activation.

Deaths n=8

Of the 12 deaths reported in this category, 8 were related to the delay in transfusion. Two were 'probably related' and 6 'possibly related' to the delay. In one case, although the reporter noted that the death was 'unrelated' to transfusion delay, the cause of death was 'multiple organ failure secondary to uncontrolled bleeding'. These are described below.

Deaths 'probably related' to delay n=2

Case 10a.1: Delayed transfusion with contribution from multiple assumptions

A man in his 80s was in the high dependency unit (HDU) following elective aortic aneurysm repair and had a haemoglobin (Hb) of 77g/L due to haematuria. He had ischaemic heart disease (IHD). A transfusion was prescribed in the evening but he did not receive the transfusion and suffered cardiac arrest the following morning.

Many assumptions were made and there was poor handover: the prescribing doctor requested that the transfusion take place as soon as possible, but the nurses assumed it was non-urgent; staff assumed there was already blood available, but the units prepared for surgery had been returned to stock. The patient was shortly to be transferred to a ward and there was a policy not to transfuse at night unless essential.

Case 10a.2: Delay treating gastrointestinal (GI) haemorrhage

A man in his 80s was admitted (at 08:55) with a GI bleed (history of blood in stools) and Hb 76g/L. He was unwell, hypotensive (blood pressure 93/42mmHg) dizzy and unable to stand, with a raised early warning score. Two units were requested at 10:16, available at 12:07, but were not prescribed and never transfused. He was on warfarin for atrial fibrillation (AF) and his international normalised ratio (INR) was 7 for which he received timely treatment with PCC and intravenous (IV) vitamin K. He deteriorated and had a cardiac arrest within 5.5 hours (at 14:26) and died due to prolonged untreated hypovolaemic shock. The primary cause of death was recorded as massive upper GI haemorrhage due to gastric ulcers.

The case review noted that the emergency department (ED) staff did not recognise how unwell the patient was at transfer, particularly as there was no overt bleeding, and also that there was no clear plan and a lack of communication about the proposed transfusion on transfer to the ward at 12:50. There was clear evidence of deterioration in the vital signs (increased respiratory rate, tachycardia and continued fall in blood pressure) which was not escalated to the medical team.

Deaths 'possibly related' to delay n=6

Case 10a.3: Death from GI haemorrhage due to failure to recognise and treat this in a timely manner

A man in his 70s was admitted with back pain and shortness of breath and died while receiving a red cell transfusion 2 days later. Multiple co-morbidities included IHD with previous stroke, chronic kidney disease and AF for which he was on warfarin. He had known previous anaemia and received iron injections at home. On admission his Hb was 83g/L so he was prescribed a unit of red cells in the evening of Day 1. His INR was >7 for which he received a suboptimal dose of 1mg vitamin K; during the admission he had several episodes of melaena. He was transferred from the ED to the medical admissions unit (MAU) and then to a ward but the transfusion did not start until the morning of Day 3 when he then had a cardiac arrest.

Several issues were identified in the investigation:

- Failure to look for evidence of GI bleeding. A digital rectal examination was not carried out by the doctor in the ED, the foundation year doctor (who clerked the patient), nor the reviewing consultant. Had the GI bleeding been identified on Day 1 the patient could have had a gastroscopy on Day 2 and this may have prevented his death
- Failure to rapidly reverse his anticoagulation. Vitamin K was administered at 18:20 on Day 1 but only 1mg, which is inadequate for acute bleeding with a prothrombin time (PT) of 101 seconds (s) (normal range usually about 12s). Further PT results on Day 2 confirmed that only partial correction had occurred. Consideration of prothrombin complex concentrate treatment should have taken place when bleeding was overt, at 02:00 on Day 3
- Transfusion was delayed. It was planned on Day 1, and again by the reviewing consultant at 13:45 on Day 2. Transfusion was indicated after 17:00 on Day 2 when a falling Hb of 71g/L was reported
- Poor and confusing medical and nursing documentation

Case 10a.4: Delay in recognising serious GI bleeding

A man in his 70s was admitted with community-acquired pneumonia reporting a 10-day history of productive cough on a background of chronic obstructive pulmonary disease (COPD). During admission his Hb level fell from 151g/L on admission to 128g/L on Day 2. Repeat blood tests and

rectal examination were not done on Day 3, despite the patient complaining of black stools and being on medication which could cause bleeding (aspirin). On Day 5 (a Saturday) he had episodes of melaena - 'a large amount' - and was noted to be hypotensive with a tachycardia; Hb was 89g/L. He was stable so oesophago-gastroduodenoscopy (OGD) was planned for Day 7 (Monday), The patient had a two-unit red cell transfusion due to a further fall in Hb to 61g/L on Day 6 (Sunday) associated with tachycardia and repeated episodes of melaena. In the early hours of Day 7 (Monday) he became agitated and complained of abdominal pain. His Hb was 60g/L and four units of red cells were given. He deteriorated further and suffered cardiorespiratory arrest. Cardiopulmonary resuscitation (CPR) was commenced but was unsuccessful.

The National Institute for Health and Care Excellence (NICE) guidelines recommend that patients with an upper gastrointestinal bleed should have an OGD within 24 hours (of admission) (NICE 2012). Patients with upper GI bleeding should have a Blatchford score recorded to assess the bleeding risk (Banister et al. 2018; Chatten et al. 2018). There was a delay in obtaining senior review on Day 7. There was a further delay in starting the transfusion due to difficulty with venous access.

The case review noted that patients who deteriorate likely due to upper GI bleeding should have urgent senior review and blood transfusion started without delay.

Case 10a.5: Multiple causes for delay with death from hypovolaemic shock due to GI bleeding

A woman in her 80s was seen at home for a chest infection (Day 1) and refused to come to hospital. The following day (Day 2) she was seen again by the general practitioner (GP) and again declined admission although she was noted to be very pale and hypotensive (94/54mmHg, pulse rate 96 beats per minute (bpm)). On Day 3 the ambulance crew were called to her home where she was found collapsed, very short of breath and cyanosed. The working diagnosis was an acute exacerbation of COPD. She was admitted at 11:05 and waited in a chair for 3 hours. Blood results available at 17:20, 6 hours after admission, showed Hb 65g/L. She was then noted to have melaena at 19:00 so a diagnosis of GI bleeding was made, and red cell transfusion authorised. At 8 hours after admission (19:00), a blood sample was taken for crossmatch (which arrived in the laboratory 1.5 hours later). Blood was issued within an hour, however the transfusion was delayed and did not take place at all.

At 01:46 she had a cardiac arrest and died. The cause of death was recorded as cardiac arrest due to hypovolaemic shock and GI bleeding. The report notes communication failures and staff distractions due to the unit being very busy.

Learning point

- Prompt recognition and timely management of gastrointestinal (GI) bleeding, especially in complex elderly patients, is imperative. Delays can contribute to patient death. Every second counts

Patients with evidence of GI haemorrhage require close monitoring, timely investigation and appropriate transfusion; this may be incremental to keep up with bleeding, keeping a close watch on the Hb and clinical signs of bleeding. These patients do not often have sudden massive haemorrhage, and many are at increased risk of TACO (age and comorbidity). (Case 17b.1 in Chapter 17b, Transfusion-Associated Circulatory Overload (TACO), 'Rapid correction of anaemia can precipitate TACO in the absence of other comorbidities and risk factors').

Case 10a.6: Delay related to poor communication

A frail woman in her 80s died from hypovolaemic shock with bleeding from a leg haematoma. When blood was requested the laboratory requested a second sample as clinicians had not communicated the urgency. There was a delay of more than 2 hours.

In an emergency the need for a group-check sample from a previously untransfused patient may be overridden if this would delay urgent transfusion.

Case 10a.7: Intraoperative death from haemorrhage

An elderly patient was admitted with trauma. During planned surgery on Day 7 of admission there was unpredictable and catastrophic bleeding (estimated more than 2.5L within minutes), and the patient arrested and died in theatre.

A serious incident external review was undertaken. There was a changeover of anaesthetist during the procedure. The patient received two units of fresh frozen plasma (FFP) but no red cells. The external reviewer noted that the major haemorrhage protocol was not activated and considered that this degree of bleeding should have resulted in more aggressive action. In severe haemorrhage minutes may matter; there was also concern over internal delays in blood gas analysis. This unfortunate event could not have been foreseen and probably was not preventable. The external reviewer noted the considerable impact of this event on the medical staff involved.

Extract from the external review of this case notes the importance of supporting the staff involved in any serious incident

The reviewer noted the openness of discussion and the open learning culture in the department.

'This has been a great shock to a 4th year consultant anaesthetist; their confidence has been shattered, their self-belief shredded….this colleague has learnt a hard and bitter lesson. It is now time to heal and support them.

The two juniors directly involved show complete and heartfelt discomfort .. I detect, and it is unfair, self-blame and doubt. One junior has doubted their career path and considered a change.

The role of the primary consultant: I was moved by the obvious torture he is still going through…in hindsight he admits his actions were not optimal. Given time again it would all be dealt with differently. I think this shows a very brave and commendable degree of insight .. the role of a consultant can be a lonely and high stress environment. Decisions are often based on incomplete evidence under sub-optimal circumstances. It is all too easy in the comfort of an office to review notes and find glaring inadequacies in others.'

The external reviewer felt that all reasonable actions were taken to maximise this patient's chances of survival for the majority. However, he noted that only a litre of crystalloid was given, the changeover of anaesthetic staff occurred at a critical moment, no group-specific blood was given. The junior doctor requested crossmatched blood, then left. The surgical team thought that 'blood was ordered' so were unaware that this could take up to one hour to provide. Consequently, the MHP was not followed.

Case 10a.8: Potentially unsafe use of O D-negative blood in an emergency in a patient with red cell alloantibodies at a hospital with no overnight transfusion laboratory support

A woman in her 70s on peritoneal dialysis presented to her local hospital with acute bleeding overnight when the laboratory was closed. Anticoagulation with full dose low molecular weight heparin had been started on this day, and she developed a very large subcutaneous haematoma. This was treated as major haemorrhage and she received two units of emergency O D-negative blood while awaiting crossmatched blood from another site. However, neither the laboratory staff (who could have come in) nor haematologist was contacted. The clinical staff did not note that she had atypical antibodies (anti-N and auto anti-e) and therefore that the O D-negative units might be incompatible. She was transferred to the dialysis unit at another hospital where she later died as a result of complications of this bleed. There was no adverse reaction to the O D-negative units and the crossmatch of further units was completed at a distant site. Six compatible units were issued 12 hours after admission and one transfused.

The death from bleeding was initially classified as 'unrelated to transfusion' but due to the presence of many relevant factors, it has been included as possibly related (imputability 1) here.

It is important that patients who are bleeding do not die from haemorrhage so it may be necessary and appropriate to use emergency group O D-negative red cells. However, in the presence of irregular antibodies these may not be compatible and have the potential to result in haemolysis. Group O D-negative red cells will be e-positive. Advice should be sought from the haematologist and transfusion laboratory staff in this situation for both transfusion (how to monitor for and manage potential immune haemolysis) and anticoagulant management.

A case of haemolysis following transfusion of incompatible O D-negative red cells in an emergency (postpartum haemorrhage) is reported in Chapter 18, Haemolytic Transfusion Reactions (HTR). In this instance the patient had known anti-Jk^{a}. The patient was admitted to intensive care with renal impairment and required ventilation. Retrospective typing of the emergency units showed one or more was Jk^{a}-positive.

Additional educational cases

Case 10a.9: Delay caused by misunderstanding of abbreviations

Red cells were requested with the clinical details 'IUT 27+6/40 PROM'. The biomedical scientist (BMS) interpreted IUT as 'intrauterine transfusion' and ordered red cells suitable for this. However, in this instance, IUT meant 'in utero transfer'; the blood was required for the mother, not the baby. There was additional miscommunication during a telephone call resulting in delay to provision of red cells for the mother, and wastage of three units that had been provided as 'suitable for intrauterine transfusion'. On review of this case the haematologist suggested that all requests for intrauterine or exchange transfusion should go through a senior member of the transfusion laboratory staff.

Several medical abbreviations have multiple meanings so should be avoided, particularly in communication across different departments. For example, PID can mean pelvic inflammatory disease or prolapsed intervertebral disc, and there are 75 other meanings. AAA (abdominal aortic aneurysm) has 198 alternatives (source: acronyms.thefreedictionary.com). This may occur even within a specialty (e.g. MI can mean both mitral incompetence and myocardial infarction).

Learning point

- Abbreviations may be misunderstood, so do not assume that others understand without spelling it out. One abbreviation can have more than one meaning

Case 10a.10: Transfusion inappropriately delayed overnight with misinterpretation of guidelines (see also Case 10a.1 above)

An elderly woman (with diabetes) was admitted with a low Hb of 46g/L due to severe iron deficiency. The medical team refused to authorise transfusion overnight despite adequate ward staffing with three very experienced nurses more than capable of managing a transfusion reaction. She was prescribed two units of red cells. The on-call medical team were not happy for the patient to be transfused overnight in view of minimal medical cover to provide support for possible transfusion reaction. Although clinically stable at the time, the patient was at high risk due to her very low Hb. The hospital transfusion policy, while stating that consideration must be given to the safety of the transfusion, notes that the patient's clinical condition must be taken into account. The policy does not prohibit transfusion at night.

In this case there was clearly a difference of opinion between the nursing and medical staff. The nursing numbers and experience in this case were adequate to proceed. SHOT guidance is clear that transfusion must not be delayed where the need is urgent. This elderly woman also had diabetes and likely cardiovascular disease, increasing her risk of ischaemic damage from hypoxia with this degree of anaemia. Transfusion of one unit followed by reassessment would be appropriate to see at what point she could continue with iron rather than red cell transfusion.

Case 10a.11: Delayed transfusion: failure to recognise and respond appropriately to a haematological emergency in an elderly man

The elderly man with chronic lymphatic leukaemia (CLL) and significant co-morbidity complicated by known autoimmune haemolytic anaemia (AIHA) was admitted as an emergency with Hb 44g/L but did not receive transfusion until 15 hours later. Referral to the haematology team (to whom he was known) was not made for nearly 12 hours when treatment was rapidly escalated but there were additional delays; the second unit of blood was delayed as the patient transferred between wards.

The investigation identified lack of a clear transfusion plan, no referral to haematology on admission, no direct communication between the admitting doctor and the laboratory, and despite documented deterioration of the patient, the nurses and doctors failed to recognise or respond to this.

Case 10a.12: Urgent blood release delayed after postpartum haemorrhage (PPH) because of a verbal error in the order

The laboratory issued group-specific A red cells for Patient 1 following a 2L PPH but the blood was required for a different patient, Patient 2, whose group was O. There were two patients with the same first name who delivered at the same time. The midwife ordering the blood heard the wrong name and ordered blood for another woman. The group A red cell unit could not be collected from the electronic kiosk because the identification (ID) on the pick-up slip did not match the ID on the electronic system.

The reporter noted that they were very short of midwives and could not recruit and retain staff. As a result of this incident staff were reminded to always repeat back all verbal requests to ensure the details are correct. This illustrates the importance of correct patient identification and wrong transfusion was prevented by the information technology (IT) system.

Problems related to management of major haemorrhage n=34

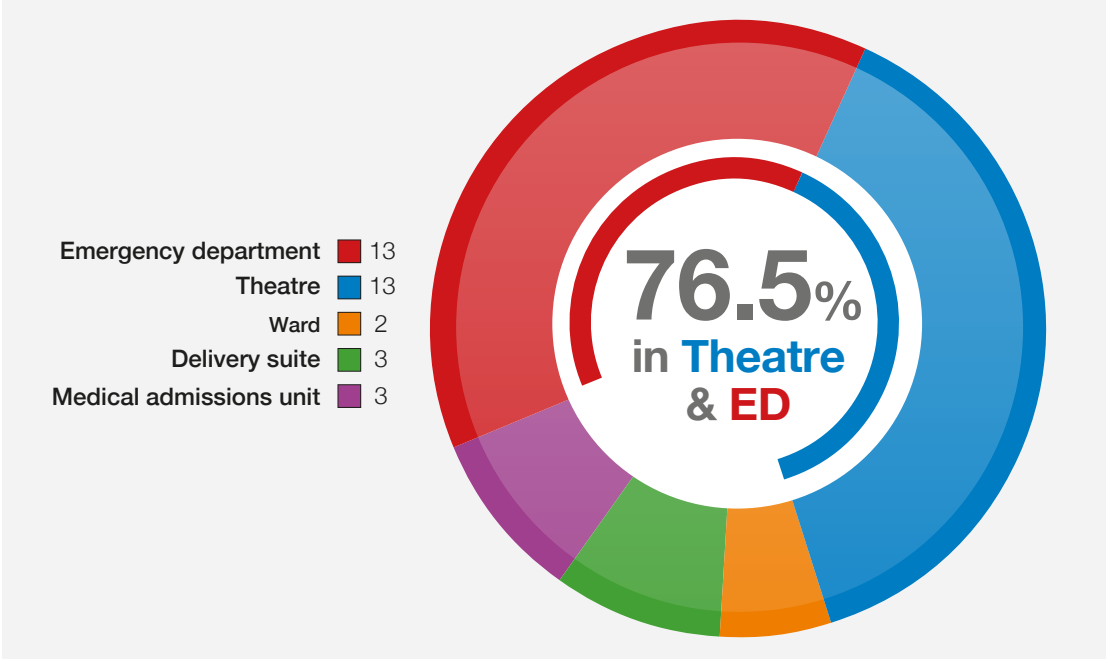
This subsection describes all incidents related to major haemorrhage, and includes 19 delayed transfusions, 12 instances of avoidable transfusion and 3 overtransfusions.

In this group of patients, there were 6 deaths, 5 unrelated to the delay and 1 (Case 10a.7) was 'possibly related' to the delay.

The transfusion priority in 32/34 was 'emergency', 1 was 'urgent', and 1 was not specified. The MHP was activated in 27/34 cases.

The majority, 26/34 (76.5%) of reported incidents in this category occurred in the ED or theatre.

Figure 10a.2: Location of major haemorrhages



There were 12 cases of avoidable transfusion related to major haemorrhage with (11) or without (1) protocol activations; in 9 of these, emergency O D-negative units were transfused unnecessarily.

There were 19 cases of delayed transfusion (in addition one avoidable case where O D-negative blood was transfused unnecessarily was also delayed). In 6 of these there was major haemorrhage without MHP activations.

There were 3 cases of overtransfusion in the context of major haemorrhage, all are detailed below.

Case 10a.13: A young person with significant multisystem injuries

A very seriously injured young person was transferred with multiple trauma: head injury with raised intracranial pressure, major chest injuries, significant intra-abdominal uncontrolled haemorrhage from a high-grade liver laceration and very high-grade splenic injury. Peripheral injuries included stable pelvic fracture, femoral shaft fracture and the patient was haemodynamically unstable. The patient received red cells and plasma in transit. Following admission during complex surgery and resuscitation they received 19 units of red cells, 14 units of FFP, three units of platelets and four of cryoprecipitate. Post-transfusion Hb was 199g/L requiring venesection.

The emergency care resulted in survival from these extensive injuries. However, case review was undertaken to investigate why the patient was overtransfused. Persistent hypotension and poor perfusion had been attributed to blood loss when it was caused by misplacement of the chest drain resulting in a tension pneumothorax. Repeated blood gas and laboratory analyses were available throughout surgery and stabilisation showing adequate Hb levels of about 140g/L but these had not been taken into account.

Case 10a.14: Unexpected bleeding during surgery

An elective nephrectomy for a tumour was converted from a laparoscopic to an open procedure with estimated 2L blood loss from the renal vein. The patient received 15 units of red cells, five of FFP, two of platelets and two of cryoprecipitate. The pre-transfusion Hb was 123g/L and 4 hours later was 156g/L. The patient suffered cardiac arrest and was transferred to ITU postoperatively, but this was not attributed to the transfusion.

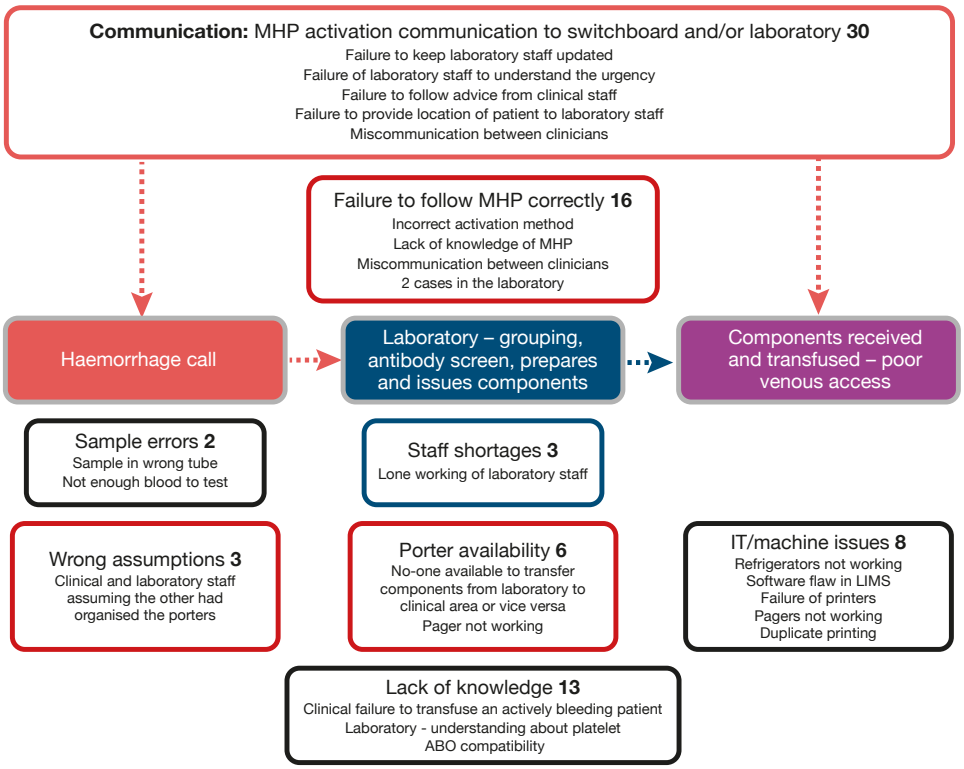
Case 10a.15: Inaccurate estimate of bleeding

Unexpected blood loss into a drain (300mL) following mastectomy resulted in activation of the MHP. This was considered to be an inappropriate activation with an overestimation of the blood loss. The patient received two units of blood and the FFP was wasted. The post-transfusion Hb the next day was 123g/L.

These three cases demonstrate difficulties in assessment of blood loss in an emergency. The first case was particularly difficult for the attending staff owing to the very severe injuries; the case review was important as it noted that in the stressful environment the useful evidence from blood tests was overlooked.

Factors identified in 34 major haemorrhage cases (27 MHP calls) n=81 (often more than one per case)

Figure 10a.3: Holdup points identified in the major haemorrhage transfusion pathway



MHP=major haemorrhage protocol; IT=information technology; LIMS=laboratory information management system

30/34 (88.2%) communication factors

- Miscommunication between clinicians
- Failure of biomedical scientist or porter's pagers
- Misunderstanding of verbal information between clinician and laboratory staff
- Failure to follow advice from haematology staff
- Failure of laboratory staff to understand clinical urgency
- One hospital had different packs depending on whether the MH was associated with trauma (Pack 1 includes FFP) or not associated with trauma (Pack 1 does not include FFP)
- Failure to update laboratory staff following MHP activation. Recurring failure of clinical area to update laboratory staff and confirm stand down
- Failure to check transfusion history in a patient with known alloantibodies followed by transfusion of O D-negative units
- Failure to provide location of the patient to the laboratory staff

16/34 (47.1%) MHP procedure not followed correctly

- Incorrect activation method
- Misunderstanding of correct procedure including failure to use emergency group O D-negative units
- Provision of platelets with MHP Pack 1 in error (should only be in Pack 2)
- Failure to complete patient identification, and prescription in the wrong place
- Failure to ensure the laboratory staff and porters were contacted

- Failure of laboratory staff to start thawing FFP following use of Pack 1 in order that it would be ready for Pack 2
- Laboratory staff lack of knowledge and failure to follow procedures

13/34 (38.2%) lack of knowledge contributing to the two issues above

- Failure to transfuse actively bleeding patients or activate the MHP when advised to

6/34 (17.6%) porter availability e.g. nobody to transport blood units from laboratory to clinical area

5/34 (14.7%) equipment failures

- Blood refrigerator in theatres out of action, porters had been informed but the clinical staff were not aware
- Failure of plasma thawer

3/34 (8.8%) wrong assumptions made

- Laboratory staff received no calls from the ED following admission of a patient with haemorrhage and first provision of emergency units so they assumed the MHP was stood down (there was a special telephone number not used by the clinical area)
- Continued transfusion on the assumption that the patient was bleeding without consulting available results which showed normal Hb results
- Clinical area and laboratory staff each assumed the other was responsible for organising the porters

3/34 (8.8%) staff shortages – lone working of laboratory staff

3/34 (8.8%) IT issues included failure of printers, duplicate printing and inability to release paediatric emergency units due to a software flaw

2/34 (5.9%) sample errors – one sent initially in heparinised tube, second sample too small to test; another sample sent in wrong tube so needed to be repeated

Logistics

These included situations where there had been no one available to transport the relevant components to the clinical area from the laboratory. These were related to staff shortages. There were some cases where incorrect assumptions had been made causing delays.

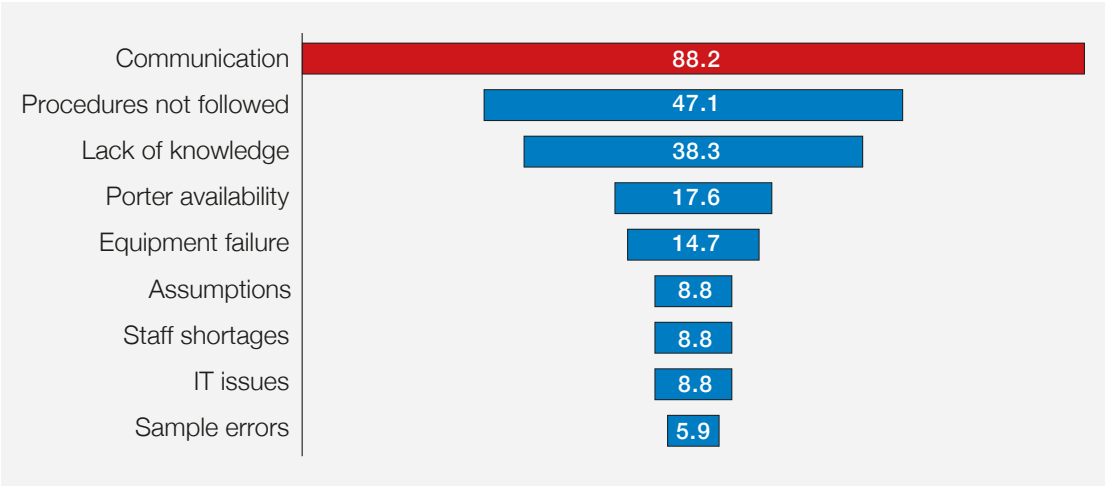


Figure 10a.4: Poor communication is the most common factor contributing to errors in MHP-related reports (results as %)

IT=information technology

Major bleeding without activation of the MHP was reported in 7/34 (20.6%) cases.

There were 6 cases that occurred in theatre and 1 case in the delivery suite.

There were overall 9/34 cases of major haemorrhage that occurred in trauma patients, all associated with delay.

Commentary

It is disappointing that there were so many problems reported in the management of major haemorrhage, most resulting in delayed transfusion. In major bleeding every minute counts. A published review of 680 trauma patients noted that every minute of delay from activation of the MHP to delivery of components increased the odds of death by 5% (Meyer et al. 2017). It is now more than 8 years since the National Patient Safety Agency published their Rapid Response (NPSA 2010). This alert was issued in relation to 11 deaths and 83 incidents of harm due to delays reported over a 4-year period. Here we report 34 incidents related to major haemorrhage in a single year, 19 resulting in delay. There were 16 reports to SHOT of delay in 2016, and 19 in 2017, in total 54 over the past 3 years. The most important factor contributing to delay is poor communication, as shown above and similarly in previous years.

Guidelines published in 2015 recommend that all staff 'involved in frontline care must be trained to recognise major blood loss early, know when to activate/trigger the local major haemorrhage protocol and take prompt and appropriate action' (BSH Hunt et al. 2015) and good communication is essential. One centre has devised a transfusion prescription template which improved balanced transfusion (FFP:RBC ratio) in trauma cases monitored 2012-2016 (Swieton et al. 2018). This template includes reminders about what blood samples to take and which patients might be eligible for group O D-positive rather than D-negative emergency units. A recent review addresses the many advances in management of major haemorrhage in trauma but not these basic issues of communication and logistics (Curry and Davenport 2019). The key components of a MHP are listed in another recent review (Booth and Allard 2018) and include scope, activation method, choice of components, communication, stand-down and regular review including training and drills. The evidence from SHOT reporting suggests that there is room for improvement.

Additional cases related to errors in major haemorrhage protocol activation are found in Chapter 14, Laboratory Errors, Case 14.7, and Chapter 13, Right Blood Right Patient (RBRP), Case 13.1.

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Avoidable Transfusions n=106

10b

Definition:

Where the intended transfusion is carried out, and the blood/blood component itself is suitable for transfusion and compatible with the patient, but where the decision leading to the transfusion is flawed. This includes transfusion based on poor knowledge, communication failures, incorrect decisions or poor prescribing.

Avoidable use of emergency O D-negative blood where group-specific or crossmatched blood was readily available for the patient.

The total of 106 excludes 3 cases classified under delay which were also associated with avoidable transfusion of O D-negative units. This compares with 101 in 2017.

Avoidable transfusions contributed to circulatory overload in 15 cases. These are counted in Chapter 17b, Transfusion-Associated Circulatory Overload TACO).

MHP factors n=12

These cases are discussed in more detail in the section under delayed transfusions.

Cases involving major haemorrhage factors included 9 with MHP activation, resulting in avoidable use of O D-negative units.

In one case, misreading the gas machine result as 'Hb 50' when this was 'HHb', resulted in MHP activation and the patient was transfused.

Most blood gas machines include CO-oximetry as a bolt-on option. It is a separate unit to the main Clarke electrode blood gas analyser. The CO-oximeter unit tends to use specific wavelengths of light to look at oxygenation state of haemoglobin by specific wavelength absorption. Commonly, it reports total haemoglobin (tHb, A in Figure 10b.1), although this is not especially accurate. It also reports carboxyhaemoglobin and methaemoglobin. The final value reported on some (but not all) machines is reduced haemoglobin, i.e. structurally normal haemoglobin in a deoxygenated state. This is often annotated HHb, the first H relating to hydrogen, hence the 'reduced' state (B in Figure 10b.1) and is not the true Hb result.

	Results				Crit. Low	Reference Low	Reference High	Crit. High
	Measured (37.0°C)							
	pH		7.37		[7.20	7.35	7.45	7.60]
	pCO_2	↑	6.8	kPa	[2.6	4.3	6.4	9.3]
	pO_2	↓	9.0	kPa	[6.0	11.0	14.4	--]
	Na^+	↓	135	mmol/L	[120	136	145	160]
	K^+		4.2	mmol/L	[2.8	3.5	5.1	6.5]
	Cl^-		99	mmol/L	[80	98	107	120]
	Ca^{++}		1.19	mmol/L	[0.75	1.15	1.33	1.60]
	Hct	↓	35	%	[18	37	50	60]
	Glu	↑	14.4	mmol/L	[2.5	3.6	5.3	25.0]
	Lac	↑	2.3	mmol/L	[--	0.3	2.0	4.0]
	CO-Oximetry							
A	tHb	↓	110	g/L	[70	117	174	200]
	O_2Hb		92.5	%	[--	90.0	95.0	--]
	COHb		1.3	%	[--	0.0	3.0	10.0]
	MetHb		0.8	%	[--	0.0	1.5	--]
B	HHb	↑	5.4	%	[--	1.0	5.0	--]
	sO_2		94.5	%	[--	94.0	98.0	--]
	Derived							
	BE(B)	↑	3.1	mmol/L	[--	-2.0	3.0	--]
	HCO_3^-std		27.3	mmol/L	[10.0	21.0	28.0	40.0]

↑↓ Outside Reference Range

Figure 10b.1: Blood gas result illustrating the difference between total Hb (A) and HHb (B)

Avoidable use of O D-negative units n=27

There were 27 cases of avoidable O D-negative red cell use, of which 9 (see above) were associated with MHP calls and one other with major haemorrhage without MHP activation. In the 10 cases with major haemorrhage, 5 were less than 50 years of age (3 male and 2 female), but 5 were over 60 years of age (3 male and 2 female).

In those without major haemorrhage, n=17, a total of 12 patients 6/8 women and 6/8 men (together 75.0%), were over 50 years of age (in 1 case age and gender was not provided).

A national audit of the use of O D-negative red cells (May 2018) including data from 193 sites with fate known for 5343 units, found that 321 (6%) O D-negative red cell units were transfused to male and female patients >50 years of age as an emergency. This audit reported that 32% of sites do not have a policy to provide O D-positive red cells in an emergency to unknown male patients and females >50 years old.

Learning point

- Group O D-positive units are suitable in an emergency for females over 50 years, and for males >18 years of age

The stability of supply chain for O D-negative red cells is a challenge for all Blood Services. Measures should be in place to ensure supply is adequate for those who need this group the most:

- O D-negative patients with detectable or historical anti-D
- O D-negative women of childbearing potential
- Patients of childbearing potential and paediatric patients of unknown blood group
- O D-negative males <18 years of age

Regularly transfused O D-negative patients and patients whose blood specifications cannot be met within their own blood group might require O D-negative red cells. Unnecessary use outside these indications can destabilise the supply chain and expose the most vulnerable patients to additional risk.

Recommendation

- Hospitals should regularly review their transfusion policies in relation to use of O D-negative red cells and consider including use of O D-positive red cells for males >18 years of age and female patients of non-childbearing potential when an emergency transfusion is required

Action: Hospital/Health Board Transfusion Committees

In 30 patients (including 3 delays) the use of group O D-negative red cells was avoidable;

- In 10 cases group-specific units were available
- In 9 cases delayed provision of crossmatched units was due to an earlier error (includes the 3 delays)
- In 7 cases crossmatched units were available
- In 1 case two samples were taken from the wrong patient
- In 1 case O D-negative was given to a patient with antibodies who could only be crossmatched at a distant centre. This is also potentially unsafe but the emergency need may override this
- In 1 case bleeding post tonsillectomy, the MHP was activated but the patient was transfused with Hb 143g/L
- In 1 case with folate deficiency the MHP was activated inappropriately, Case 10b.4 below

Learning points

- Use of crossmatched or group specific red cells is preferable to use of O D-negative units. Group O D-negative red cells are not safe for all patients. They may be incompatible and result in haemolysis in patients who have irregular red cell antibodies
- Patients should not die from lack of red cells. In major haemorrhage where the patient has a positive antibody screen or known antibodies for which compatible blood is not readily available aim to give ABO, full Rh and K-matched units and discuss with a haematologist

For further information see SHOT Bite No 8. Massive Haemorrhage - Delays (under current resources on the SHOT website www.shotuk.org).

Three cases of delay where emergency O D-negative units were used:

Case 10b.1: Wrong details provided by ambulance staff

A patient was transferred from another hospital with ruptured abdominal aortic aneurysm. Patient details were wrong on the ambulance transfer form (the hospital-based ID band and addressograph labels were not used) and then these wrong details were used for the hospital's information system. Several samples with different spelling of the first name were sent to transfusion; group O D-negative red cells were used in the interim.

Case 10b.2: Wrong bleep number

Emergency O D-negative red cells were used as the ED could not get through to the laboratory staff because they were using the wrong bleep number.

Case 10b.3: Potentially unsafe use of O D-negative units in a patient with AIHA

A patient with AIHA secondary to non-Hodgkin lymphoma and Hb 25g/L had refused blood on religious grounds but on the 3rd day consented to transfusion. Three blood samples were rejected by the laboratory; when satisfactorily repeated, the patient was found to have irregular red cell antibodies, but the clinical team decided to use uncrossmatched O D-negative units.

These are not necessarily safe (see above), but the severity of the anaemia and delay justified this decision.

Why were the samples rejected? The phlebotomist had decided her way of labelling the tubes was neater and so did not follow correct procedure; in addition, the electronic labelling equipment was not working properly.

There was an additional case of delay in a patient with AIHA (Case 10a.11).

Avoidable red cell transfusions in patients with haematinic deficiency n=8

Case 10b.4: Panic at low Hb result led to MHP activation and inappropriate transfusion of three different components for folate deficiency

A woman in her 30s was admitted as an emergency and found to have Hb 30g/L with mean cell volume (MCV) 118fL. The laboratory staff requested a repeat sample, but this advice was ignored. She had no evidence of bleeding or decompensation, was normotensive and had no symptoms of anaemia to warrant transfusion. The haematology registrar had noted the high MCV and advised that haematinics should be checked and not to transfuse the patient. However, a trainee activated the MHP. The BMS, not aware of the clinical situation, did not challenge this and the woman received an inappropriate transfusion of four units of O D-negative red cells together with two of FFP and one of platelets (count 45x10^9/L). The folate result (<1.6 microg/L indicating severe deficiency) was available 11 hours after the MHP activation.

The patient had severe anaemia and a low platelet count due to the folate deficiency and did not need platelets. Transfusion of one unit of red cells might have been reasonable, but activation of the MHP and transfusion of the other components despite advice to the contrary shows a startling lack of knowledge and lack of respect for the advice given by a specialist.

Learning points

- When a low haemoglobin (Hb) occurs unexpectedly it is advisable to repeat the sample to ensure it is not due to poor sampling
- The mean cell volume (MCV) provided as part of full blood count results can help categorise anaemia and determine which additional investigations are appropriate

There were 7 additional cases of avoidable transfusion in people with iron deficiency anaemia (IDA). Five were prescribed by registrars or foundation year doctors, and one by a consultant. Four were in the ED and two in gynaecology settings. One was caused by analyser error. There were also two cases of delayed transfusion where the primary diagnosis was iron deficiency. In many of these it might have been reasonable to transfuse a single unit if the patient was symptomatic, but all were transfused excessively (Table 10b.1). A further avoidable transfusion for iron deficiency was associated with a febrile reaction and is reported in Chapter 16, Febrile, Allergic and Hypotensive Reactions (FAHR), Case 16.3.

Learning points

- In patients presenting with very low haemoglobin (Hb) before arranging transfusion first diagnose the cause
- Look at the mean cell volume (MCV); this is very elevated in B12 and folate deficiency (treat with the appropriate vitamin and transfusion can usually be avoided even at very low Hb levels)
- The MCV is reduced in iron deficiency proportionate to the degree of anaemia. Treat iron deficiency with iron therapy
- Before transfusion consider underlying risk factors (age, comorbidity particularly ischaemic heart disease)
- Transfuse the minimum amount; if really necessary, give one unit and review
- Note that transfusion-associated circulatory overload (TACO) can be precipitated with rapid correction of anaemia (Case 17b.1, Chapter 17b, Transfusion-Associated Circulatory Overload (TACO))

Table 10b.1: Excessive or delayed transfusions in iron deficiency

Patient age	Sex	Hb g/L	Number of units transfused	Comments
50s	M	45	3	Known iron deficiency anaemia lost to follow up
50s	F	85	4	Post-transfusion Hb 166g/L. Consultant prescription pre-hysterectomy
80s	F	39	2	Four units were prescribed
Teen	F	NS	2	Menorrhagia
40s	F	49	3	Menorrhagia
70s	F	46	2	Delayed overnight inappropriately*
40s	F	54	NS	Symptomatic anaemia; Three samples rejected due to labelling errors. 5-hour delay

*NS=not specified *discussed under delays*

Recommendation

- Cases of inappropriate management of haematinic deficiency are reported every year. Education about the haematological effect of iron, B12 and folate deficiency should be taught at undergraduate level

Action: Undergraduate medical and nursing schools

Cases of avoidable transfusions complicated by TACO n=15

These cases are included in the numbers in Chapter 17b, Transfusion-Associated Circulatory Overload (TACO). The causes were mixed but reports usually noted an inappropriate number of units and/or rate of transfusion.

Table 10b.2: Avoidable transfusions precipitating TACO n=15

Age of patient	Hb and background	Number of red cell units	Notes
90s	Transfusion based on wrong Hb 67g/L, actual 114g/L	4	Pneumonia and CV* disease
70s	Hb 64g/L, MCV 108	2	Underlying CV disease, 2nd unit not needed
60s	Hb 66g/L; transfused overnight, sepsis and relapsed lymphoma	3	TACO on 3rd unit. Should check Hb after each unit
60s	Known low B12 and folate recorded in 2017, confirmed on repeat, and not treated. Hb after one unit 56g/L	1 plus 6 more issued. TACO after 3 of these	Miscommunication resulted in overtransfusion and cardiac arrest
60s	Hb 58g/L chronic iron deficiency (MCV 68fL) due to angiodysplasia	1	TACO with first unit, on aspirin and steroids, no iron
60s	Post operation with background vascular disease	2	Second unit given in error
60s	Intermittent rectal bleeding, not severe	2, then 2 more units despite symptoms of TACO	TACO on 2nd unit but still more given. Iron advised
50s	Case 17b.1** Hb 34g/L	3 units transfused very rapidly	Cardiac ischaemia and raised troponin
70s	Hb 96g/L, breathlessness attributed to this mild anaemia but may have been heart failure	2, admitted later in day to another hospital	Cardiac disease with heart failure
90s	Hb 64g/L, macrocytic	2, TACO with 2nd unit	Cardiac disease
70s	Malignancy, respiratory compromise before transfusion, Hb 76g/L	2, TACO 6 hours after 2nd	On home oxygen
70s	Relapsed lymphoma, Hb 80g/L	2, TACO after 2nd	One unit sufficient
80s	Hb 78g/L	2, 2nd was not necessary	Positive fluid balance >1.3L before transfusion
80s	MDS Hb 84g/L	NS*, readmitted with pulmonary oedema	Aortic valve disease
60s	Pancytopenia, Hb 34g/L, platelets 27, neutrophils 0.85 due to leukaemia. Case 17b.3 **	4 units of red cells, 1 of platelets 3 of FFP	Overtransfused and admitted to ITU

**NS=not specified; CV=cardiovascular; MDS=myelodysplastic syndrome*

***Chapter 17b, Transfusion-Associated Circulatory Overload (TACO)*

Other examples of avoidable red cell transfusion:

Case 10b.5: Near miss – avoidable transfusion for one patient is associated with ABO-incompatible transfusion in another due to failure of bedside identification

An elderly patient was admitted after a fall with two fractures. Her Hb was 82g/L and she was transfused with one unit of red cells. A second unit was collected but not given, as it was decided not necessary. This decision should have been made before the unit was collected. However, after checking the unit with the doctor at the nurses' station, transfusion of this unit was started in error on another patient who was also being transfused. This wrong patient received ABO-incompatible red cells as a result and suffered major morbidity (Case 8.1 in Chapter 8, Incorrect Blood Components Transfused (IBCT)).

As a result of this case transfusion training was put back on the organisation-wide programme, competencies will be logged electronically, and the roll out of electronic tracking will include bedside modules.

Three patients transfused who had religious objections to blood components

Case 10b.6: Patient transfused despite religious objection

A woman in her 70s with religious objection received a red cell transfusion (despite having specified that she did not want transfusion) due to failure of handover when she was transferred to ITU.

Case 10b.7: An elderly man with repeated transfusions against his religion was detected incidentally

An elderly man with renal disease was transfused red cells on six occasions over a 3-year period but with no evidence of consent. His religion was not consistently recorded in the notes nor is there evidence that alternatives to red cells were discussed, nor whether or not he consented to red cell transfusion on the last two occasions. This was picked up incidentally at a morbidity and mortality review following trauma management. In 2014 there was evidence of consent for transfusion for serious bleeding when the Hb was 51g/L. On three other occasions he was transfused with no record of consent. The renal physician commented regarding past refusals of transfusion, there is no evidence that this was followed up.

Case 10b.8: Missed advance directive

A patient with religious objection and an advance directive in place was transfused following GI bleeding at a time when lacking capacity. This was discovered later and was due to communication factors and failures to follow hospital policy.

A further case is described under the prothrombin complex concentrate section.

Avoidable transfusion of platelets n=17

Case 10b.9: An inappropriate platelet transfusion due to confusion over names and failure of correct patient identification

A haematology patient informed his consultant that he had been called in for a platelet transfusion 3 months earlier. Despite repeated questioning at the time by the patient, and a normal platelet count of 230x10^9/L a month before, he received this transfusion without a check of his count on the day.

The doctor had made a verbal instruction to the booking clerk. Two patients had the same surname and the wrong one was called in for transfusion. The other one, who needed platelets and who had been informed verbally by the doctor, was admitted as an emergency the day before.

There were several failures of procedure. The review resulted in the following corrective actions:

- The patient scheduler will email back to the referring person following a verbal request to confirm identification and instructions

- The prescriber/authoriser will check the platelet count prior to prescribing and will document the result
- The person administering the component will check the count prior to administration
- The transfusion laboratory staff will save and store telephone logs for up to a year

The other 16 cases of inappropriate platelet transfusions included:

- 3 cases where the platelet count was above the threshold for transfusion
- 3 cases where the low platelet count was caused by clumping in the sample
- 2 had dilute samples from drip arms; clinicians ignored the request for repeat
- 1 wrong blood in tube sample
- 1 patient transfused four adult treatment doses of platelets without appropriate indication
- 1 patient was transfused platelets that were intended for weekend cover
- 1 patient was on aspirin and anticoagulants; platelets not correct treatment
- 1 patient with chronic aplastic anaemia without bleeding
- 1 inappropriate transfusion at another hospital
- 1 misreading of the result, '8.6' read when the result was $86x10^9$/L
- 1 transfusion of platelets in major haemorrhage when major haemorrhage Pack 1 erroneously contained platelets (these are included in Pack 2).

Avoidable transfusion of FFP n=4

Case 10b.10: Inappropriate FFP transfusion based on coagulation results from heparinised syringe

Three units of FFP were transfused for abnormal coagulation results prior to surgery. These results were caused by the blood being taken into a heparinised syringe and were therefore invalid.

The patient had possible ascending cholangitis and an endoscopic retrograde cholangiopancreatogram (ERCP) was planned. The white cell count was raised at 23.8x10^9/L (normal range 4-10x10^9/L), with normal coagulation and platelet count.

The next day the white cell count was still raised, and the platelet count had fallen (335 on admission down to 177x10^9/L). The coagulation screen was abnormal, and repeat was also abnormal with prothrombin time (PT) 23 seconds (s) (normal range (NR) usually 11 to 13.5s), activated partial thromboplastin time (APTT) 40s (NR usually 30-40s but varies with method and range was not given in this case report), and thrombin time (TT) 18s, (NR 12-14s). Two days later the platelet count had fallen to 54x10^9/L.

The patient was very difficult to bleed; several attempts had been made by different members of staff. It was decided to take an arterial blood sample (and the laboratory had agreed to this). The doctor knew the arterial blood gas kit contained heparin, but he knew the laboratory staff were aware. Blood was taken and then transferred into the coagulation sample tube and into tubes for a full blood count and electrolytes.

The platelet count was 27x10^9/L consistent with continued fall. The coagulation screen results were more abnormal with PT 24s, TT 46s and no APTT result could be given. The laboratory comment was 'results abnormal, repeat'. The consultant haematologist reviewed these and previous results, being aware that the patient was difficult to bleed. He decided not to repeat the bloods and advised 10mg IV vitamin K and one unit of platelets followed by a full blood count 1-hour post transfusion to confirm that the platelets incremented by 30-40. He advised that the patient should receive 1 to 2 litres of FFP and be monitored for overload.

The following morning a full blood count and coagulation screen showed that the platelet count was 20x10⁹/L and the coagulation was normal. Another request was made for a unit of platelets pre-procedure. The junior doctor who had come back on duty noted the grossly abnormal results from the previous evening. He asked his colleague if there had been any difficulties taking the sample. At this point the junior doctor realised what had happened regarding the results due to the heparin contamination.

Lessons learnt

- Samples for coagulation studies must not be taken in any sample bottles containing heparin
- If staff are struggling to take coagulation screen samples the coagulation department should be contacted directly to discuss the options available to them with one of the BMS staff. The department can provide smaller bottles (1.2mL) compared to the normal 3.2mL fill volume
- If in the future abnormal coagulation screen results of a similar nature are obtained the laboratory should perform a fibrinogen (if there is enough sample and it is not too old to analyse)

It is surprising that the consultant haematologist did not recognise the characteristic abnormalities associated with heparin in the sample – a relatively unchanged PT, prolonged TT and unrecordable APTT. These results were very different to the previous ones and not characteristic of hepatic dysfunction.

Commentary

- Many avoidable transfusions demonstrate a surprising lack of knowledge of basic haematology which should be taught at undergraduate level, particularly the characteristic features in the blood count in iron, B12 and folate deficiency
- Group O D-negative blood is a precious resource and it is clear that hospital policies could permit greater use of O D-positive units for older women and men in an emergency
- Avoidable transfusions contributed to several cases of TACO reinforcing the messages and recommendation for appropriate pre-transfusion assessment

Under or Overtransfusion n=15 10c

All cases of under or overtransfusion were clinical errors. One undertransfusion was also delayed (and included in those numbers) due to a laboratory misunderstanding.

There were 3 patients that were undertransfused and 12 over transfused, 3 of these in relation to major haemorrhage. There were 6 paediatric cases: 1 undertransfused and 5 overtransfused.

Deaths n=1

There was 1 death related to overtransfusion. This is described in Case 10c.4.

Undertransfusion n=3

Case 10c.1: Confusion about dose of red cells in a young child

A young child was given a smaller volume of red cells than required due to confusion over the calculations and involving two units of red cells.

Case 10c.2: Transfusion not monitored properly after patient transfer

An elderly woman admitted with gastrointestinal bleeding received O D-negative blood in the emergency department but about 6 hours later checking established that only a small volume had been given. The transfusion had not been properly monitored and repeat Hb results suggested this might also have been an avoidable transfusion.

Case 10c.3: A second case of inadequate monitoring of transfusion

An elderly woman with fractured neck of femur was undertransfused. Six hours after a unit of red cells was set up it was noted that the pump had been switched off and the patient had not received the full unit. The patient died but this was unrelated to the transfusion.

Overtransfusion n=12

The 3 cases that relate to major haemorrhage are described earlier (see Cases 10a.13 to 10a.15).

Case 10c.4: Death related to overtransfusion

A patient in her 70s, weight 38kg, presenting with a rectal bleed was overtransfused, receiving three units. The pre-transfusion Hb was 158g/L and post transfusion was 195g/L. The patient was venesected but 2 days later had a cerebral event. She died 5 days after the transfusion and a further cerebral event. The transfusion was thought to be contributory to her death.

Further overtransfusion cases can be found in the supplementary information on the SHOT website www.shotuk.org.

Commentary

It is notable that the death occurred in an elderly woman of low weight, whose Hb was normal prior to transfusion. Such cases have been reported in previous years. GI bleeding can be difficult to assess and this is a reminder that such vulnerable patients need continued re-assessment for the evidence of bleeding and Hb monitoring.

As in previous years 5 cases were errors in volumes given in children, particularly 4 overtransfusions in infants. An additional case classified as a handling and storage error is noted in Chapter 23, Paediatric Cases (Case 23.7); a child received an excessive volume because of incorrect pump setting.

These cases reinforce the recommendation from last year, that clinical staff authorising or prescribing for children should receive training in weight-based prescribing (Bolton-Maggs et al. 2018, p170).

Reference

Bolton-Maggs PHB (Ed), Poles D et al. (2018) on behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. The 2017 Annual SHOT Report. https://www.shotuk.org/shot-reports/ [accessed 30 May 2019].

Incidents Related to Prothrombin Complex Concentrate (PCC) n=9

10d

These occurred in an elderly population, age range 62 to 90 years, median 83 years.

Six (66.7%) of these were reported because of delayed treatment. All were classified as emergency or urgent transfusions. Minutes count.

Case 10d.1: PCC given at an inappropriate rate due to lack of knowledge

Treatment was indicated for insertion of a chest drain in a patient with a haemothorax. PCC was started at the wrong rate of 8mL/hour instead of 8mL/minute. The prescribing doctor did not state a rate and was not competent to administer it. This was a fraught situation including cardiac arrest during the transfusion. As a result, further training was provided in the ED and there was discussion with all staff involved.

Case 10d.2: Inadequate dose required urgently for intracranial haemorrhage

Urgent treatment was required for an elderly patient on warfarin, INR 3.5, with intracranial haemorrhage. This site only had 500IU in stock and there was a delay in obtaining the rest of the 1500IU from another site resulting in delay of 1.5 hours. Although stock checks had taken place the staff had not ensured further supplies were ordered. The procedures have been tightened up.

Case 10d.3: Treatment delay due to lack of knowledge

Emergency surgery for a perforated ulcer was delayed because the ward staff were unclear how to obtain and administer PCC. Training needs were identified and have been resolved.

Case 10d.4: Confusion over similar trade names results in wrong product transfusion

An elderly man was admitted with gastrointestinal bleeding. There was confusion over similar blood component/product names. The patient was admitted with bleeding needing warfarin reversal. The patient also received emergency group O D-negative red cells (three), and platelets. Octaplas® (solvent-detergent fresh frozen plasma (SD-FFP)) was requested verbally without informing the laboratory staff about the need for warfarin reversal, and five units of Octaplas® were issued after 2 hours waiting for the correct documentation. Three units were transfused before the written request clarified what was required, and Octaplex® (PCC) issued with a delay of 3.5 hours for treatment. The laboratory BMS agreed they should not have released the product without written confirmation.

Learning points

- Transfusion laboratories and hospital transfusion protocols should not use trade names, which are particularly confusing, but rather describe these clearly as ‘solvent detergent fresh frozen plasma (SD-FFP)’ and ‘prothrombin complex concentrate’ in order to avoid confusion
- There are slight differences between the two commercially available prothrombin complex concentrate (PCC). Hospital/Health Board protocols should reflect dosage as indicated for the specific product
- PCC should be administered immediately (NICE 2015) and certainly within an hour particularly for serious bleeding and intracranial haemorrhage (ICH)

Further cases can be found in the supplementary information on the SHOT website www.shotuk.org.

These cases demonstrate lack of knowledge in many areas. It is surprising that clinical staff do not know that 'Octaplas®' and PCC are blood products.

Reference

NICE (2015) Guideline NG 24 Blood transfusion. https://www.nice.org.uk/guidance/ng24/chapter/Recommendations#prothrombin-complex-concentrate-2 [accessed 31 May 2019].

See also several useful references in the 2016 Annual SHOT Report (published 2017) page 106-107.

Bolton-Maggs PHB (Ed), Poles D et al. (2017) on behalf of the Serious Hazards of Transfusion (SHOT) Steering Group. The 2016 Annual SHOT Report. https://www.shotuk.org/shot-reports/ [accessed 30 May 2019].