11 Delayed Transfusions n=312

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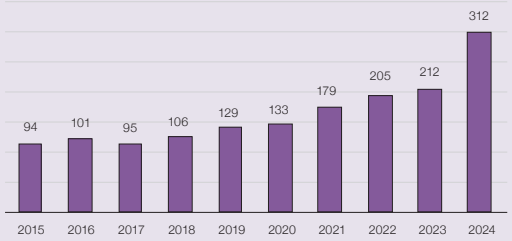
Headline data 2024

Number of reports n=312
Deaths n=18
Major morbidity n=12

Delayed transfusion reports by year



Demographic data

Male n=132
Female n=179
Unknown n=1
Adults n=282
Paediatric n=30

Blood component data

Red cells n=214
Platelets n=47
Fresh frozen plasma (FFP) n=9
Cryoprecipitate n=2
Solvent-detergent FFP n=1
Granulocytes n=1
Multiple components n=38

Key findings:

- There was a striking increase in the number of delays particularly in the laboratory
- There was an increase in the number of serious adverse patient outcomes
- Transfusion delays in major haemorrhage (MH) continue to rise

Gaps identified:

- Communication failures were the most frequently cited issue, affecting decision-making, blood component requests, and sample processing
- Lack of training, understaffing, and unfamiliarity with emergency protocols significantly impacted transfusion response times in both clinical and laboratory areas
- Failure to effectively implement major haemorrhage protocols (MHP)
- Many delays resulted from failure to identify and escalate cases early, leading to late transfusion initiation

Good practice:

- Increased levels of recognition of delays and reporting of such events
- Improved staff awareness
- Increasing recognition of causal and contributory factors that can help improve safety

Next steps:

- Ensure recommendations from the Central Alerting System (CAS) patient safety alert: Preventing transfusion delays in bleeding and critically anaemic patients (SHOT/2022/001) are fully implemented

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

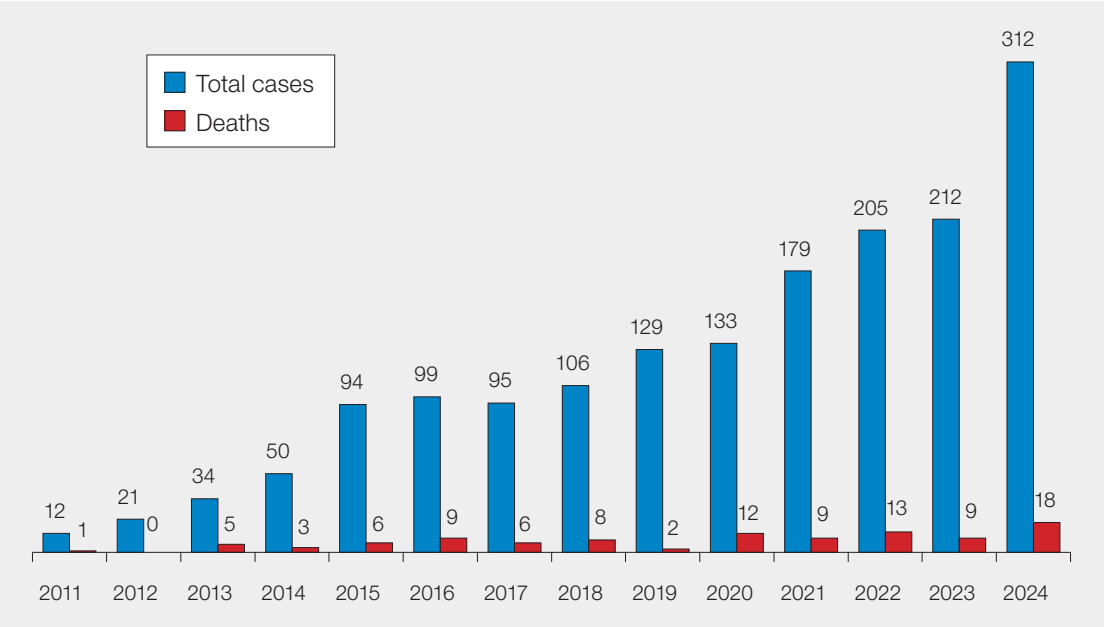
Definition:

Where a transfusion of a blood component was clinically indicated but was not undertaken or non-availability of blood components led to a significant delay (e.g., that caused patient harm, resulted in admission to ward, or return on another occasion for transfusion).

Introduction

Increasing reports of delays prompted the publication of a CAS patient safety alert, with actions for hospitals (SHOT, 2022). The number of delays in transfusion reported to SHOT has further increased (n=312) when compared to previous years (Figure 11.1). The substantial increase in reports and the increase in deaths associated with transfusion delays is alarming and concerning. Delays in transfusion are often not attributed to a single point of failure but are commonly a result of multiple issues that contribute to a delay in care. The key themes identified in previous Annual SHOT Reports such as ineffective communication, delay in the recognition of bleeding and lack of relevant staff knowledge continue to be factors in 2024.

Figure 11.1: Delayed transfusions by year 2011-2024



Deaths related to transfusion n=18

There were 18 deaths reported due to delays: 8 imputability 2 (probable) and 10 imputability 1 (possible). This is a steep increase from 9 deaths related to delays in 2023 and 13 in 2022. The majority (n=15) were associated with delays in urgent or emergency transfusions. Common themes were delays in decision-making and missing vital steps in the transfusion process due to lack of knowledge, training, and poor staffing levels. In 12 cases there were delays in transfusion in patients with acute bleeding.

There were 3 deaths due to laboratory-related errors associated with delays in making blood components available. Lack of knowledge of alternative options in emergency settings was a key theme in these events.

Case 11.1: Delay in provision of alternative blood component contributes to the death of a paediatric patient (imputability 2 – probable)

A neonatal consultant requested platelets for an unwell neonate who was waiting to be transferred to a specialist unit. The urgency of the transfusion was not clearly communicated by the clinical team initially. In addition, the transfusion biomedical scientist (BMS) was not aware of alternative options available.

This case is discussed further in Chapter 17, Laboratory Errors (Case 17.1) and Chapter 25, Paediatric Cases (Case 25.1).

Fifteen deaths were related to clinical errors resulting in avoidable delays, most of these were associated with patients who were actively bleeding (n=9). There were 11 errors at the request stage, 3 at sample taking and 1 at prescription. All incidents were multifaceted, most commonly associated with delay in recognising bleeding, communication failures, and lack of knowledge of local processes.

Case 11.2: Failure to recognise bleeding contributed to the death of a new mother (imputability 1 – possible)

A woman experienced a significant bleed following the birth of her baby. There was a delay in the clinical team recognising the severity of bleeding and escalating care appropriately. This was due to multiple factors including issues with equipment and focus on an alternative diagnosis. The MHP was not activated, delaying appropriate transfusion support. Coagulopathy was not promptly recognised and addressed; fibrinogen replacement was initiated too late to be effective. The patient suffered multiple cardiac arrests, and despite surgical intervention and intensive care, she died a few days after giving birth with disseminated intravascular coagulation.

Maternal deaths from haemorrhage are uncommon. A recent national report on maternity care (MBRRACE-UK, 2024) noted 6.5% deaths were due to maternal haemorrhage (18 of 275) in the period 2020 to 2022, a rate of 0.89 per 100,000 maternities.

Case 11.3: Multiple issues contributed to the delay in transfusion during major haemorrhage (imputability 2 – probable)

A patient with postoperative bleeding failed to receive a timely blood transfusion out-of-hours. There was a 3-hour delay in recognising the severity of bleeding and therefore the MHP was not activated. The initial group and screen (G&S) sample was rejected, and the urgency of the transfusion was not clearly communicated to laboratory staff. The clinical team on the ward were unfamiliar with the management of patients with major bleeding and were not aware of the procedures for accessing emergency blood components. The patient suffered a cardiac arrest and died.

Case 11.4: Assumption resulted in a 10-hour transfusion delay (imputability 2 – probable)

An elderly patient with a gastrointestinal (GI) bleed and a haemoglobin (Hb) of 45g/L was prescribed a unit of red cells. There was a misunderstanding regarding who should request the red cell units from the transfusion laboratory. The prescribing doctor assumed the nurses would request the blood as this was routine practice in the clinical area where they previously worked. Conversely, the nurses assumed the doctor would be requesting the blood as this was routine practice on the current ward. The error was noticed when the doctor reviewed the patient 10 hours later, the Hb had dropped to 38g/L. The patient was transfused one unit of red cells but suffered a cardiac arrest and died.

Major morbidity n=12

Major morbidity was reported in 3 cases associated with delays in the transfusion laboratory in making blood components available. Two of these delays were associated with an urgent need for blood components and occurred during MH.

Case 11.5: Multiple issues during major haemorrhage resulted in avoidable delays in accessing blood components

A patient with a suspected ruptured ectopic pregnancy presented to the emergency department (ED). O D-negative red cells were requested for immediate transfusion, but staff were unable to access units from the blood refrigerator despite multiple attempts. Similar issues occurred when trying to obtain red cells from the theatre and maternity refrigerators. The MHP was activated, but the incorrect obstetric alert was issued, delaying an appropriate response. The patient was transferred to theatre, where blood components were finally administered. The patient had lost 3L of blood and required intensive care unit (ICU) admission. A subsequent investigation revealed that an electronic blood management system upgrade had prevented units from being removed from the blood refrigerator.

Major morbidity was reported in 9 cases associated with delays due to clinical errors in the following processes, blood collection (n=2), sample taking (n=3), requesting components (n=3) and prescribing/

authorisation (n=1). Seven out of the 9 delays were associated with urgent cases in patients who were bleeding.

Case 11.6: Multiple issues and delayed decision-making contributed to a delay in blood component provision during a MH

A patient with significant bleeding required an urgent transfusion, but rejection of multiple samples delayed the provision of crossmatched red cell units. When emergency red cell units were requested, further delays occurred due to problems accessing the remote blood refrigerator. By the time emergency red cell units were obtained, the patient had lost approximately 1000mL of blood, suffered a cardiac arrest and was admitted to the ICU.

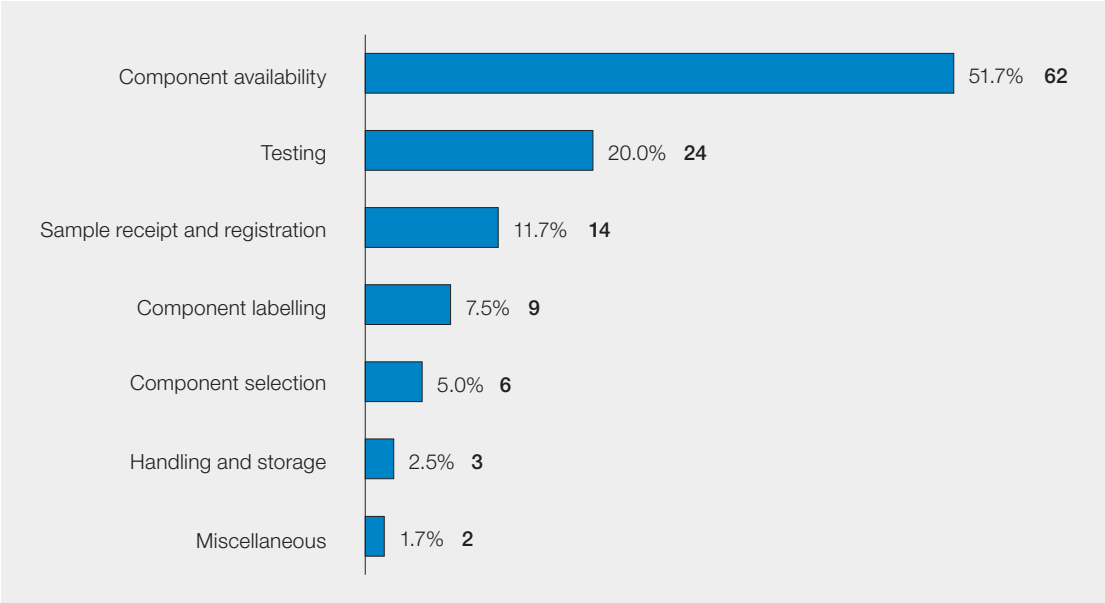
Case 11.7: Failure to contact the laboratory during MH resulted in blood component delays

A patient was found in the hospital grounds with a massive upper gastrointestinal bleed. The MHP was activated, but no blood components were sent from the laboratory. Upon investigation, the transfusion laboratory had not received the notification of the activation, leading to a significant delay in blood provision. Emergency O D-negative red cells units were administered from the ED, but the patient required further transfusion support and ICU admission. Multiple follow-up calls with communication gaps, compounded by confusing terminology contributed to the delay. In-person visits to the laboratory were necessary to clarify the request and obtain the required components.

Laboratory errors n=120

The number of laboratory errors that resulted in delays has more than doubled since the previous Annual SHOT Report (2024 n=120, 2023 n=56) with common themes. Failure in communication was the most common issue. Problems specifically occurred during handover in 26 cases. SHOT data have previously shown that incomplete handover is a contributory factor in many laboratory errors (Tuckley, et al., 2022). The availability of blood components was a key step in the transfusion process where errors occurred. Poor communication between clinicians, transfusion laboratories, and porters or couriers frequently led to delayed decision-making and blood availability.

Figure 11.2: Transfusion process step where laboratory errors occurred resulting in transfusion delays in 2024 (n=120)



Case 11.8: Delay in provision of blood components during a MH due to red cell antibodies

Provision of emergency blood components caused delays for a woman with a massive obstetric haemorrhage. A new red cell antibody was identified in the G&S sample. The clinical team was advised that they needed approval from the haematology specialist registrar before emergency

group O or group-specific red cell components could be issued. This led to a delay in blood provision for a bleeding patient.

Case 11.9: Patient put at risk due to staffing issues in the laboratory

A woman with suspected ectopic pregnancy presented to the ED out-of-hours. G&S samples were sent to the transfusion laboratory for urgent crossmatch. The transfusion laboratory was not staffed and a lone-working BMS in the biochemistry department received undue pressure to also cover the transfusion service. Clinical site managers at the hospital were not aware of the situation. The clinical team knew how to access emergency blood components, and the patient was transfused with full recovery.

A more detailed case study is provided in Chapter 17, Laboratory Errors (Case 17.3).

Case 11.10: Multiple issues resulted in a delay in blood for a patient with a GI bleed

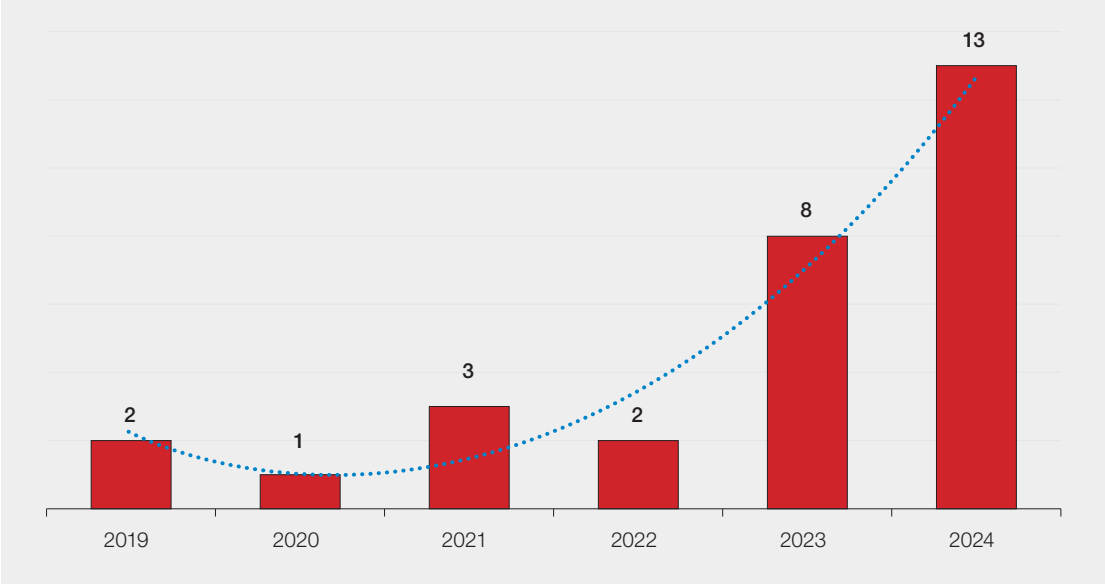
A patient with multiple co-morbidities and an upper GI bleed due to varices required blood components. The MHP was activated, and multiple clinical specialties were involved in his care. There was a delay in accessing blood components, the patient did not have a valid G&S and the laboratory requested a G&S sample. The porter was subsequently unable to access the blood refrigerator. The patient suffered cardiac arrest as the blood was being transfused and was transferred to ICU where he died, unrelated to the delay.

Blood Service errors n=13

There were 13 delayed transfusions due to errors in Blood Services (Figure 11.3). In many of these cases the delays were a combined result from errors in the hospital as well as in the Blood Services. In 3/13 cases the patients were paediatric, all requiring red cell units for neonatal exchange transfusion. Of the 13 cases, there were 3 patients affected by the national platelet shortage, 2 haematology patients and 1 major obstetric haemorrhage patient who was issued a B D-positive adult therapeutic unit of platelets (the patient's blood group was O D-positive). This was reserved for a different patient, but at that time, the transfusion laboratory did not hold any other unit in stock. One sickle cell disease patient with multiple red cell antibodies received a lower volume transfusion in two exchange transfusions than indicated during the national amber alert. This was due to unavailability of suitable red cell units.

Communication issues including miscommunication about urgency of the transfusion request, unclear timelines from the Blood Services and specialised blood components required were the most common contributory factors identified. In 1 case, the red cell units crossmatched by the reference laboratory were delivered to the wrong hospital. Even though there was no major clinical impact reported in these patients, they had to return on a different day for their appointment or be transfused later on the same day with potential risk for harm.

Figure 11.3: Trend in Blood Service-related errors 2019-2024



Delays associated with MH n=73

Delays associated with MH continue to rise year-on-year (Figure 11.4). Several recurring themes have emerged in this year's Annual SHOT Report, highlighting the systemic, procedural, and logistical issues contributing to delays in blood transfusion during MH cases. These high-pressure, time-sensitive scenarios reveal that each case is not simply a result of a single error but rather a multitude of factors resulting in delayed care. These common factors are highlighted in Figure 11.5.

Figure 11.4: Delays associated with MHP 2016-2024

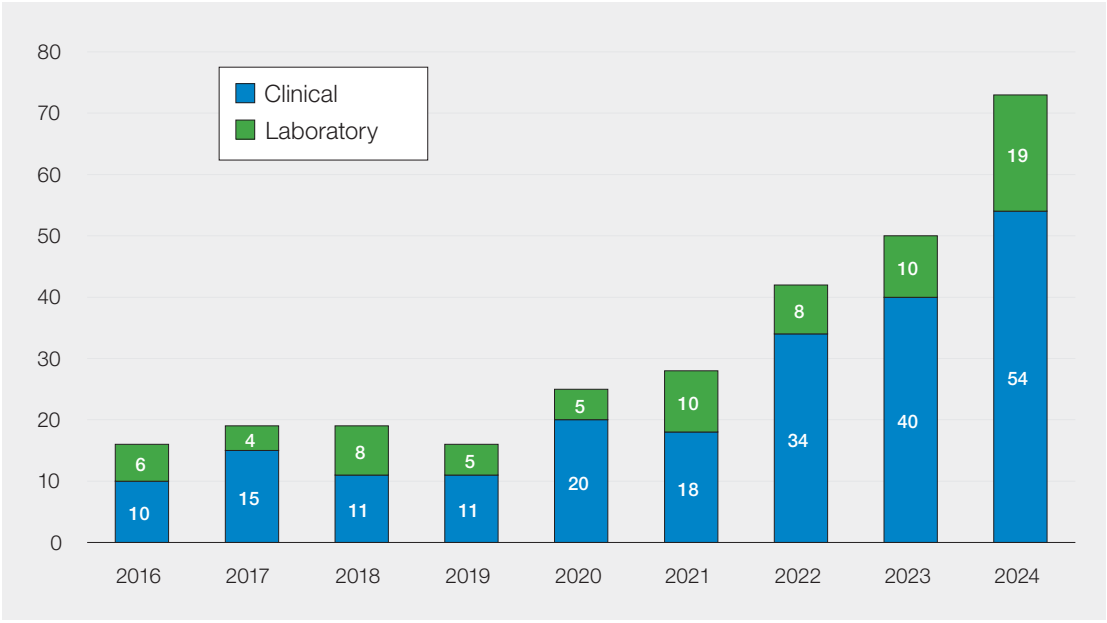
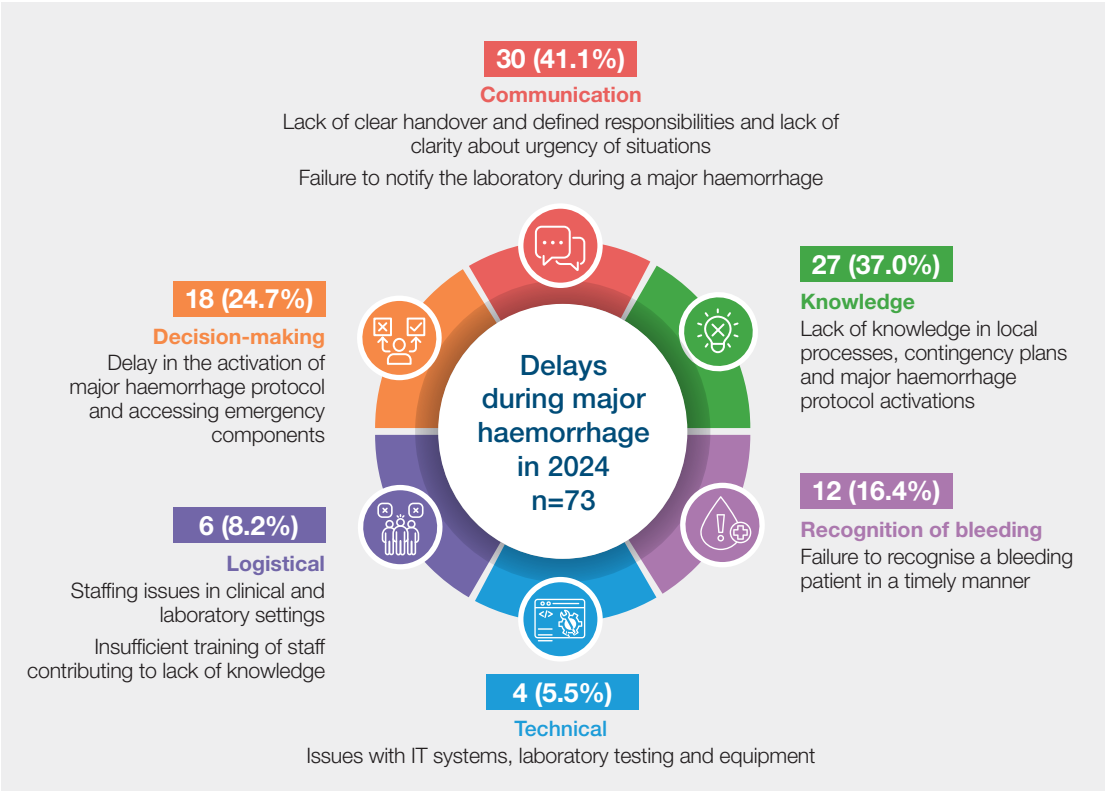


Figure 11.5: An image depicting the multiple contributing factors that resulted in delays during major haemorrhage in 2024 (n=73)



IT=information technology; MH=major haemorrhage; MHP=major haemorrhage protocol

Learning points

- Effective handover is essential especially when serious bleeding occurs out-of-hours
- All clinical and laboratory staff working in transfusion must have adequate knowledge and skills to ensure safety
- Prompt recognition of bleeding is crucial for timely and appropriate treatment
- Awareness of contingency plans is essential to ensure smooth processes when technical issues arise
- Clear protocols should be in place to support laboratory staff when issuing blood components in emergency situations, especially for patients with red cell antibodies

Conclusion

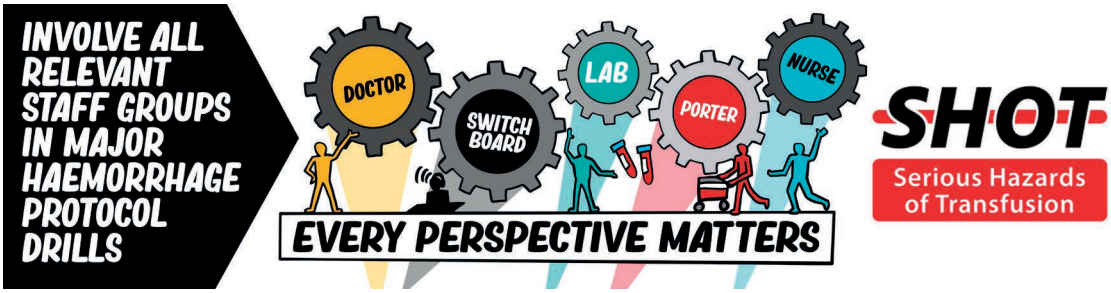
Patients should not die or suffer harm from transfusion delays. Poor communication, lack of clinical knowledge, and workforce issues continue to be key contributors. Urgent action is required to improve transfusion safety, particularly during MH and emergency situations.

Any delay initiating a necessary blood transfusion can cost lives. Timely transfusion support is not optional; it is a critical, life-saving intervention. All systems, processes and staff must prioritise immediate access to blood components to prevent avoidable harm or death. The steep increase in laboratory errors leading to delays is a cause of concern and calls for urgent action.

Ensuring laboratory safety is fundamental to patient care. Every incident is a signal, not just of risk but of opportunity to strengthen systems, eliminate hazards and build a culture where safety is everyone's responsibility. A safe laboratory is essential for trust, quality and care without harm.

Reliable and safe transfusion information technology (IT) is vital to ensure patient safety. System failures, delays or design flaws can directly compromise patient safety. Every effort must be made to ensure transfusion IT systems are robust, effective, and resilient.

The SHOT CAS alert provides clear recommendations to mitigate these risks (SHOT, 2022), but effective implementation is dependent on addressing staffing levels, training gaps, and improving communication pathways within transfusion laboratories and across clinical services.



Recommended resources

Avoidable, Delay and Under or Overtransfusion (ADU) Cumulative Data
https://www.shotuk.org/resources/avoidable-delay-and-under-or-overtransfusion-adu-cumulative-data/

SHOT Bite No. 8: Massive Haemorrhage Delays
https://www.shotuk.org/resources/shot-bite-no-8/

SHOT Video: Delayed Transfusion in Major Haemorrhage
https://www.shotuk.org/resources/delayed-transfusions-in-major-haemorrhage/

SHOT Webinar: Every Minute Counts
https://www.shotuk.org/resources/every-minute-counts-webinar-2021/

SHOT
Serious Hazards of Transfusion

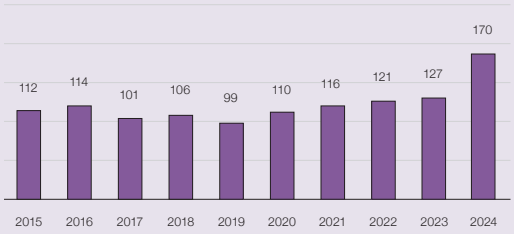
12 Avoidable Transfusions n=170

Authors: Catherine Booth, Paula Bolton-Maggs and Vera Rosa

Headline data 2024

Number of reports n=170
Deaths n=0
Major morbidity n=0

Avoidable transfusion reports by year



Demographic data

Male n=76
Female n=93
Unknown n=1
Adults n=158
Paediatric n=12

Blood component data

Red cells n=128
Platelets n=33
Fresh frozen plasma (FFP) n=3
Cryoprecipitate n=1
Multiple components n=5

Key findings:

- Reports of avoidable transfusions increased by 33.9% compared to 2023
- There was an increase in reports related to avoidable platelet transfusions
- There were 124 completely avoidable transfusions and 46 involving avoidable use of emergency group O red cells

Gaps identified:

- Lack of knowledge of transfusion indications
- Failure to question unexpected results
- Inadequate or inaccurate handover, both within and between teams (medical, nursing, laboratory)
- Multiple systems, steps and staff involved in the switch to group-specific blood during major bleeding

Good practice:

- Reports reflect some detailed investigations with good insight into multiple human and systems factors involved
- Incorporation of a prompt for consent built into the prescription chart

Next steps:

- Review local policies and processes to ensure timely switch to group-specific blood components in major bleeding

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

Definition:

Where the intended transfusion is carried out, and the blood component itself is suitable for transfusion and compatible with the patient, but where the decision leading to the transfusion is flawed. Every unit transfused should be an individual decision, so this might include transfusion of multiple units where not all were appropriate/necessary.

Introduction

The 170 reports of avoidable transfusions in 2024 represents a 33.9% increase compared to the 127 reported in 2023. The most notable increase was in reports related to platelets: 33 compared to 15 in 2023.

There were 124 transfusions that might have been avoided entirely: 82 involved red blood cells, 33 platelets, 3 fresh frozen plasma (FFP), 1 cryoprecipitate and 5 multiple components. In addition, there were 46 reported cases of avoidable use of emergency group O red cells.

Deaths and major morbidity related to transfusion n=0

There were no deaths and major morbidity cases related to avoidable transfusions in 2024.

Classification of avoidable transfusions n=170

Table 12.1: Classification of avoidable transfusions in 2024 (n=170)

Group	Red cells	Platelets	Plasma components	Multiple components	Total reports
Flawed decision	30	13	3	3	**49**
Decision based on inaccurate results	35	12	1	1	**49**
Failure to respond to change in circumstances	7	6	0	0	**13**
Transfusion necessitated by error	2	0	0	1	**3**
Transfusion without decision	8	2	0	0	**10**
Sub total	**82**	**33**	**4**	**5**	**124**
Avoidable use of emergency group O	46	0	0	0	**46**
Grand total	**128**	**33**	**4**	**5**	**170**

Flawed decision n=49

These included 9 avoidable transfusions for haematinic deficiencies (6 iron, 3 B12/folate), 6 unnecessary use of multiple units, 23 transfusions outside guideline thresholds, 8 related to inaccurate estimation of bleeding and 3 related to specific conditions (immune thrombocytopenia and sickle cell disease). In most cases, these related to gaps in knowledge.

Case 12.1: Unnecessary prophylactic platelet transfusion related to miscommunication and knowledge gaps

A patient with myeloma was admitted unwell and one adult therapeutic dose (ATD) of platelets was transfused as the platelet count was 11x10^9/L. The consultant's plan was to transfuse further platelets if the count was less than 20x10^9/L. This was misread as 70x10^9/L by a locum resident doctor, who lacked the knowledge to question the threshold. The patient's platelet count was 45x10^9/L and platelets were given. The consultant, who was covering for the doctors' strikes, was in a rush and did not write clearly, and the patient was on a medical admissions unit rather than the haematology ward, where staff were unfamiliar with use of platelets.

Transfusion decision based on inaccurate results n=49

These included 10 patients transfused based on results from haemodiluted samples, 9 on another patient's results, 9 erroneous results of uncertain aetiology, 6 related to point-of-care results (4 blood gas machines, 1 thromboelastography (TEG) and 1 device used in the community), 5 cases of platelet clumping, 4 old results, 3 clotted samples, 2 transcription errors and 1 verbal handover. A recurring theme was a failure to question results which were unexpected, had changed significantly from historical values or did not fit the clinical picture.

Case 12.2: Wrong blood in tube for full blood count (FBC)

Two patients on a ward required repeat blood samples to be sent for FBC and biochemistry. A nurse took the samples from patient 1 but labelled them as patient 2 and then took patients 2's samples and labelled them as patient 1. Patient 2 was noted to have a haemoglobin (Hb) drop from 90 to 70g/L and was transfused two units of red cells. The following day, the pharmacist was reviewing the blood results for biochemistry and noted that they seemed erroneous. The FBC results were then reviewed, and patient 2 had a post-transfusion Hb of 129g/L. Both patients' results were discarded. Patient 1's repeat Hb was 77g/L and transfusion was not required.

Case 12.3: Transcription error involving triplets

A premature triplet had an incorrect Hb level of 105g/L (the result of his sibling) transcribed into his notes and as a result was transfused 20mL/kg packed red blood cells. A subsequent result (delayed as the initial sample had clotted) demonstrated a pre-transfusion Hb of 136g/L, which was above the threshold for transfusion for his gestation. The post-transfusion Hb was 148g/L.

Failure to respond to change in circumstances n=13

There were 4 cases where a change of management plan was documented but not clearly communicated to nursing staff, and 1 with multiple contradictory plans. In 2 cases, prescriptions were written in advance where current results were not reviewed. One case involved a delayed procedure and in 2 cases, prescriptions for blood components were made 'just in case' that were then given routinely. Additionally, in 2 patients, clinical status had changed but transfusion occurred and in 1 case, the planned transfusion had already been given in theatre but nurses on the ward were unaware as they had no access to the separate anaesthetics chart. The final case highlights a risk when blood transfusion is not recorded in a common single patient record, which can also have implications for investigations of reactions and lookback for infections.

Case 12.4: Platelets transfused based on anticipated need without up-to-date review

A patient had a target platelet count of >50x10^9/L for treatment dose anticoagulation for a new pulmonary embolism. Platelets were ordered based on the predicted rate of fall of their count after the last transfusion. The plan following discussions on the ward round was for these to be given at 06:00 (before the anticoagulation dose was due). The night nurses asked the on-call medic to prescribe these as they had not been written up. The FBC was checked after one ATD of platelets and found the platelet count to be 126x10^9/L, well above the target threshold.

Case 12.5: Platelets in major haemorrhage pack given despite cessation of bleeding

The major haemorrhage protocol was activated for a patient with lower gastrointestinal bleeding with a platelet count >150x10^9/L, and they were on no antiplatelet medication. Four units of red cells and two FFP were issued, and two ATD of platelets were requested on blue light delivery. Upon contacting the ward to inform them they were available; the laboratory was informed they were no longer needed. The patient went on to receive additional platelets more than 12 hours after the major haemorrhage alert with no apparent indication.

Transfusion necessitated by error n=3

One patient suffered significant bleeding in the context of over-anticoagulation. Suboptimal antenatal management of iron deficiency anaemia in another patient meant transfusion was required prior to

caesarean section. A patient with von Willebrand disease suffered significant intraoperative bleeding and needed transfusion support. The patient had been taken to theatre without liaison with haematology or any prophylactic haemostatic treatment pre-operatively.

Transfusion without decision n=10

Ten patients were given a transfusion that had not been prescribed. Often this was the result of errors in verbal handover.

Case 12.6: Red cells transfused in place of intravenous (IV) iron due to erroneous verbal handover

A woman who had been anaemic throughout pregnancy had a post-delivery Hb of 74g/L, having suffered minimal blood loss. A prescription was written for IV iron but the nursing plan, which documented 'IV iron transfusion', became 'blood transfusion' during verbal handover. An agency nurse ordered and administered a unit of red blood cells, and a doctor was asked to prescribe these retrospectively.

Avoidable use of emergency group O red cells n=46

Reports related to avoidable use of emergency group O red cells have increased (33 in 2022, 37 in 2023), likely due to an increased focus on this important issue.

In 5 reports, emergency group O red cells were accessed when the transfusion was not clinically urgent.

In 18 cases, group-specific blood components were available but not collected, either due to errors during collection, difficulty in accessing red cell units from remote refrigerators or a lack of communication with clinical teams about availability. In 10 reports, there was no valid sample, often due to delays in sending or samples being rejected due to mislabelling. In 8 cases, there were laboratory delays processing the sample. Errors with information technology (IT) systems were implicated in 5 cases.

The diversity of errors illustrates the complexity of processes for providing group-specific blood components: involving many systems, steps, and staff groups. SHOT has produced a guide to describe these steps, to assist in reviewing local protocols (see 'Recommended resources').

Following the June 2024 cyberattack that disrupted laboratory information systems, several major London hospitals had to rely exclusively on group O blood for all patients. This approach was necessary due to logistical constraints, the risk of ABO-incompatible transfusions, manual crossmatching demands, staffing pressures, analyser limitations, and available bench space. The reliance on group O continued until IT systems were fully restored in late September 2024. These cases have not been reported individually as avoidable transfusions of group O. However, it is acknowledged that this unplanned use placed considerable strain on national blood supplies, exacerbating existing shortages of group O stock.

Case 12.7: Lack of communication with clinical area results in avoidable use of O D-negative red cells

Emergency O D-negative red cells were collected for a patient as the staff member was unaware that group-specific red cells were available via electronic release. There was no biomedical scientist in the hospital or on call out-of-hours, so the clinical area had not been contacted to tell them that electronic release was available. Only limited stocks of O D-negative red cells were held in the remote refrigerator, so this was depleted overnight unnecessarily, with no ability to replenish until the following day.

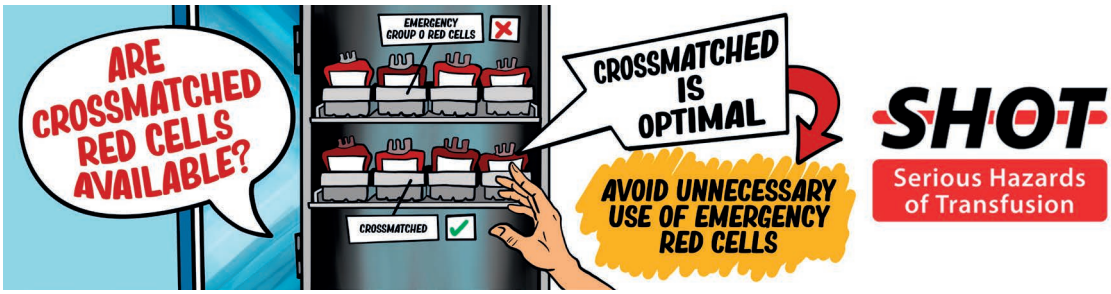
Case 12.8: Configuration of remote refrigerator prompted staff to collect group O red cells unnecessarily

A patient was actively bleeding, and staff went to collect two red cell units from the remote refrigerator via electronic issue (as there was a valid pre-transfusion sample). The refrigerator was configured not to allow multiple collections for a single named patient at the same time, to prevent transposition of labels. Staff successfully removed one unit of group-specific red cells but were unable to remove the second unit at that time. Staff assumed no other group appropriate blood components was available,

so an emergency O D-negative red cell unit was also taken for transfusion. Further O D-negative red cells were collected later in the shift, as the staff member continued to assume that no group-specific blood was available.

Learning points

- Guidance on appropriate transfusion thresholds should be made readily available to clinicians, in concise and convenient formats to support real-time decisions
- Accurate patient identification is essential during any interaction with the patient themselves or any part of their record (e.g., looking up or transcribing results, and writing a prescription)
- Unexpected results, particularly those not consistent with the current clinical picture, should be questioned and tests repeated before using them to make management decisions
- In a non-bleeding patient, the cause of thrombocytopenia should be investigated before considering platelet transfusion
- Verbal handover carries great potential for error and plans should be confirmed in writing wherever time allows
- The switch from emergency group O to group-specific red cells during major bleeding can be a complex process. The steps required should be considered in detail when designing and practising the major haemorrhage protocol



Conclusion

Two major events in 2024 placed a spotlight on avoidable transfusions and may have contributed to the increase in number of reports received this year.

England saw a prolonged amber alert for shortage of group O red cells. An amber alert is declared by the Blood Service when there is reduced availability of blood with impact on clinical activity (NHSBT, 2025b). Ready access to group O red cells may have prevented transfusion delays in many of the cases reported. Every effort should however be made to give group-specific blood components and avoid unnecessary use of emergency group O red cells.

The Infected Blood Inquiry serves as a stark reminder that transfusion is not without risk and should be avoided unless clinically essential. Effective patient blood management is fundamental to transfusion safety.

Recommended resources

National Blood Transfusion Committee Indication codes for transfusion (updated 2024)
https://nationalbloodtransfusion.co.uk/recommendations

Royal College of Physicians Acute care handover toolkit
https://www.rcp.ac.uk/improving-care/resources/acute-care-toolkit-1-handover/

SHOT Bite No. 34: Switching to group-specific red blood cells in major haemorrhage
https://www.shotuk.org/resources/shot-bite-no-34-switching-to-group-specific-blood-components-during-major-haemorrhage/

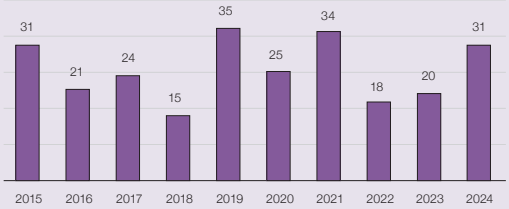
Under or Overtransfusion n=31

Authors: Paula Bolton-Maggs, Catherine Booth and Vera Rosa

Headline data 2024

Number of reports n=31
Deaths n=1
Major morbidity n=3

Under or overtransfusion reports by year



Demographic data

Male n=19
Female n=12
Adults n=11
Paediatric n=20

Blood component data

Red cells n=27
Platelets n=2
Plasma n=0
Cryoprecipitate n=2
Multiple components n=0

Key findings:

- An increase in numbers reported compared with previous 2 years
- Paediatric cases predominate (64.5%)
- Several haemoglobinopathy patients over or undertransfused

Gaps identified:

- Calculation and infusion rates for transfusion
- Communication issues and knowledge gaps

Good practice:

- Local investigations were carried out and relevant improvement actions were undertaken
- Vigilant laboratory staff querying appropriateness of requests for transfusion

Next steps:

- Patients with haemoglobinopathies should be managed under discussion with specialists and following national guidelines
- Practitioners who authorise transfusions for paediatric patients should be adequately trained to ensure calculations of volume are correct, and the correct infusion equipment is used

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

Definition:

A dose inappropriate for the patient's needs, excluding those cases which result in transfusion-associated circulatory overload (TACO) and usually resulting in a haemoglobin or platelet level significantly outside the intended target range. Infusion pump errors leading to under or over transfusion with clinical consequences (if no clinical consequences, then it is reportable under handling and storage errors (HSE).

Introduction

There has been an increased number of reports received in this category in 2024, 31, compared to 20 in 2023. Most, 20/31 (64.5%), were paediatric cases. The majority were caused by wrong calculations or wrong infusion rates. Overtransfusion was reported in 13 cases, and 11 of these were paediatric patients. Undertransfusion occurred in 18 cases, and 9 of these were paediatric patients.

Eight cases occurred in patients with haemoglobinopathies, 3 with thalassaemia (all paediatric) and 5 with sickle cell disease (2 paediatric).

Most (27/31) related to red cells; 2 related to cryoprecipitate (a baby received too much and an adult with major haemorrhage was underdosed). A child received an excess of platelets due to an administration error, and an adult was undertransfused platelets due to an error with the infusion pump.

Deaths related to transfusion n=1

Case 13.1: Death from severe drug-induced haemolysis and ineffective transfusion (imputability 1 – possible)

An elderly person died from probable severe drug-induced haemolysis with haemoglobinuria and ineffective transfusion. The patient had an infected joint prosthesis and was receiving rifampicin. Over a 4-day period, red cell transfusions were provided using best-matched concessionary release red cells together with steroids and intravenous immunoglobulin. However, there was insufficient response in the haemoglobin (Hb) due to the rampant haemolysis.

Rifampicin-induced haemolysis is recognised, often severe, but rare and deaths have been reported despite best available treatment (as in this case) (Ahrens, et al., 2002; Covic, et al., 1998; Sveroni, et al., 2018). Limited details were available regarding this case and from the information provided, rampant haemolysis resulted in patient death whilst transfusion was being administered.

Major morbidity n=3

Case 13.2: Extravasation of transfusion and inadequate monitoring

An elderly patient presenting with rectal bleeding received a transfusion of red cells which extravasated extensively with bruising of his arm. The patient received no benefit from the transfusion which was also not adequately monitored. They were very unwell with fluid overload and renal dysfunction and died but unrelated to the transfusion.

Case 13.3: Undertransfusion during exchange transfusion: use of wrong giving set

A neonate underwent exchange transfusion for haemolytic disease of the fetus and newborn but was significantly undertransfused. The wrong giving set was used resulting in a lower volume transfusion than planned. The hospital's supplier produced two paediatric giving sets that looked very alike, one for transfusion and one for fluids. Exchange transfusion was very infrequently performed in this hospital. The infant developed hypovolaemic shock with cardiac arrest and required ventilation. The child recovered when appropriately transfused.

This case is also described in Chapter 25, Paediatric Cases, Case 25.7.

The 3rd case involved overtransfusion of red cells due to a calculation error in a child who was also severely thrombocytopenic.

Errors in haemoglobinopathy patients n=8

Five of 8 cases occurred in paediatric patients. A young child only received a quarter of the intended volume (101 rather than 404mL) due to a miscalculation resulting in a lower than desired Hb at the next visit. Two other patients were transfused based on a wrong calculation and 2 based on an incorrect prescription. An adult with sickle cell disease received an inadequate number of red cell units for exchange transfusions due to difficulty sourcing compatible group O D-positive units. The patient had multiple antibodies and there was a national shortage of group O.

Case 13.4: Overtransfusion of a child with thalassaemia

An infant with known beta thalassemia was prescribed 80mL red cells but was transfused 210mL in error. There were additional concerns: there were significant delays in providing the blood components due to mislabelled samples, conflicting information regarding whether irradiated units were required, how fresh the blood should be, and what component type i.e., large volume unit vs paediatric packs. The child was not harmed.

The management of this case suggests staff were not familiar with the process. Transfusion of patients with haemoglobinopathies is specialised and should follow national guidelines including standards for clinical care in thalassaemia (UK Thalassaemia Society, 2023; Trompeter, et al., 2020a; Trompeter, et al., 2020b).

Case 13.5: A patient with sickle cell disease could not complete their exchange transfusion

A young person was receiving an exchange transfusion via an implanted central venous line which stopped functioning during the procedure. Two red cell units were returned to the refrigerator but as they had been out of temperature control for 31 minutes, they were not subsequently released to finish the transfusion. The patient was not harmed.

The local review considered that concessionary release of these red cell units could have been appropriate to complete the exchange.

Learning point

- Wherever possible, patients with haemoglobin disorders should be managed by specialists with appropriate transfusion protocols

Near miss n=3

An incorrect Hb result was reported for a patient who was bleeding and in need of surgery.

This was at the time of a laboratory information technology cyber-attack which increased the laboratory workload and necessitated manual transcription of results with some delay. The surgical staff did not question why the reported Hb of 130g/L was so different to the previous day (Hb 84g/L). During surgery, repeat Hb measurement on the blood gas machine confirmed significant anaemia (Hb 59g/L) and the patient received a single unit of red cells which was all that was available. The corrected result for the original Hb was 74g/L. The patient came to no harm and was not undertransfused.

There were 2 other cases of near miss, both related to overtransfusion, which were identified when laboratory staff queried the transfusion request.

Conclusion

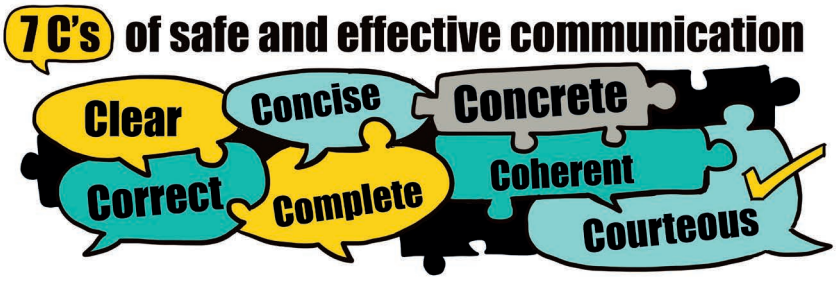
Cases of under or overtransfusion occur most commonly in paediatric patients (see additional comments in Chapter 25, Paediatric Cases). Patients with haemoglobin disorders should be managed under specialist guidance. In cases of catastrophic haemolysis, it may not be possible to keep up with the fall in Hb by transfusion.

Recommended resources

Avoidable, Delay and Under or Overtransfusion (ADU) Cumulative Data
https://www.shotuk.org/resources/avoidable-delay-and-under-or-overtransfusion-adu-cumulative-data/

Avoidable, Delayed or Under/ Overtransfusion webinar (ADU)
https://www.shotuk.org/resources/avoidable-delayed-or-under-overtransfusion-webinar-adu/

SHOT Bite No.4: Lessons in Paediatrics (including neonates)
https://www.shotuk.org/resources/shot-bite-no-4-lessons-in-paediatrics-including-neonates/



SHOT
Serious Hazards of Transfusion

Incidents Related to Prothrombin Complex Concentrates (PCC) n=35

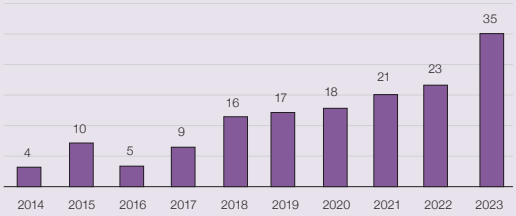
14

Authors: Paula Bolton-Maggs and Vera Rosa

Headline data 2024

Number of reports n=35
Deaths n=1
Major morbidity n=1

PCC reports by year



Demographic data

Male n=15
Female n=20
Adults n=35
Paediatric n=0

Blood product data

Prothrombin complex concentrates (PCC) n=35

Key findings:

- PCC administration in emergencies, particularly with intracranial haemorrhage (ICH), is often delayed
- Patients are often elderly with multiple pathologies
- Most patients presented in the emergency department (ED) and needed urgent treatment
- Use of trade names can cause confusion resulting in incorrect treatment

Gaps identified:

- Lack of knowledge of PCC and how it is administered
- Communication problems between clinicians and haematologists
- PCC not easily accessible near the ED resulting in delays
- Contributory human factors, particularly very busy ED

Good practice:

- PCC is used infrequently; in one hospital difficulty locating the standard operating procedure (SOP) on the computer system resulted in revision of the title making it easier to find using key words – 'PCC SOP' instead of 'Management of Bleeding and Management of Anticoagulation'

Next steps:

- Introduce fixed dose PCC in ED with audit of use
- Where possible, automated dispensing with appropriate SOP should be set up
- Instructions about using PCC should be clear and easy to locate; the product should be easily accessible

For all abbreviations and references used, please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. Please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2024/).

Definition:

Hospitals are asked to report incidents related to PCC infusion where there was delay or inappropriate transfusion. Allergic reactions should be reported to the Medicines and Healthcare products Regulatory Agency (MHRA) through the Yellow Card scheme, https://yellowcard.mhra.gov.uk/.

Introduction

Delays were the most common reason for PCC case reports, occurring in 22/35 (62.9%). Avoidable use of PCC was reported in 5 cases. Problems with administration were noted in 8 cases, mostly wrong rates of infusion, and confusion over the prescription in 7. The patient age range was 32 to 97 years with the majority, 26/35 (74.3%) >70 years of age. The median age was 81 years. There were 8 cases with ICH.

Most cases, 31/35 (88.6%) originated from clinical areas, and 4 were attributed to the laboratory. In 2 laboratory cases, wrong lot numbers were allocated, and the other 2 cases reported delays in issuing PCC. In all 22 cases of delay the need was urgent and 14/22 (63.6%) patients were in the ED. Communication failure was reported in 8/22 (36.4%). Four patients experienced delays of more than 10 hours. Several reports noted lack of knowledge of PCC and how to administer it. Overall, 19/35 (54.3%) incidents were reported from the ED.

Death related to transfusion n=1

Case 14.1: Slow reversal of warfarin with PCC associated with increased ICH and death (imputability 1 – possible)

A patient who was on warfarin for a previous deep vein thrombosis suffered an assault resulting in head injury. A computed tomography (CT) scan of the head was done within an hour of admission when the patient was fully alert. This showed ICH and vitamin K was given 3 hours after the CT report. The patient sneezed just after this with a rapid deterioration in Glasgow Coma Scale. PCC was prescribed 30 minutes later and given an hour after the sneeze. This was 4 hours after the CT report. Repeat CT confirmed extension of the ICH and 9 hours after admission, the patient became unresponsive. They were transferred to a neurosurgery unit but died from the ICH. The delay in treatment with PCC was considered to have possibly led to the patient death.

PCC and vitamin K should be administered to reverse warfarin as soon as ICH is suspected or diagnosed (before imaging or transfer to another department) and certainly within an hour.

Major morbidity n=1

Case 14:2: Delayed treatment with PCC after injury resulted in a prolonged stay in the intensive care unit (ICU)

An elderly patient on warfarin attended a very busy ED after a fall in the shower sustaining a head injury. Blood tests showed a high international normalised ratio of 12.0 and vitamin K was given. Imaging showed peritoneal haematoma related to a fractured vertebra with a damaged blood vessel. Interventional radiology (IR) was planned to treat this. However, due to confusion, lack of understanding among staff and poor communication, there was a delay of at least 15 hours before PCC was requested, delaying the IR procedure. Had the PCC been given sooner, this delay may not have occurred, and it is possible that admission to ICU would not have been required. The patient was in ICU then the high dependency unit for a total of 2 weeks.

Wrong blood component or blood product n=3

Three patients failed to receive the correct blood component and/or blood product. A patient with metallic heart valves and acute-on-chronic subdural haemorrhage (SDH) was prescribed PCC for anticoagulant reversal which is contraindicated because of an increased risk of thrombosis. The haematologist was not told of the metallic valves. However, this contraindication is relative rather than absolute (Uncu, et al., 2024) and the balance of risks for the individual patient should be considered.

The 2nd patient had suspected thrombotic thrombocytopenia purpura (TTP) and received PCC (Octaplex®) instead of fresh frozen plasma (Octaplas®). These components should always be prescribed using proper names (prothrombin complex concentrate, fresh frozen plasma) and not trade names to avoid this confusion which has been reported to SHOT before. The identification and treatment of TTP is a medical emergency requiring discussion with and transfer to a specialist centre, and the patient should start plasma exchange within 4 to 8 hours of diagnosis (Scully, et al., 2023).

The 3rd patient received PCC when cryoprecipitate was required following thrombolysis for a cerebrovascular event.

Learning points

- Using similar sounding trade names leads to errors in treatment. Proper names should be used to identify blood products and components
- Providing all key information when seeking clinical input supports safe decision-making

Near miss n=1

An elderly patient had PCC issued with the wrong hospital number. The product was returned to the laboratory and reissued with the correct number.

Conclusion

Delayed administration could be avoided by better recognition of bleeding, having a simple accessible protocol and a supply of PCC in the ED. Hospitals have variable arrangements for PCC release. Storage in the transfusion laboratory is not ideal (biomedical scientists may be unfamiliar with the indications), and it may be difficult to locate an on-call pharmacist. An optimal route might be via an automated dispensing system set up with correct governance via the pharmacy.

In the 2023 Annual SHOT Report, the evidence for using a single fixed dose for emergency administration was reviewed and this approach was recommended (Narayan, et al., 2024). In 2024, two systematic reviews also supported this approach (Alwakeal, et al., 2024; Condeni, et al., 2024). Alwakeal, et al. (2024) reported a total of 323 participants in randomised controlled trials, 161 fixed dose and 162 variable dose; there were also 1912 patients in cohort studies (858 fixed dose and 1054 variable dose). These authors concluded that using a fixed dose results in dose reduction, faster administration time, improved clinical haemostasis, reduced mortality, and reduced thromboembolic events.

Data from a United Kingdom-wide audit of reversal agents for direct acting oral anticoagulant-associated bleeding included 2477 patients, median age 80 years, 1010 with ICH (Buka, et al., 2024). PCC was used in 2037 cases and further conclusions about timing, effectiveness and side effects will be available when the full data are published.

Recommended resource

SHOT Bite No. 16: Errors with Prothrombin Complex Concentrate
https://www.shotuk.org/resources/shot-bite-no-16/