12 Delayed Transfusions n=308

Authors: Josephine McCullagh, Paula Bolton-Maggs, and Vera Rosa

Headline data 2025

Number of reports n=308
Deaths n=15
Major morbidity n=11

Delayed transfusion reports by year

Demographic data

Male n=133
Female n=165
Adults n=264
Paediatric n=44
Unknown n=10

Blood component data

Red cells n=239
Platelets n=35
Fresh frozen plasma (FFP) n=10
Cryoprecipitate n=2
Granulocytes n=1
Multiple components n=21

Key findings

- The number of transfusion delays remains high with 15 cases resulting in death and 11 cases of major morbidity, mainly in urgent and emergency settings.
- Communication gaps were the most common contributory factor across all transfusion priorities.
- Major haemorrhage (MH) cases highlight recurrent, multifactorial system failures.

Gaps identified

- Communication issues were the most frequently cited factor, 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.

Good practice

- Increased levels of recognition and awareness of delays resulting in reporting of such events.
- Increasing acknowledgement of causal and contributory factors that can help improve safety.

Next steps

- Utilise the resources of the SHOT Major Haemorrhage Simulation Toolkit to improve safety and readiness when managing MH.

For all abbreviations and references used in this chapter please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. For further information please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2025/).

Definition

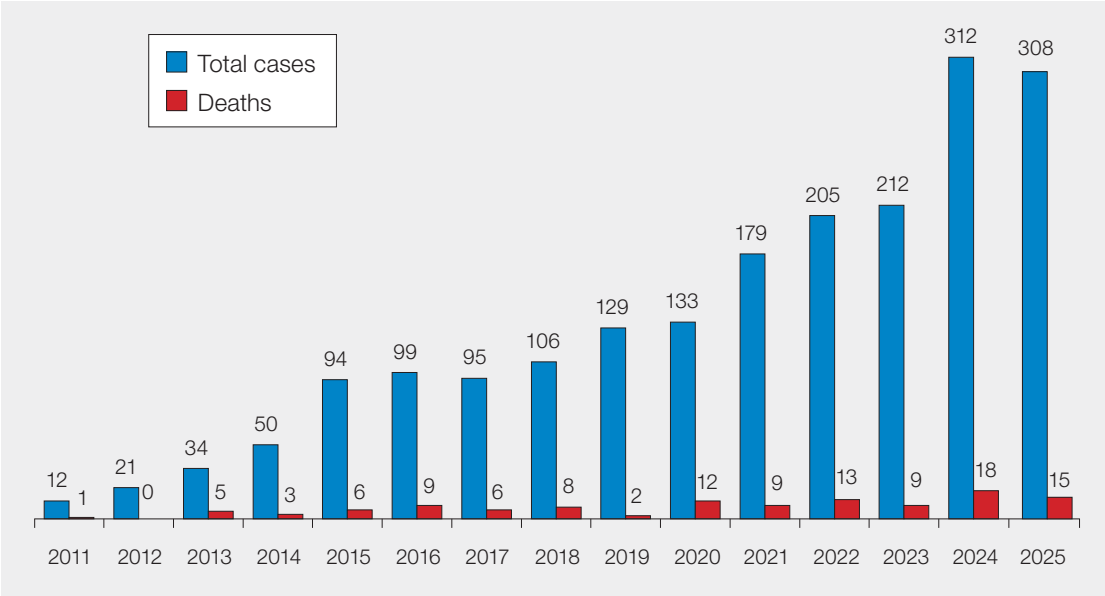
Where a transfusion of a blood component was clinically indicated but was not undertaken or non-availability of blood components led to a significant delay (e.g., that caused patient harm, resulted in admission to ward, or return on another occasion for transfusion).

Introduction

Reports of delays in transfusion continue to be a significant patient safety concern. Despite the publication of a Central Alerting System (CAS) patient safety alert outlining actions for hospitals (SHOT, 2022), the number of delays reported to SHOT remains worryingly high (Figure 12.1). In 2025, a total of 308 delays were reported, with 15 associated deaths and 11 cases of major morbidity. These figures are concerning and highlight the ongoing serious risk to patients when timely transfusion is not achieved.

As in previous years, delays in transfusion are rarely attributable to a single point of failure. Rather, they typically arise from a combination of system, process, and human factors that collectively contribute to delays in patient care. Recurring themes identified in earlier reports, including ineffective communication, delayed recognition of bleeding, and gaps in knowledge and training, continue to feature prominently in this year's analysis. The persistence of these issues highlights the need for sustained focus, organisational learning, and effective implementation of existing safety recommendations to reduce harm from transfusion delays.

Figure 12.1: Delayed transfusions by year 2011-2025



Deaths related to transfusion n=15

There were 15 deaths reported due to delays. This compares with 18 deaths related to delays in 2024 and 9 in 2022. The majority (n=11) were associated with delays in urgent or emergency transfusions. Common themes were delays in recognition of bleeding and miscommunication.

- 6 probably related (imputability 2)
- 9 possibly related (imputability 1)

Of all the deaths associated with delays in transfusion, 13 were related to clinical errors and 2 were related to laboratory errors. Most of the delays affected patients who were actively bleeding (n=9). Common themes identified were miscommunication (n=7), a delay in recognising bleeding in the patient (n=6), component collection processes not being followed (n=1) and equipment failure (n=1).

Case 12.1: Multiple issues in communication contributes to the death of a critically ill newborn baby (imputability 1 – possible)

A full-term woman underwent an emergency caesarean section for placental abruption. The baby was born profoundly pale and in poor condition. Red cells were urgently requested. Although urgency was communicated to the laboratory, the O D-negative units available in the theatre refrigerator were not used. An adult O D-negative unit was authorised and issued within 5 minutes; however, delays occurred as the staff member transporting the unit had no access to theatres and had to wait for entry. On arrival, the baby had been transferred to the special care baby unit, which had not been communicated between teams, causing further delay while access was gained. Red cells were transfused approximately 25 minutes after the request. A second unit was later requested and transfused. Despite transfusion and resuscitation, the baby died later that evening.

Case 12.2: Inadequate communication results in delayed blood provision for an elderly patient with red cell antibodies (imputability 2 – probable)

A patient with known myeloma was admitted to the emergency department, which was severely overcrowded, with extensive corridor care. They had a significantly low haemoglobin and red cell antibodies, and compatible blood was requested from the Blood Service. Once the compatible blood was received in the laboratory, its availability was not communicated to the clinical team. While waiting for blood, the patient fell, became unresponsive and suffered a cardiac arrest. During resuscitation, one unit of emergency O D-positive red cells was administered; however, resuscitation was unsuccessful.

This case is discussed in further detail in Chapter 18, Laboratory Errors, Case 18.1.

Major morbidity n=11

There were 11 cases that resulted in major morbidity due to delays. This compares with 12 in 2024.

Delays in recognising bleeding, technical information technology (IT) issues and sampling errors were the most common reasons identified.

Case 12.3: Lack of knowledge of MH protocol contributes to the harm of an obstetric patient

The obstetric MHP was activated in maternity theatres for a patient with placental abruption. Confusion arose regarding whether fresh frozen plasma (FFP) was included in MH packs. An outdated protocol, which included FFP in standard packs, remained displayed in theatres despite an update removing FFP from packs and directing staff to a rotational thromboelastometry (ROTEM)-guided pathway. As a result, FFP was not requested when indicated, leading to a 28-minute delay. The patient suffered a seizure and rapidly deteriorated due to haemorrhage and disseminated intravascular coagulation. Leadership and communication challenges were noted. At the time of submission, the investigation into patient harm was ongoing.

Reason for delays n=308

Table 12.1 summarises the main contributory factors associated with transfusion delays reported in 2025, divided into priority of transfusion request. Delays were most frequently reported in routine (n=118) and urgent (n=106) transfusions, with 51 emergency delays also identified.

Across all transfusion priorities, communication issues were the most reported contributory factor, particularly in routine and urgent cases. These included breakdowns in communication between clinical teams and transfusion laboratories, unclear escalation pathways, and delays in relaying critical information. Deviation from established processes was the second most frequently reported factor highlighting ongoing challenges with adherence to transfusion policies and procedures.

The distribution of contributory factors across all transfusion priorities shows that delays arise from a combination of clinical, laboratory, and organisational factors. Addressing these requires coordinated system-wide approaches, with particular focus on improving communication, strengthening process effectiveness, and ensuring adequate resources to support timely transfusion care.

Table 12.1: Primary reason for transfusion delay in 2025 (n=308)

	Emergency	Urgent	Routine	Unknown	Total
Communication issues	14	30	37	9	**90**
Deviation from established processes	9	20	17	7	**53**
Sample errors	4	17	27	4	**52**
Logistical issues	4	9	16	4	**33**
Delayed recognition of bleed or urgency	11	15	2	2	**30**
Technical issues with IT equipment	8	7	6	1	**22**
Insufficient resources (including staff)	1	5	3	4	**13**
Incorrect referral processes	0	1	8	0	**9**
Other	0	2	2	2	**6**
Total	**51**	**106**	**118**	**33**	**308**

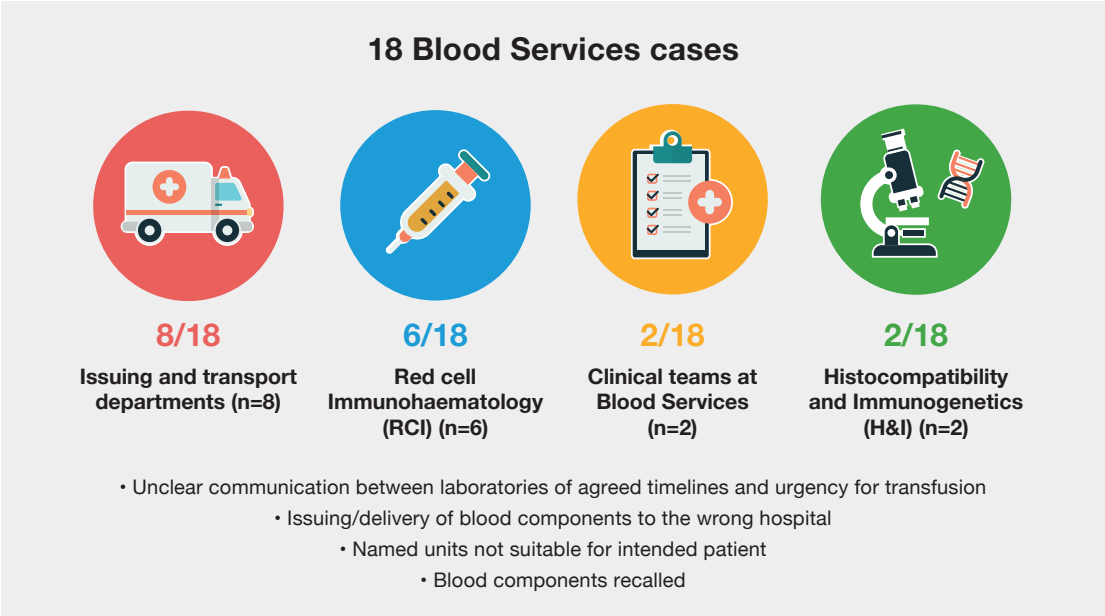
Laboratory errors n=82

The number of laboratory errors that resulted in delays were fewer in 2025 than in the 2024 Annual SHOT Report (n=120), but up from the 2023 Annual SHOT Report (n=56). Communication issues and deviation from the correct procedure were the most common problems identified. The availability of blood components was a key step in the transfusion pathway where errors occurred. Inadequate communication between clinicians, transfusion laboratories, and porters or couriers frequently led to delays in decision-making and blood availability.

Blood Service errors n=18

There were 18 reports of delayed transfusions reported by hospitals related to errors from the Blood Services in the UK. Details of these cases are shown in Figure 12.2.

Figure 12.2: Reason for delays in blood transfusion and location of errors associated with Blood Services in 2025 (n=18)



To strengthen haemovigilance monitoring, learning from and improving transfusion safety across the system, the Blood Services in the UK began reporting to SHOT in August 2025. This is a new process, and the project was initially launched with 4 reporting categories, which may expand in future to include

for example delayed transfusions. Further information about this collaborative project, reporting categories and cases submitted by the Blood Services can be found in the relevant chapter of this report: Chapter 7, United Kingdom (UK) Blood Services Reporting.

Delays associated with MH n=42

Issues associated with MH continue to be a major contributor to delays (Figure 12.3). Although 2025 has seen a reduction in overall reports of delays during MH (2024 n=73), there has been an increase in the proportion of these cases resulting in serious patient harm; 8/42 (19.1%) resulted in death and 5/42 (11.9%) resulted in major morbidity. Several recurring themes continue to be raised in this year's Annual SHOT Report, highlighting the systemic, procedural, and logistical issues contributing to delays in blood transfusion during MH cases (Figure 12.4). 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.

Figure 12.3: Delays associated with MHP 2016-2025, including the proportion of reports resulting in mortality or major morbidity

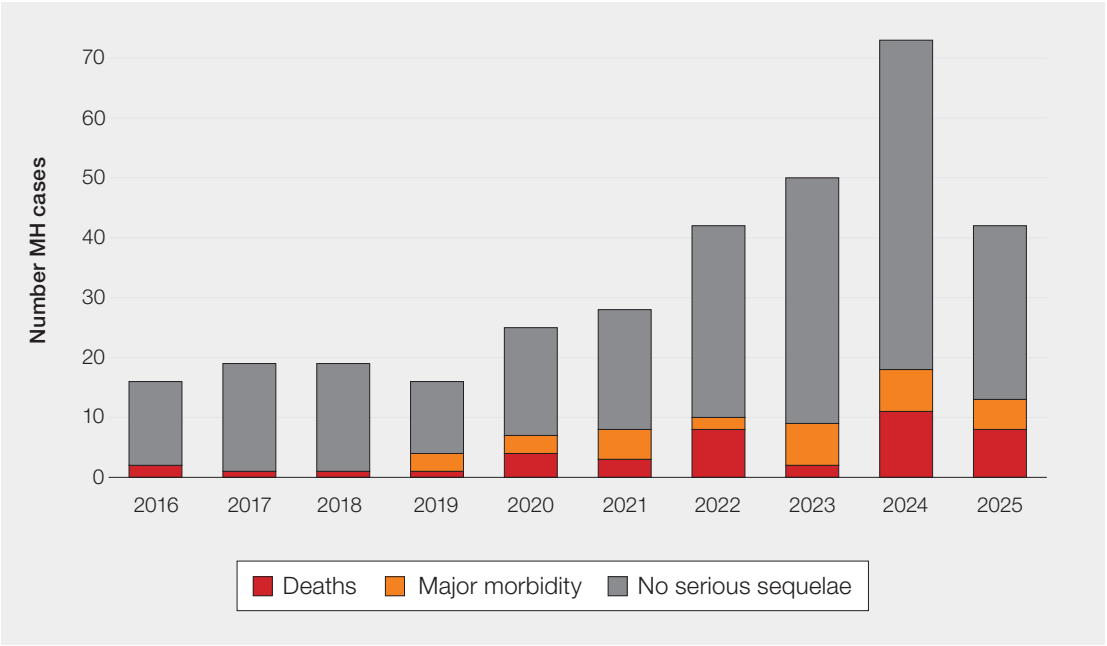
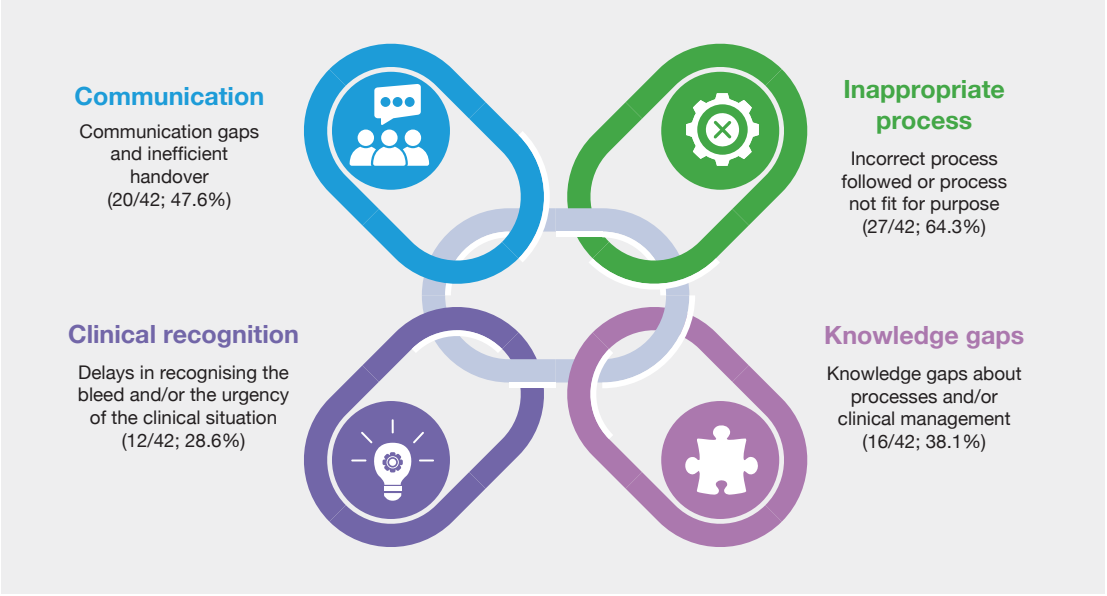


Figure 12.4: Common themes identified that contributed to delays during MH in 2025



Learning points

- 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 healthcare staff when requesting and issuing blood components in emergency situations, especially for patients with red cell antibodies.

Near miss delayed transfusion n=1

This case involved difficulties in contacting the transfusion laboratory during a MH situation. A review of the event resulted in the installation of a second telephone line in the laboratory.

Conclusion

Patients should not die or suffer harm as a result of transfusion delays. The continued occurrence of deaths and cases of major morbidity associated with delayed transfusion in 2025 remains a serious concern. Persistent contributory factors including communication issues, gaps in clinical knowledge, and workforce pressures continue to be key drivers of harm. Urgent and sustained action is required to improve transfusion safety, particularly during major haemorrhage and emergency situations.

Any delay in initiating a clinically necessary blood transfusion has the potential to cost lives. Timely transfusion support is a critical, life-saving intervention. All systems, processes, and staff involved in transfusion care must prioritise rapid access to blood components to reduce the risk of avoidable harm or death.

Reliable and safe transfusion IT systems are vital to patient safety. System failures, delays, or design limitations can compromise timely transfusion and place patients at risk. Continued attention and investment are needed to ensure transfusion IT systems are robust, effective, and resilient.

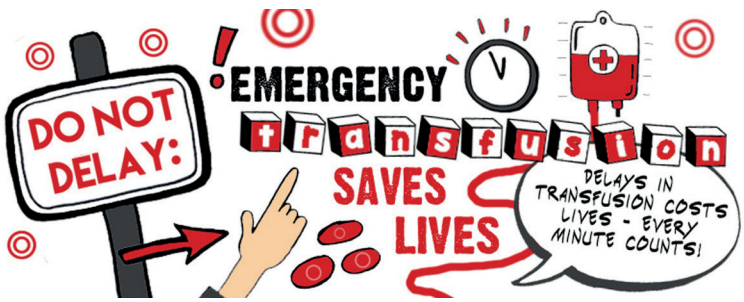
The SHOT CAS alert provides clear recommendations to mitigate the risks associated with transfusion delays (SHOT, 2022). Effective implementation depends on addressing challenges related to staffing capacity, education and training, and communication pathways within transfusion laboratories and across clinical services. The recently published Major Haemorrhage Simulation Toolkit provides a structured framework to support the implementation of MH simulation, a CAS alert action. Sustained commitment in these areas is essential to support improvement and reduce the risk of future harm.

Recommended resources

SHOT Bite No. 8: Massive Haemorrhage Delays

SHOT Video: Delayed Transfusion in Major Haemorrhage

Major Haemorrhage Simulation Toolkit



SHOT
Serious Hazards of Transfusion

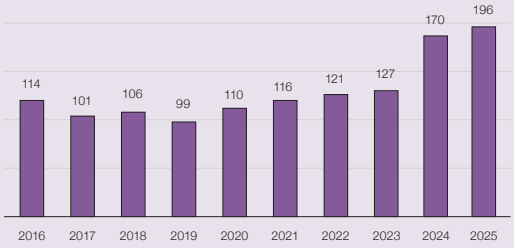
13 Avoidable Transfusions n=196

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

Headline data 2025

Number of reports n=196
Deaths n=0
Major morbidity n=0

Avoidable transfusion reports by year



Demographic data

Male n=83
Female n=108
Unknown n=5
Adults n=185
Paediatric n=11

Blood component data

Red cells n=163
Platelets n=21
Fresh frozen plasma (FFP) n=8
Cryoprecipitate n=2
Multiple components n=2

Key findings

- There has been an increase in reports of avoidable transfusions compared to 2024
- The largest rise in reports related to flawed decisions and avoidable use of emergency group O red cells.
- There were 135 transfusions that might have been completely avoidable.

Gaps identified

- Clinician knowledge of appropriate anaemia management for haematinic deficiencies.
- Ineffective communication of results, decisions and component availability.
- Lack of timely and accurate group and screen sampling in patients presenting with bleeding or with potential need for transfusion.

Good practice

- Evidence of avoidable transfusions minimised following challenges by nursing, laboratory and other medical staff.
- In-depth local investigations providing insight into a range of contributory factors.

Next steps

- Feed back avoidable transfusions to clinical teams as learning opportunities and ensure tools to support decision-making are readily available in clinical areas.

For all abbreviations and references used in this chapter please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. For further information please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2025/).

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 196 reports of avoidable transfusions in 2025 continues the upward trend of previous years. The increase was driven by additional reports related to flawed decisions and avoidable use of emergency group O. This is likely to reflect increased awareness and vigilance from transfusion teams. The challenge is disseminating this same awareness to clinical staff.

There were 135 transfusions that might have been avoided entirely (compared to 124 in 2024). In addition, there were 61 reported cases of avoidable use of emergency group O red cells (46 in 2024).

Deaths or major morbidity related to transfusion n=0

No cases reported in the avoidable transfusion category resulted in death or major morbidity.

However, some deaths or cases of major morbidity reported in other chapters (e.g. transfusion-associated circulatory overload (TACO) or febrile, allergic or hypotensive reactions (FAHR)) were the result of potentially avoidable transfusions.

Classification of avoidable transfusions

Table 13.1: Classification of avoidable transfusions

Group	Red cells	Platelets	Plasma components	Multiple components	Total reports
Flawed decision	39	14	9	1	**63**
Decision based on inaccurate results	43	5	1	1	**50**
Failure to respond to change in circumstances	9	2	0	0	**11**
Transfusion without decision	8	0	0	0	**8**
Transfusion necessitated by error	3	0	0	0	**3**
Sub total	**102**	**21**	**10**	**2**	**135**
Avoidable use of emergency group O	61	0	0	0	**61**
Grand total	**163**	**21**	**10**	**2**	**196**

Flawed decision n=63

These included 32 patients transfused outside of guideline thresholds, 13 patients unnecessarily receiving multiple units, 12 avoidable transfusions for haematinic deficiency (10 iron, 2 B12/folate), and 3 transfusions in patients with sickle cell disorder without a clinical indication. All of these were due to gaps in knowledge. In addition, there was 1 case related to inaccurate estimation of bleeding and 2 patients transfused despite withholding their consent.

Case 13.1: Multiple units transfused for anaemia due to B12 and folate deficiency

A patient with severe anaemia (haemoglobin (Hb) 29g/L) due to profound B12 and folate deficiency, who was moderately symptomatic but stable, was transfused seven units of red cells in the medical assessment unit. Post-transfusion Hb was 86g/L. It was noted that the patient presented overnight,

resulting in decisions being made without senior or specialist input. Shift handovers did not clearly highlight the reversible cause for the chronic anaemia.

Decision based on inaccurate result n=50

These included 17 haemodiluted samples, 15 erroneous laboratory results, 7 inaccurate results from blood gas machines, 4 old results, 4 cases where results were misread or handed over incorrectly and 3 cases of wrong blood in tube for the full blood count (FBC).

Case 13.2: Missed opportunity to review a decision to transfuse based on a haemodiluted sample

A Hb result of 67g/L was telephoned through for a patient on the surgical assessment unit. A consultant told a resident doctor to authorise two units of red cells. A venous blood gas taken an hour later gave a Hb of 96g/L, in keeping with the patient's baseline. The resident doctor filed these results but did not question the transfusion decision. During transfusion of the second unit, a nurse noticed the blood gas result and queried the discrepancy with the out-of-hours biomedical scientist. The transfusion was paused whilst a repeat FBC was performed. The repeat Hb was 110g/L. The original FBC sample was found to have been taken from the same arm that had intravenous fluids running.

Learning points

- Results that are not in keeping with the clinical picture should be questioned, particularly where there is a marked change from previous values. Unless there is clinical urgency, repeat samples should be taken before deciding to transfuse.
- Creating a culture where decisions are open to discussion and challenge can help all staff (resident doctors, nurses, laboratory staff) to feel able to question transfusion plans.

Failure to respond to change in circumstances n=11

There were 4 cases where components ordered 'just in case' were transfused routinely, 4 prescriptions/authorisations written in advance for regularly transfused/day unit patients whose latest results were not checked, 2 changes in treatment plan not communicated and 1 patient who had received iron and had no repeat Hb check to assess the need for transfusion.

Case 13.3: Change in plan for an iron infusion rather than blood transfusion in pregnancy not communicated

A pregnant woman reported tiredness and was found to have a Hb of 88g/L. A blood transfusion was initially planned, but this was changed to an iron infusion following medical review after haematinic results were available. This was not communicated to the midwife, although the plan was documented. The notes were not checked at the change of shift, and a unit of red cells was transfused. Two units had originally been requested, but this was reduced to one after challenge by the laboratory.

Learning points

- Transfusion should only be given in the context of haematinic deficiencies when the anaemia is severe, and the patient has significant symptoms or there is a risk of decompensation. The minimum volume to achieve clinical stability should be given. There is a high risk of TACO in this scenario.
- There is a risk of errors during verbal handover. Written plans and patient results should be checked wherever possible.

Transfusion without decision n=8

These included 3 patients transfused based on a prescription/authorisation written in error (should have been for another patient), 2 patients had no prescription/authorisation, and 3 received multiple units which had been ordered but not all were prescribed/authorised or intended. Verbal handover was a common factor.

Case 13.4: Lack of training in electronic systems resulted in an avoidable transfusion based on a verbal handover

Two units of red cells were crossmatched for a patient presenting with a suspected ectopic pregnancy, in preparation for possible surgery. The Hb was 116g/L. One unit was administered on the ward following a verbal handover from an emergency department (ED) nurse. None of the ward staff were trained to use the electronic blood tracking system and a nurse was called from another ward to start the transfusion. Staff did not know where to locate the prescription/authorisation on the electronic patient record and were therefore unaware that one had not been completed.

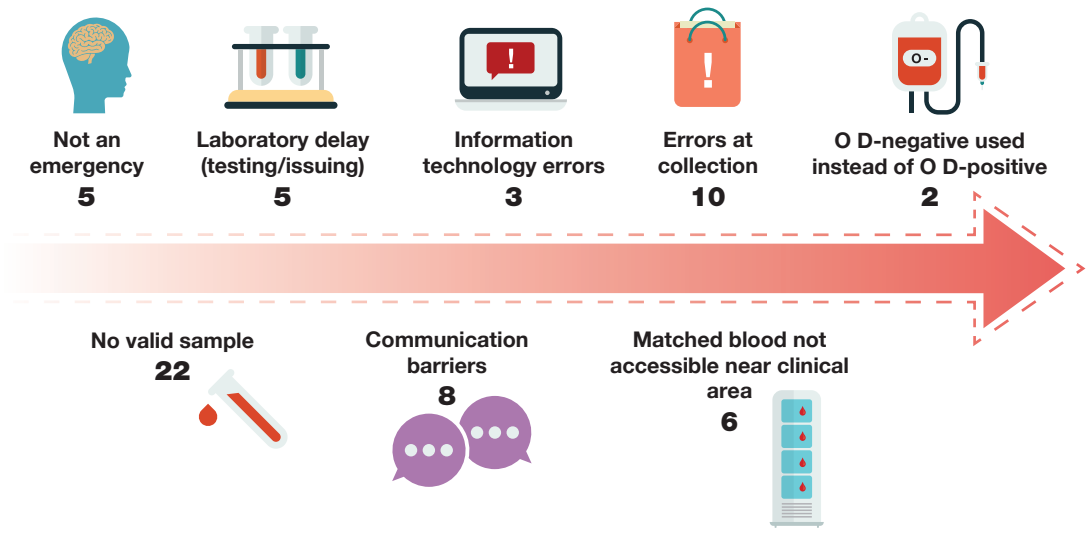
Transfusion necessitated by error n=3

These 3 cases all related to inadequate management of iron deficiency (2 in pregnancy), resulting in blood transfusion being required at the time of surgery.

Avoidable use of emergency group O n=61

Errors can occur at any point in the transfusion pathway leading to avoidable use of emergency group O. The number of reports related to key points is illustrated in Figure 13.1. The largest category involved delays in sending group and screen samples, or where samples were rejected due to mislabelling. It should be noted that reverting to emergency group O in this scenario is appropriate, to avoid patient harm from delay to a necessary transfusion, however this could have been avoided had a sample been available.

Figure 13.1: Errors during the transfusion pathway resulting in avoidable use of emergency group O (n=61)



Case 13.5: Delay in taking a group and screen in a patient with gastrointestinal bleeding results in the avoidable use of emergency group O

An elderly male presented to the ED with haematemesis. No group and screen sample was taken at the primary assessment. Six hours later, it was noted he had ongoing haematemesis, but no blood tests were taken at that time. A further two hours later, he deteriorated and was transfused with a unit of emergency group O. The first transfusion sample was only taken after this. In addition, group O D-negative was selected when he could have received O D-positive. It was noted that staff numbers in the ED were insufficient for the volume of patients received.

Learning point

- Patients with high potential to need transfusion (e.g. presenting with bleeding or an acute surgical problem) should have transfusion samples taken as part of their initial assessment.

Near miss avoidable transfusions n=6

There were 6 cases where an avoidable transfusion was prevented in 2025. All cases were in the clinical area and included 2 instances of the wrong results being reviewed; reticulocyte count instead of platelet count in 1 case, and blood sugar results instead of haemoglobin in the other. The remaining cases involved platelets being ordered for the wrong patient, a unit almost being administered without a Hb check, an O D-negative unit being collected instead of a fully crossmatched unit, and finally a unit that was almost transfused to prevent wastage.

Conclusion

All staff have a role to play in ensuring transfusion is only given when there is a clear indication. The decision must be informed by sound clinical assessment, judgement and guidelines, based on accurate laboratory results, and plans correctly executed. High quality consent discussions and involvement of patients in shared decision-making can provide a further opportunity to scrutinise the recommendation to transfuse and ensure all alternatives have been fully explored.

Cases where transfusion could have been avoided should be fed back to the teams directly involved but also shared more widely as learning opportunities.

UK Blood Services saw a severe shortage of group O red cells throughout 2024, and although this eased in 2025, ongoing high demand means the stock situation remains delicately balanced. Ensuring wise use of emergency group O should still be a priority, and the increasing number of reports in this category confirms this issue remains a focus for transfusion teams.

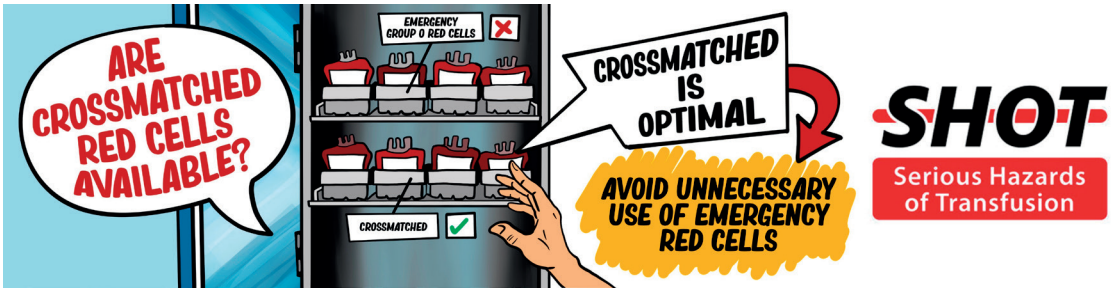
Recommended resources

SHOT Bite No. 34: Switching to group specific red cells during major haemorrhage

SHOT Major Haemorrhage simulation toolkit

National Blood Transfusion Committee Indication codes for transfusion (updated 2024)

Blood Components app



Under or Overtransfusion n=38

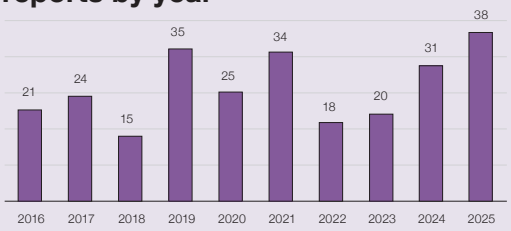
14

Authors: Paula Bolton-Maggs and Vera Rosa

Headline data 2025

Number of reports n=38
Deaths n=0
Major morbidity n=1

Under or overtransfusion reports by year



Demographic data

Male n=15
Female n=19
Adults n=19
Paediatric n=19
Unknown n=4

Blood component data

Red cells n=30
Platelets n=4
Fresh frozen plasma (FFP) n=1
Granulocytes n=2
Multiple components n=1

Key findings

- Paediatric cases made up half of all reports of under and overtransfusion.
- Errors with pump settings and infusion rates are common.

Gaps identified

- Programming of infusion pumps at the wrong rate or the wrong total volume.
- Environmental factors can lead to equipment errors, for example insufficient lighting.
- Knowledge gaps surrounding granulocytes dosing and requesting resulted in undertransfusion; standard doses come as two units.

Good practice

- Investigations showed appropriate corrective and preventive actions, including shared learning.
- Examples of prompt action and escalation following identification of under- and overtransfusions, which led to improved patient outcomes.
- Involvement of parents at each stage of the investigation for a paediatric undertransfusion error.

Next steps

- Include guidance on how to calculate the volume and rate required in policies for paediatric and neonatal transfusions.
- Ensure staff have sufficient knowledge on how to programme infusion pumps correctly.

For all abbreviations and references used in this chapter please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. For further information please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2025/).

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 were 38 cases in total, of which 20 related to issues with pumps or rates of infusion (15 resulted in undertransfusion and 5 in overtransfusion). Paediatric cases made up 19/38 (50.0%), including 5 with haemoglobin disorders. Overall, the majority, 37/38, were due to clinical errors.

Deaths related to transfusion n=0

There were no deaths as a result of under or overtransfusion in 2025.

Major morbidity n=1

A patient received a transfusion over 30 minutes resulting in admission to the intensive care unit (ICU) (Case 14.1).

Overtransfusion n=18

In 3 patients, 2 with major haemorrhage and 1 acute gastrointestinal bleed, more red cells were administered than necessary. In an emergency the extent of blood loss may be difficult to assess. Regular checks on the haemoglobin (Hb) (including point-of-care tests (POCT)) can help to avoid overtransfusion.

A patient with chronic anaemia due to cancer treatment, weight 47kg, was prescribed 188mL and was transfused a whole unit (288mL) but came to no harm.

An infant received an excessive red cell transfusion volume when a POCT measurement of Hb was misheard as 116g/L but the correct result was 160g/L.

Errors in prescription/authorisation n=8

Where there was an error in prescription/authorisation, 7 cases involved paediatric patients, of which 2 were on regular transfusions for thalassaemia. In another case where preoperative transfusion occurred, two units were each given over 1 hour instead of 3 hours. The anaesthetist changed the prescription/authorisation to ensure the top-up occurred before surgery on the same day for a fractured neck of femur.

Errors in infusion equipment n=5

There were 5 errors due to infusion equipment; 3 due to pump errors and 2 due to infusion errors, which are described in Case 14.1 and Case 14.2.

Case 14.1: Rapid transfusion followed by respiratory compromise

A young patient with a history of renal transplantation and continued renal dysfunction was admitted with abdominal pain and prescribed a single-unit red cell transfusion. This was infused over 30 minutes instead of 3 hours. Eight hours later, the patient developed haemoptysis and desaturated, necessitating admission to the ICU. Chest X-ray changes favoured infection rather than fluid overload. The patient received furosemide without obvious benefit. Criteria for TACO were not met, and the patient made a full recovery.

Case 14.2: Dim light associated with wrong infusion settings

A small child was transfused an excessive volume of red cells (327mL) resulting in a Hb rise from 82g/L to 169g/L. The prescribed volume was 150mL over 4 hours. The parents had requested the child not be disturbed, so the transfusion was set up in dim light and not checked later at staff changeover.

Undertransfusion n=20

In 15 cases the infusion was given at the wrong rate or there were problems with the pump settings (including battery failure); 6 were paediatric cases. Most related to red cells but 2 patients did not receive their intended dose of granulocytes (2 bags) as the second bags were not infused (one of these was a laboratory error). One adult only received a single unit of FFP which was an inadequate dose.

Learning point

- Infusions using pumps should be carefully set up, and the electricity supply should be confirmed to be adequate to ensure the patient receives the intended quantity of the transfusion.

Conclusion

Over or undertransfusion is more likely to occur in paediatric patients and where infusion pumps are incorrectly set or used. Gaps in knowledge and understanding of paediatric and neonatal transfusion volume calculations in line with national guidance continue to impact patient and transfusion safety.

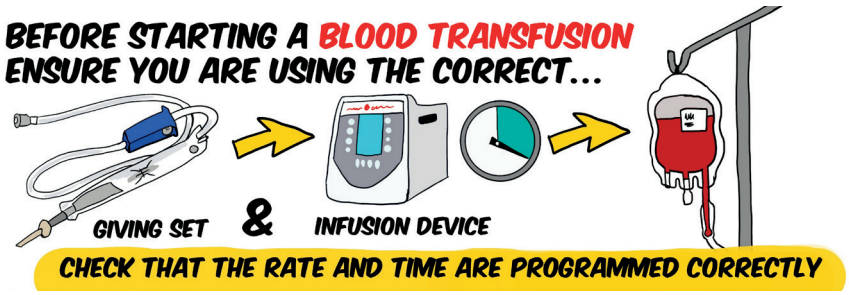
Transfusion of the incorrect rate or volume can lead to serious consequences, impacting on patient wellbeing. Overtransfusion can be a contributory factor in cases of TACO, as discussed in Chapter 21a.

Recommended resources

Avoidable, Delay and Under or Overtransfusion (ADU) Cumulative Data

Avoidable, Delayed or Under/Overtransfusion webinar (ADU)

SHOT Bite No.4: Lessons in Paediatrics (including neonates)



15 Incidents Related to Prothrombin Complex Concentrates (PCC) n=39

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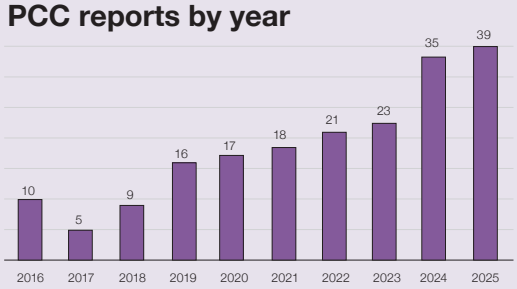
Headline data 2025

Number of reports n=39
Deaths n=3
Major morbidity n=0

PCC reports by year



Demographic data

Male n=22
Female n=15
Unknown n=2
Adults n=39
Paediatric n=0

Blood product data

Prothrombin complex concentrates (PCC) n=36
Fresh frozen plasma (FFP) n=1
Solvent-detergent FFP n=1
Multiple components n=1

Key findings

- Delays remain the main reason for PCC reports, 23/39 (59.0%).
- Most patients were elderly (74.4% aged >70), with intracranial haemorrhage (ICH) common in this group.
- Most events occurred in clinical areas, 35/39 (89.7%).

Gaps identified

- Uncertainty about local policy for dose, stock location, ordering, and administration contributes to delays.
- Failure to recognise clinical urgency and bleeding risk in patients receiving anticoagulants.

Good practice

- Retrospective audits of PCC usage and major haemorrhage protocols (MHP) identified PCC incidents, which may lead to improved processes in the future.

Next steps

- Protocols for anticoagulant reversal should be accessible and include how to prescribe, order, and administer PCC.
- Rapid release of a fixed dose PCC in the emergency department (ED) should be considered, with follow up international normalised ratio (INR) for patients on warfarin to ensure adequate correction.

For all abbreviations and references used in this chapter please see the **Glossary** and **Reference list** at the end of the full Annual SHOT Report. For further information please see the supplementary information on the SHOT website (https://www.shotuk.org/shot-reports/annual-shot-report-2025/).

Definition:

Delays in administration, inappropriate prescription, or problems with administration related to PCC infusion. 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 in treatment with PCC occurred in 23/39 (59.0%) cases. Avoidable use of PCC was reported in 5 cases. The patient age range was 39 to 103 years with the majority, 29/39 (74.4%), >70 years of age. The median age was 80 years. There were 22 cases with ICH, including 18 with a delay in treatment. Most cases, 35/39 (89.7%) originated from clinical areas.

In 14 of 39 cases, a knowledge gap contributed to the error. Two patients received less than the recommended dose and 8 received more than recommended. Both available brands of PCC have an upper limit for dosing, and this should be adhered to.

Deaths related to transfusion n=3

There were 3 deaths related to delayed PCC infusion (1 possibly, and 2 probably related). These 3 patients all had ICH, 2 were over 90 years of age: 1 possibly related had a delay of 5 hours (Case 15.1), and 2 cases probably related had delays of 8.5 (Case 15.2) and 7.5 hours.

Major morbidity n=0

One patient suffered a cerebrovascular event within 48 hours of anticoagulant reversal (details in the supplementary material) but it was not considered to be related to the PCC administration.

Delays: Every minute counts n=23

In all 23 cases of delay the need was either urgent (11) or emergency (12) and 14/23 (60.9%) patients were in the ED. Eight patients had delays of more than 10 hours with the longest delay being 36 hours. One patient did not receive the PCC. A large UK-wide study demonstrated notable delays in anticoagulant reversal (Buka, et al., 2025).

Case 15.1: Delayed treatment of haemorrhagic stroke (imputability 1 – possible)

An elderly patient developed neurological deterioration, and the computed tomography (CT) scan demonstrated ICH. PCC was recommended for anticoagulant reversal but was not given before the patient was transferred to a ward. There was communication confusion which resulted in a 5-hour delay in treatment. The patient died and the delayed treatment was considered contributory.

Case 15.2: Head injury and ICH with delayed PCC (imputability 2 – probable)

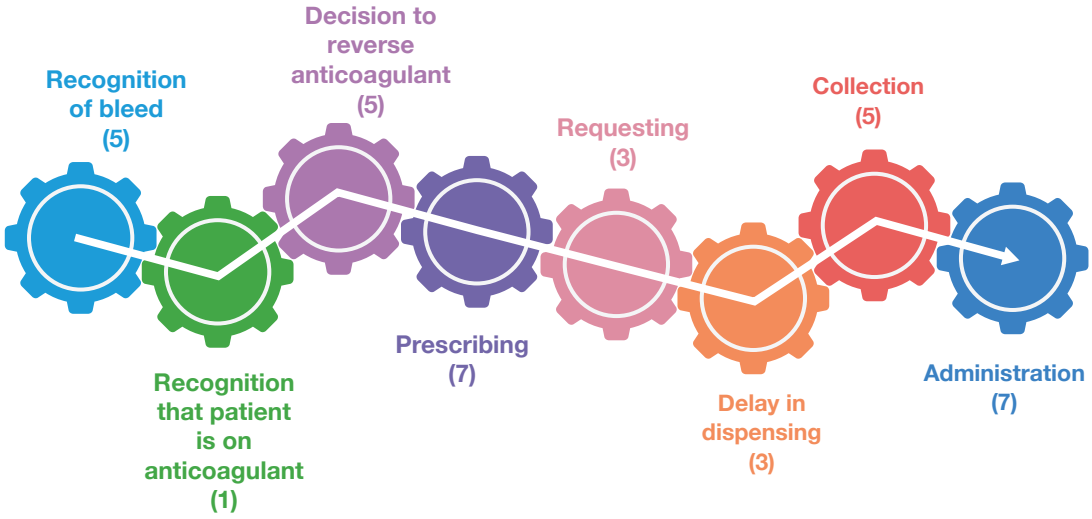
An elderly patient with atrial fibrillation (AF) fell at home, hit their head and lost consciousness for 5 minutes. They waited 3 hours for a paramedic crew to arrive. A head CT scan showed an acute subdural haematoma. Neurosurgeons advised warfarin reversal with PCC, but this was not achieved for 8 hours. The patient deteriorated neurologically with a subsequent seizure and a massive increase in bleed size. The patient never regained consciousness and passed away.

Learning point

- Many elderly patients are receiving anticoagulants usually due to AF. They have an increased likelihood of falls and are at high risk of ICH. Anticoagulants should be urgently reversed upon identification of ICH.

Delays occurred at several points and there were often multiple contributory factors (Figure 15.1).

Figure 15.1: Points of delay in the PCC care pathway, 2025



Communication issues

Communication problems were recorded in 16/39 (41.0%) cases.

Case 15.3: A series of mishaps leading to delayed administration of PCC

A patient on a direct oral anticoagulant (DOAC) was admitted with a haemorrhagic stroke. PCC was prescribed but administered after a 3-hour delay caused by a combination of errors. An incorrectly completed request form sent to the transfusion laboratory had to be rewritten. The form was taken to the transfusion laboratory late because staff were not aware that the request was urgent. The ward staff were not aware that the order was ready. PCC was then delivered by the porter to the wrong ward.

Case 15.4: Lack of communication about PCC storage for emergency use

A patient required emergency above-knee amputation due to necrotising fasciitis. Their INR was 4.9. The haematology consultant advised 2000 international units of PCC and to recheck the INR and give further PCC if INR >1.5. There were multiple telephone calls between the clinical team, the transfusion laboratory and the on-call pharmacist which led to a misunderstanding as to which blood product was required and where it could be found. This resulted in factor IX concentrate (BeneFIX®), being issued from the factor issue refrigerator and administered, instead of PCC. Emergency stocks of PCC were held in the ED but were not listed on the pharmacy ward list on the intranet and could therefore not be located out-of-hours.

Consequently, a poster has been placed on the factor refrigerator in the pathology department advising on PCC location out-of-hours. Theatres have a copy to display in their clinical areas. A quick reference guide is to be developed for on-call pharmacists to delineate the various names which may be used for blood products and where these are kept.

Wrong blood component or blood product n=5

In 5 cases patients failed to receive the correct blood component and/or blood product. A patient with metallic heart valves and gastrointestinal (GI) haemorrhage was prescribed PCC for anticoagulant reversal which is relatively contraindicated because of an increased risk of thrombosis (Uncu, et al., 2024). The balance of risks for the individual patient should be considered.

Three other patients received FFP inappropriately. In 1 case, a patient with a rectal bleed and receiving a DOAC (direct oral anticoagulant) received FFP in addition to unnecessary PCC; a patient with a lower

GI bleed on warfarin (non-major haemorrhage) with a history of heart failure was given FFP instead of PCC. A patient had Octaplas® ordered instead of Octaplex®, the error being identified by the transfusion laboratory who questioned the indication for plasma. In the final case, a factor IX analogue was mistakenly ordered instead of PCC (see Case 15.4).

Learning points

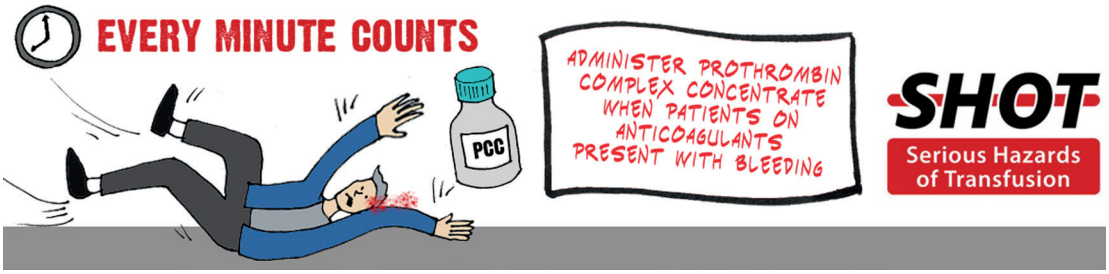
- PCC is the reversal agent of choice for warfarin and DOAC (other than idarucizumab specifically for dabigatran).
- Use of trade names and inadequate verbal communication increase the risk of incorrect blood products being administered.

Near miss PCC n=1

PCC was ordered for a patient and sent to the ward. The patient was subsequently put on an end-of-life pathway. The PCC was stored in the ward refrigerator and forgotten for several weeks.

Conclusion

Most reports were submitted were due to delays in provision and administration of PCC, particularly in patients with ICH. Clear communication using non-trade names may avoid confusion and reduce errors resulting in incorrect products being given. Easy access to protocols including clear stock locations, and fixed initial dosing of PCC facilitate timely decision-making, thus helping to reduce errors and delays. The 2023 Annual SHOT Report included a review of evidence for fixed dose PCC in the emergency setting (Narayan, et al., 2024). Systematic reviews have demonstrated benefits: dose reduction, more rapid administration, better haemostasis with reduced mortality and fewer thromboembolic events (Alwakeal, et al., 2024; Homssi, et al., 2025; Schrader, et al., 2026). This year's reports of delay are consistent with the large UK-wide study mentioned above (Buka, et al., 2025). This study also showed an increased risk of thrombosis associated with the anticoagulant reversal agent Andexanet alpha. At initiation of anticoagulant therapy patients should be counselled about risks of major bleeding, particularly ICH. Elderly patients and their carers should be reminded of this annually, as this could shorten time to presentation for ICH.



Recommended resources

CAS Alert - Preventing transfusion delays in bleeding and critically anaemic patients

SHOT Bite No. 16: Errors with Prothrombin Complex Concentrate