

A blue header bar featuring a repeating pattern of white medical icons: a biohazard symbol, a person on a gurney, a blood drop, a nurse, and a clipboard with a person icon.

Cases from the 2017 SHOT Annual Report

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They have been loosely categorised, but some cases may be appropriate to illustrate more than one type of error

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Donor Haemovigilance



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Donor with delayed faint involved in road traffic collision within 24 hours of donation

- *A young female whole blood donor had an uneventful first donation*
- *Following donation, the donor had a delayed faint whilst driving her car out of the venue car park. The donor was transferred to the local emergency department (ED) by ambulance*
- *No injuries were sustained by the donor*
- *The donor was found to be hypotensive and discharged from the ED following treatment with intravenous (IV) fluids*
- *The donor has been withdrawn from blood donation*
- *A root cause analysis confirmed that all standard procedures were followed and nothing could be identified that needed to be addressed to be able to prevent this SAED*

Venepuncture related persistent arm pain >1-year post donation

- *A female regular whole blood donor who had donated 11 times previously reported problems with her donation arm which had persisted for longer than 12 months post donation*
- *The donor reported the venepuncture being painful and the donation being slow*
- *The donation was discontinued appropriately before the full volume could be collected*
- *The donor had local bruising for several days after donation and intermittent pain to the inner aspect of her elbow radiating down her wrist and up her upper arm*
- *She also reported weakness in her arm when performing tasks*
- *The donor is under the care of her general practitioner (GP) and may be referred to a specialist*
- *The donor has been withdrawn from blood donation*

Human Factors



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Total culpability attributed to individuals may fail to highlight system problems

- *A patient was issued and transfused platelets and red cells in separate incidents with only one group on record in the laboratory information management system (LIMS)*
- *In the morning a group and screen sample was processed and one unit of platelets was requested for the patient*
- *The biomedical scientist (BMS) realised that there was no historic group on record for this patient and added the code to the report stating that if blood components were required, a second sample would be needed to confirm the patient's group*
- *In the early hours of the following day another BMS received a request for one unit of red cells and one unit of platelets*
- *Having seen that a sample had been received and processed earlier the day before, and that the patient had already received a unit of platelets, the BMS crossmatched red cells and issued these with a second unit of platelets, both of which were transfused although the patient had not yet had a group-check sample tested*

Failure to assign scores for human factors may reduce learning opportunities

- *A unit of red cells was transfused the day after the validity had expired for the sample used for crossmatch*
- *No scores were assigned for contributory human factors and the reporter did not answer whether they had read the self-learning package, but important additional information implied system-related problems*
- *This patient was transfusion-dependent and needed transfusing two or three times a week so samples used for crossmatching must be less than 72 hours old at transfusion*
- *Units are crossmatched by the Blood Service (BS) due to antibody complexity and this can add delay between sampling and transfusion. To facilitate traceability, units issued via the LIMS have a default de-reservation period of 48 hours, so the date automatically prints on the compatibility label as two days later*
- *When de-reservation is required after one day, because the sample validity would expire by then, the BMS must manually amend the label and annotate with the correct date*
- *In this case, the BMS did not annotate the label with the correct de-reservation date and the unit was not de-reserved*

Laboratory Errors



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Blood issued and transfused with incorrect spelling of forename (1)

- *Clinical staff notified the laboratory that they had removed, by remote issue, a unit of red cells from the blood refrigerator with an incorrect spelling of the patient's forename*
- *One unit of red cells had already been transfused to the patient with this incorrect spelling*
- *The sample and request form used for crossmatching were labelled with the full first name but the historical record had a shortened version of the same name*
- *This discrepancy had been checked with the electronic patient record at initial input in 2012 and again on the second sample received in 2013*
- *In 2014 the electronic patient record was changed to the full name*

(continued)

Blood issued and transfused with incorrect spelling of forename (2)

- *When booking in this sample in 2017 the difference in the first name was not noted and it was booked in under the historical record of the short version without updating the forename to the full correct name*
- *Two BMS failed to notice that the forename on the request form and sample were different to that on the historical record*
- *The error was also not detected by ward staff and consequently a unit was transfused with the incorrect patient's forename*
- *At the time of the incident the BMS staff had up-to-date competency assessments*

Preparing units for two patients with the same blood group simultaneously resulted in one patient receiving units intended for the other, 3 errors

- *Patient 1 received blood crossmatched for Patient 2*
- *The incident involved two 2-unit crossmatches issued within 4 minutes of each other for two patients whose blood groups were both O D-positive with no antibodies detected*
- *The crossmatched units were labelled and issued to the wrong patients*
- *Patient 2's units were labelled with Patient 1's compatibility tag and Patient 1's units were labelled with Patient 2's compatibility tag*
- *Patient 1 was transfused both units with no adverse events reported*
- *Patient 2 was not transfused and the units were returned*
- *The error was not detected either at collection or at administration because the compatibility tag was not checked against the component label it was attached to*
- *The error was identified by the medical laboratory assistant (MLA) when fating the units as transfused in the LIMS*

Blood issued before compatibility testing was complete

- *A full indirect antiglobulin test (IAT) crossmatch was set up by BMS 1 during a weekend shift for a patient with a known anti-K antibody which was not detectable at this time*
- *Full testing was incomplete by the end of this shift as the crossmatch had not been interpreted*
- *BMS 1 handed over the patient/testing information to BMS 2 who was starting the next shift, but they ended up working in the haematology section of the laboratory and not in transfusion*
- *BMS 3, who also started on this shift and was covering the transfusion laboratory, assumed testing had been completed for this patient*
- *The red cell unit was labelled, checked and moved from the holding shelf of the testing refrigerator into the issue refrigerator*
- *K-negative red cells had been selected for this patient*
- *The error was not detected until later in the shift when the gel card used for crossmatching was found still in the incubator*
- *BMS 3, realising the error, checked the issue refrigerator however, the unit had been removed and transfused to the patient*
- *The LIMS and report form indicated the units had been compatibility tested*

Out-of-date LIMS and a manual interpretation error leads to two different blood groups being reported on a patient's record

- *A new patient was grouped on two separate occasions*
- *Manual interpretation of the results was performed by the BMS*
- *The first result recorded was interpreted as A D-positive and the second result was interpreted as B D-positive*
- *Group O compatible red cells were issued, and one unit was transfused before the error was noted by a second BMS*
- *The laboratory used an out-of-date LIMS which added complication to authorising results and allowed two different blood groups to be reported on the same patient*

Non-irradiated platelet units issued to a <10-year-old patient despite a warning flag, 3 errors (1)

- *A BMS issued two bags of platelets for a patient who required irradiated cellular components*
- *This specific patient requirement was recorded on the LIMS. BMS 2 was covering for a break during a night shift, and receipted the platelets on arrival from the Blood Service*
- *When BMS 1 returned from their break, they received a handover message that the platelets had been placed on the agitator but required irradiation*
- *This message was taken verbally but not written down*
- *It is usual practice at this hospital for all platelets to be irradiated on arrival from the Blood Service and then placed on the agitator, however in this instance that did not happen*

(continued)

Non-irradiated platelet units issued to a <10-year-old patient despite a warning flag, 3 errors (2)

- *The shift ended and day staff arrived*
- *BMS 3 issued the platelets assuming they had been irradiated*
- *A message flagged up that they had not been irradiated but was overridden*
- *At administration BloodTrack® was used but it did not pick up the need for irradiated platelets, and it was not picked up by the registered nurse administering them and so the patient received the transfusion*
- *The error was noticed during the bedside check for the second unit*
- *The unit was returned to the laboratory and an incident form completed*

Multiple specific requirements for a patient where the need for K-negative units was overlooked

- *A telephoned request was taken for red cells for a <10-year-old girl, but full details were not entered onto the telephone request form at the time of request, therefore gender was omitted and this was not obvious from the patient's name*
- *The request was taken by a lone overnight worker who was interrupted by a bleep so did not complete the task by looking up the record on the LIMS*
- *Subsequently the LIMS became unavailable due to a planned downtime*
- *A second BMS later issued the red cells while the LIMS was still unavailable, so the patient was looked up on the in-house specific requirement back-up file which stated that the specific requirements were for CMV-screened and irradiated cellular components*
- *This was then written on the request form*
- *A red cell unit was crossmatched, issued and transfused*
- *When the LIMS was back up and running it was noted that the additional requirement for K-negative units, due to patient gender and age, had been overlooked and a K-positive unit had been transfused*

Incorrect D-group red cells given following liver transplant (donor D-negative, recipient D-positive) (1)

- *Following a telephone call from the transplant coordinator to the transfusion laboratory, staff became aware that D-positive blood had been issued and administered to a post-liver transplant patient outside the hospital local protocol*
- *The blood was compatible with the recipient but not with the donor organ, which was D-negative*
- *The error was noticed by ward staff and was quickly rectified and new blood components issued by the transfusion laboratory staff*
- *The previous units were removed to prevent any further components being erroneously transfused*

(continued)

Incorrect D-group red cells given following liver transplant (donor D-negative, recipient D-positive) (2)

- *The investigation report noted that sample processing occurred outside normal working hours; this was not unusual for a liver transplant patient and workload was not excessive*
- *The checking process and issuing of blood components had been dealt with by three members of staff and covered two handover periods*
- *The blood sample and request also had arrived towards the end of the shift for one of the staff members*

Blood issued and transfused related to an incorrectly labelled sample (1)

- *A patient was admitted to the emergency department (ED) and had their surname recorded on the patient administration system incorrectly with a unique patient number but no DOB was provided*
- *Two samples labelled as above were received and processed by the transfusion laboratory*
- *The following day the patient's central record was updated with the name changed to a different but similar and correct surname and updated with a DOB, but the unique patient number remained unchanged*
- *The transfusion laboratory was not informed that there had been a change to the patient's details*
- *Two days later the laboratory received a request for two units of red cells which was fulfilled using the original samples with the incorrect name and no DOB*

(continued)

Blood issued and transfused related to an incorrectly labelled sample (2)

- *A member of staff from the clinical area was sent to collect a unit of red cells for this patient and failed to undertake full patient identification checks*
- *At the time they realised that there was no DOB recorded, that the unique patient number was the same but they did not check the patient's name*
- *On return to the clinical area, the staff member contacted the transfusion laboratory and enquired about the missing DOB*
- *They were informed that the component could be transfused*
- *However, two further samples were now needed by the transfusion laboratory*
- *At administration a two-person check was undertaken at the bedside but no check was performed against the identification band and the unit was then transfused*
- *On investigation the staff member said that they were concerned about the lack of a DOB however, when they telephoned the laboratory they were told that the blood was safe to use*

Transfusion of FFP which had exceeded the post-thaw expiry time

- *FFP was requested for an elderly patient who was bleeding during a hip replacement*
- *The laboratory keeps stocks of different types of frozen plasmas (methylene blue-treated FFP (MB-FFP), solvent detergent treated FFP (SD-FFP) and standard FFP) and usually keeps pre-thawed standard FFP for up to 5 days for major trauma only (JPAC 2016)*
- *A BMS selected thawed MB-FFP, which was beyond its permitted 24-hour post-thaw storage period, and issued it for the patient*
- *The error was detected by the transfusion practitioner while following up data collection*
- *The BMS on duty did not notice that the pre-thawed plasma was not suitable for 5-day storage and inappropriate for non-MHP use*

A patient with sickle cell disease received an incorrectly phenotyped component following an error from the Blood Service

- *A unit of red cells was requested from the Blood Service for a patient with sickle cell disease*
- *The Blood Service crossmatched the unit but it was not matched for Rh and K*
- *Specific requirements for sickle cell patients are that red cell units should be sickle-negative (HbS-), matched for both Rh and K, and <10-days old*
- *The receiving transfusion laboratory failed to identify this omission and made the unit available for the patient*
- *The patient subsequently developed anti-C as they should have received red cells negative for the antigens C, E and S that were also HbS-negative as recommended by the Blood Service expert laboratory report*

FFP reconnected and transfused after being disconnected

- *FFP was being administered to a patient when a problem arose with the cannula*
- *The nurse stopped the transfusion and disconnected the component*
- *The nurse took the component to the laboratory to ask how long FFP can be out the refrigerator and if it could still be given within the allowed timeframe*
- *The BMS advised that the component could be re-connected to finish the transfusion as it was still within time*
- *The nurse (who had received transfusion training) queried this instruction as she would not have done this with red cells but because two BMS told her the same thing she assumed this was correct*
- *The nurse re-connected the unit and completed the transfusion*
- *The nurse was unaware of the correct procedure to follow if a cannula becomes blocked (i.e. to discard remainder of the unit after disconnecting)*
- *It was noted that she had relied on inappropriate advice*

Pathology LIMS was down, manual back up of patient data was available but had not been updated for 3 months, so missed the patient's specific requirements (1)

- *Over time, several hard drives containing the pathology LIMS records failed and eventually the final hard drive failed*
- *The LIMS shut down throughout pathology, which covered three teaching hospitals across two cities, including the blood transfusion department*
- *It was not reinstated until 8 days later and was not in full use until the 9th day following validation*
- *During this period blood requested for a patient had no indication on the request form of any specific requirements or history of alloantibodies*
- *Some patient history was available on an out-dated spreadsheet, including specific requirements and alloantibodies, but this was not consulted before issuing blood*
- *This was because it was time consuming to do, and staff were very busy because of the increased workload*

(continued)

Pathology LIMS was down, manual back up of patient data was available but had not been updated for 3 months, so missed the patient's specific requirements (2)

- *Education for this important step was not routinely delivered in training*
- *In addition, the working environment became difficult due to the amount of paper being used for each record and space became compromised due to the amount of manual work that had to be completed, all of which had to be completed with the existing number of staff*
- *Staff morale was affected by the demands of increased concentration required, user requesting and overall stress of providing a service during this situation*
- *A manual backup from the LIMS to an Excel spreadsheet which records known alloantibodies was last performed three months before and was only ever done on an ad-hoc basis*
- *Had this been done more frequently, then the potential for missing a specific requirement or alloantibody would have been reduced*

Right Blood Right Patient (RBRP)



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Doctor uses their own name by mistake when completing the transfusion record sheet

- *A unit of red cells had been collected according to hospital policy by using the collection slip*
- *However, when the transfusion record sheet (TRS) was returned to the laboratory for traceability purposes, the name on the TRS did not correspond with the expected patient's name*
- *On investigation the doctor had filled in their own name when completing the TRS with the patient's hospital number and DOB*
- *This was not identified when two clinical staff (one reading the tag and one reading the TRS) were undertaking the final bedside check and subsequently signing the TRS*
- *The tag attached to the unit had the correct details for the patient*

Final bedside check not undertaken correctly

- *A unit of red cells was administered without the final bedside check being undertaken correctly*
- *Another member of staff had the electronic hand-held personal digital assistant (PDA) which is used in the checking process to verify the patient details*
- *The nurse proceeded to administer the transfusion, stating it was to save time rather than waiting for the PDA*
- *Furthermore, the correct checks could have been carried out by using the tag attached to the unit which has a checklist. This can also be used for the correct procedure to administer the unit to the patient*
- *The error was identified by another staff member who brought the PDA over for the staff member to use*
- *The staff member knew the correct hospital procedure but thought that a short cut would save time and permit the transfusion to proceed more rapidly*

Inadequate validation of new LIMS results in potential for inappropriate electronic issue (EI)

- *Following implementation of a new LIMS it was noted that the default to 72-hour sample validity was not present on all patients to whom red cells had been issued*
- *Further investigation revealed that the product codes for some red cells had been put into the LIMS directory incorrectly so that the EI algorithm indicated that 'crossmatch was not necessary'*
- *Nine patients were given the right blood but should not have been eligible for electronic issue*
- *A full validation of the EI programme would have identified this problem but was not carried out*

Bedside alarm not heeded

- *A patient with gastrointestinal (GI) bleeding was admitted to the emergency department (ED) where he was registered with a misspelling of his first name (by one letter)*
- *The doctor used these details to generate request forms and labelled the samples from details on the identification band*
- *After the samples had been dispatched the error was noted and the first name changed so a new identification band was printed*
- *When the blood was issued it did not match the identification band so the bedside PDA highlighted the discrepancy*
- *The doctor checked this with the laboratory who advised that the blood should not be given but the doctor said he knew it was the right patient and that it was an emergency*
- *The transfusion of three units went ahead*

Handling and Storage Errors (HSE)



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Communication error leads to excessive time to transfuse

- *Nurse 1 asked if she could help her colleague (Nurse 2) by administering the transfusion for a haematology patient to allow Nurse 2 to have her break*
- *Nurse 2 went for her break while the blood was being collected but left the instruction that the blood had to 'run slow' as the patient was breathless*
- *The transfusion was commenced by Nurse 1 at 11:10 with observations being completed according to hospital policy, prior to, and 15 minutes into the transfusion*
- *On completion of these observations Nurse 1 returned to her allocated clinical area and assumed that her responsibility for the transfusion was over and that Nurse 2 would resume responsibility on return from their break*
- *However, at 16:45 an agency nurse taking over from Nurse 2 reported that the transfusion was still running (more than 5 hours)*
- *On this occasion the patient did not come to any harm*

Staff multitasking and being distracted during a suspected transfusion reaction led to miscommunication

- *Following a suspected transfusion reaction, the nurse, who had limited experience of administering transfusions, contacted the laboratory for advice and was asked to return the unit 'to the refrigerator'*
- *The nurse then proceeded to return the blood to the ward refrigerator and not to the temperature monitored transfusion laboratory refrigerator*
- *The inexperienced nurse was distracted by the suspected transfusion reaction in the patient and did not understand the instruction from the laboratory staff leading to a miscommunication between the laboratory and the nurse*

Incorrect transport and delivery of red cells by clinical staff

- *A porter was asked to collect blood urgently by theatre staff in a 'cool box'*
- *When the porter arrived at the laboratory there was no biomedical scientist (BMS) there to assist*
- *After speaking to a BMS from another discipline who stated that they did not know where the cool packs were, the porter took a 'cool box' and signed the blood out of the refrigerator*
- *On arrival in theatres ice was added from the theatre ice machine before delivering to the theatre. It was not established if this was by the porter or theatre staff*
- *The first unit was transfused and the second unit was returned to the laboratory and discarded*
- *Theatre staff were aware of the correct procedure which was to page the BMS to request blood to be delivered in a special box*

Incorrect Blood Component Transfused (IBCT)



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A newborn baby (AB D-negative) was transfused with O D-positive red cells due to a manual interpretation error that went undetected on several occasions (1)

Day 1:

- *A newborn baby was admitted with cardiac and respiratory compromise due to tetralogy of Fallot*
- *A group and screen (G&S) sample was received with an electronic tracking number as no unique number was yet assigned*
- *The sample was labelled 'Baby' plus the last name containing one 'L'*
- *BMS 1 processed the sample on the analyser*
- *The analyser was unable to interpret the result*
- *BMS 1 manually interpreted the result incorrectly as AB D-positive and entered this on to the laboratory information management system (LIMS)*
- *Patient identification (ID) check was carried out by BMS 2 and results authorised*

(continued)

A newborn baby (AB D-negative) was transfused with O D-positive red cells due to a manual interpretation error that went undetected on several occasions (2)

Day 17:

- *Another sample was received with a unique number and labelled with a forename and the same last name as above but spelt with two 'L's*
- *BMS 3 assumed that it was the same patient as detailed above because blood group AB D-positive was stated on the request form*
- *The sample was processed on the analyser which was unable to interpret the result*
- *BMS 4 incorrectly manually interpreted this again as AB D-positive*
- *BMS 5 carried out the patient ID check and the results were authorised*

(continued)

A newborn baby (AB D-negative) was transfused with O D-positive red cells due to a manual interpretation error that went undetected on several occasions (3)

Day 34:

- *The baby eventually required extracorporeal membrane oxygenation (ECMO) following sudden deterioration*
- *A further sample was received labelled the same as the one from day 1*
- *The request was for a G&S, four red cell units and two units of platelets according to the ECMO protocol*
- *BMS 6 selected four O D-positive red cell units (no suitable AB D-positive available) for crossmatching*
- *As the baby had a previous G&S on file an uncrossmatched O D-positive unit was prepared to prime the ECMO system because of low blood volume in newborn children*
- *BMS 7 carried out the patient ID check and the unit was released*
- *Once analysis of the sample was complete, BMS 7 identified a difference in blood group (AB D-negative) from that on file (AB D-positive)*
- *The clinical area was contacted who advised that the ECMO system had already been primed with the O D-positive unit*

(continued)

A newborn baby (AB D-negative) was transfused with O D-positive red cells due to a manual interpretation error that went undetected on several occasions (4)

- *BMS 7 returned all other blood components and suitable O D-negative components were ordered (no suitable AB D-negative available)*
- *The baby had received 200mL of O D-positive red cells*
- *The haematology consultant recommended exchange transfusion to avoid alloimmunisation to the D-antigen by removing the bulk of the D-positive red cells, followed up with measurement of residual D-positive red cells and administration of an appropriate dose of anti-D Ig*
- *The baby was unstable for other reasons and was not fit enough for exchange until day 4 post D-incompatible transfusion*
- *A 1.5 x blood volume exchange transfusion took place which reduced D-positive red cells to 2.8mL and a suitable dose of anti-D Ig was given*
- *There were no side effects, however, the baby's underlying clinical condition deteriorated and the decision was made to withdraw organ support and the baby died*

Failure to complete the administration check at the bedside correctly leads to an ABO-incompatible red cell transfusion

- *Two units of red cells were issued for Patient 1*
- *A healthcare assistant collected the correct unit and took this to the correct ward and handed it to the nurse looking after Patient 1*
- *Two nurses then checked the component against the prescription in the clinical utility room and not next to the patient*
- *The nurse who was to administer the blood then went to the wrong side room and administered the blood (donation group A D-positive) to Patient 2 (group O D-positive)*
- *Within 5-10 minutes the patient complained of lumbar pain, a general feeling of being unwell, a hot sensation on his back, and had developed tachycardia*
- *Transfusion was stopped and the clinical team informed*
- *The patient stabilised and recovered with minimal medical intervention*
- *No further information was provided*

Duplicate samples lead to unintentional ABO-incompatible platelet transfusion because of a wrong blood in tube error

- *A male patient post chemotherapy for a brain tumour was admitted via the emergency department with a fever but no obvious focus for infection*
- *Two samples were obtained from the patient in the medical admissions unit and received in the transfusion laboratory from the same person but different times documented, both grouped as A D-negative*
- *Platelets were issued based on these two results*
- *Seven weeks later a new request form and sample were received for this patient, which grouped as B D-positive*
- *Due to the discrepancy in the group history a full blood count sample taken 3 days earlier was tested which grouped as B D-positive*
- *The duplicate samples from the original admission were from a different patient, i.e. WBIT, and led to the issue and subsequent transfusion of incompatible platelets; group A D-negative to a group B D-positive patient*
- *The patient had no adverse outcome*

ABO-incompatible platelets selected incorrectly by a BMS who was not paying attention to the task

- *A unit of platelets was requested for a patient with non-Hodgkin lymphoma and critical site bleeding*
- *The laboratory staff issued group O platelets by mistake for a group A patient*
- *The ward staff completed the pre-transfusion checks and transfused the unit*
- *When the error was identified by the laboratory staff they contacted the ward staff and advised them not to transfuse the platelets but were informed that the transfusion had been completed*
- *The BMS issuing the platelets was experienced and had regularly worked in transfusion but was new to this laboratory*
- *The BMS assumed that they were to take the platelets from the top shelf of the stock incubator*
- *The LIMS flagged that group O platelets were being selected for a group A patient but the BMS overrode the warning*
- *The BMS could not explain why they issued mismatched platelets but it was discovered that although the BMS had most competencies up to date they did not have competency for issue*
- *The patient did not suffer any untoward harm*

A patient whose blood group was B was transfused with group O FFP resulting from poor communication during handover

- *A patient received multiple transfusions of red cells, FFP and platelets for recurring gastrointestinal (GI) bleeding in the presence of liver disease*
- *The patient had been grouped as O due to the presence of donor red cells in the test samples (the patient's actual blood group was B)*
- *Several messages had been hand written on a single sticky note by a junior member of laboratory staff undergoing transfusion training*
- *During handover these messages were misinterpreted and in addition, no formal request form for FFP had been received from the clinical area*
- *Unused, pre-thawed group O FFP prepared for an earlier patient was issued knowingly against national guidelines (BSH O'Shaughnessy et al. 2004) as the BMS thought that concessionary release had been approved*
- *The LIMS allowed major ABO mismatches for plasma components although it did display a warning flag that was overridden*
- *The laboratory staff did not seek formal confirmation before handing the FFP to a porter*
- *The patient was transfused the incompatible FFP*
- *There was no reported clinical adverse outcome*

Staff under pressure to collect and administer platelets before surgery results in WCT

- *A woman in her 50s was admitted for planned dental surgery and required platelets*
- *Platelets were prescribed but the healthcare assistant thought she had been asked to collect red cells and was unaware there were other types of components*
- *The staff nurse administered the red cells following the correct identity checks but failed to notice it was the wrong component according to the prescription*
- *The patient was an unexpected admission to the ward and was due in theatre after the platelet transfusion; there was pressure and distraction from several calls from theatre asking if the patient was ready*

Laboratory staff removed blood from a satellite refrigerator and handed over incorrect blood components to clinical staff

- *A male patient in his 20s required red cell transfusion in theatre following major trauma*
- *Ten units were crossmatched and available in the remote issue theatre refrigerator*
- *Clinical staff were unable to gain access to the refrigerator; it was 'thinking' so they asked the attending laboratory staff for help*
- *The laboratory staff managed to open the refrigerator and removed two O D-negative units (that were designated for remote allocation) rather than the available crossmatched components*

A demographic data entry at sample receipt results in a patient receiving ABO-incompatible FFP

- *Five units of FFP were ordered by telephone for Patient 1*
- *During the laboratory IT process, the copy and paste function was used to populate the sample identification number field*
- *However, the sample ID number pasted into the sample ID field belonged to the previous patient (Patient 2)*
- *At collection, the porter noted the discrepancy between patient details of the person he was sent to collect for and those on the FFP that was given to him by the BMS*
- *The FFP was then re-labelled for Patient 2, but the BMS failed to note that the FFP was incompatible*
- *The nurse administering the FFP noted the group was different to the patient but believed that group O components were compatible for all patients*
- *This resulted in group O (Patient 2) FFP being administered to Patient 1 (group A)*

Failure at multiple points in the transfusion process both in clinical and laboratory steps leads to a patient receiving CMV-unscreened red cells

- *A request form was received in the transfusion laboratory for red cells, diagnosis stated as 'at risk of PPH' (postpartum haemorrhage) and was marked as 'urgent'*
- *There was no indication that the red cells were required for antenatal anaemia and the laboratory staff assumed the red cells were required during or at delivery*
- *A new request form was completed, but the transfusion laboratory was not contacted by telephone to inform them of the change*
- *The pneumatic tube system was not working so the original form was printed by the BMS and used to issue CMV-unscreened red cells*
- *At both collection and administration staff failed to notice the requirement for CMV-screened blood despite this being evident on the prescription*

Wrong blood transfused despite having a full electronic blood management system

- *Incorrect but compatible blood was transfused to a day-case patient in a hospital with a full electronic blood management system including both refrigerator collection and bedside safety checks*
- *The same nurses were caring for two patients*
- *The health care assistant was asked to collect blood for Patient 1 (B D-positive)*
- *She was given the compatibility tag from the first unit to collect the second unit for Patient 1 (incorrect practice)*
- *At the same time, she was given the compatibility tag from Patient 2 (O D-positive) to return to the laboratory for traceability purposes*
- *She used the blood audit and release system (BARS) to collect blood from the refrigerator but used Patient 2's details on the compatibility tag in error*
- *Back on the day-case unit, the BARS system was available but was not used*
- *The error was not detected at the bedside with manual checking so the O D-positive blood labelled for Patient 2 was transfused, fortunately without adverse event*
- *The error was detected when someone went to collect the next unit of blood for Patient 2, and it was found to be missing*

LIMS not correctly configured for sample validity

- *The transfusion laboratory identified that the incorrect sample validity had been set up in the LIMS*
- *This was correct at the time of configuration but had not been changed when new British Society for Haematology guidelines were issued in 2012 (BSH Milkins et al. 2013)*
- *In a look-back over 2 months it was identified that 30 units of red cells were transfused to 12 previously transfused individuals using 7-day rather than 3-day sample validity*

Specific requirements message does not transmit from the hospital information system (HIS) to LIMS

- *A patient for solid organ transplant required irradiated blood components*
- *Although there was no specific requirements form provided to the laboratory, the request for blood was made electronically and the requirement for irradiated blood components was indicated in that request*
- *Unfortunately, this message did not auto-populate the specific requirement field on the LIMS*
- *Investigation showed that a recent update to the specific requirement wording on HIS had not fully been tested to see if it still auto-populated*

Avoidable, Delayed or Under or Overtransfusion (ADU)



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Delayed Transfusion



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Death as a result of delayed transfusion for autoimmune haemolytic anaemia

- *A man in his 60s presented with Hb 38g/L secondary to autoimmune haemolytic anaemia (AIHA)*
- *The hospital laboratory referred the sample to an external reference laboratory (2 hours away) for further analysis due to the presence of a strong pan-reactive autoantibody*
- *The patient died before the results were issued and without receiving any red cells*
- *There had been an opportunity for a group and screen (G&S) sample to be sent a day earlier when the patient first presented*
- *It was noted that there was no haematology consultant on site overseeing the patient's care out-of-hours due to centralisation of specialist services*

Delayed transfusion contributes to death from haematemesis (1)

- *A non-English-speaking man in his 40s with a history of alcohol dependence, hepatitis C and substance misuse (on a methadone programme) attended the ED with haematemesis after a 999 call by his friends at 03:20*
- *The patient was not triaged appropriately (ambulance records of vomiting blood, pulse 130 beats per minute (bpm), blood pressure (BP) 94/60mm Hg) and his clinical state was not monitored adequately in accordance with hospital guidelines (no hourly observations and no early warning score monitoring)*
- *He should have been seen within 10 minutes but was seen after 1.5 hours*
- *At 04:28 the Hb was 56g/L*

(continued)

Delayed transfusion contributes to death from haematemesis (2)

- *The laboratory contacted the ED to report this result and later at 05:45 to offer emergency O D-negative blood*
- *This advice was declined and fully crossmatched red cells were requested at 05:09 with 'routine' priority*
- *The patient's clinical deterioration was not detected by nursing or clinical staff*
- *The major haemorrhage protocol (MHP) was not activated*
- *The patient died at 08:06 following cardiac arrest with further large haematemesis and melaena prior to receiving any blood components*

Delayed transfusion for severe anaemia related to gastrointestinal (GI) haemorrhage contributes to death

- *A man in his 70s presented with a 2-day history of bilateral leg pain and was found to have a Hb of 49g/L at 08:00*
- *He had multiple comorbidities including a history of angiodysplasia and ischaemic heart disease with multiple stents with atrial fibrillation for which he was on aspirin and rivaroxaban*
- *Blood was requested (although the first sample was rejected due to incorrect date of birth) and available for collection at 11:49*
- *The plan (at 13:54) was to transfuse to Hb >90g/L cautiously given a high risk of transfusion-associated circulatory overload (TACO)*
- *However, the patient was not transfused until the following day, when found unresponsive with an unrecordable BP, metabolic acidosis and Hb 34g/L*
- *He was transfused four units of red cells (post-transfusion Hb 73g/L) and three units of fresh frozen plasma (FFP) (international normalised ratio (INR) >2.5) and admitted to the ITU*
- *The patient died 24 hours after admission from cardiogenic shock related to profound anaemia in the context of cardiomyopathy*

Access to the laboratory refrigerator contributed to delay in provision of emergency blood

- *A man in his 60s, managed on ITU for ongoing variceal bleeding, deteriorated acutely with a further massive haemorrhage*
- *Two units were issued at 02:56, the first was collected at 03:31*
- *He became unstable with resistance to fluids and two units of red cells*
- *The MHP was activated at 03:38; units were available by 03:47 but it took 36 minutes for further red cell units to reach the ward*
- *The patient was profoundly hypotensive throughout this period and was not suitable for resuscitation by the time the blood components arrived*

Failure to follow MHP correctly contributes to delay and death

- *A man in his 80s was admitted to the ED with massive haemorrhage (no further details)*
- *The MHP was activated*
- *Emergency O D-negative units and pre-thawed FFP were available and issued for use by the laboratory in a timely manner*
- *The blood components were available to collect but the clinical staff were not aware of this and another doctor contacted the laboratory 20 minutes after the components had been issued*
- *The patient was then transferred to the radiology department but the components were delivered to the ED*
- *The patient died the same day*

Delayed transfusion in a patient with cardiac ischaemia contributes to major morbidity

- *A man in his 50s was admitted from the endoscopy unit with chest pain confirmed due to non-ST-elevation myocardial infarction (NSTEMI)*
- *The Hb was 43g/L at 10:45 (he had a previous history of GI bleeding)*
- *At 13:37 red cells were available for collection but were not transfused until 16:25*
- *The reason for the delay is unclear, although there was likely inadequate communication as a contributory factor*
- *The patient was admitted to ITU and made a full recovery*

Delayed transfusion in a patient with chest pain due to lack of knowledge about how to manage critical anaemia in the presence of pan-reactive antibodies

- *A woman in her 50s with chronic significant gynaecological haemorrhage was admitted from clinic with Hb 56g/L at 16:00*
- *She was clinically stable*
- *A G&S sample was not sent until 08:58 the following morning*
- *She was found to have a pan-reactive antibody which required further testing and the sample was sent to the local external reference laboratory*
- *At 14:00 the patient became acutely unwell with crushing central chest pain and a respiratory rate >40 breaths per minute (/min), thought to be secondary to cardiac ischaemia*
- *A repeat blood count showed Hb 46g/L*
- *Blood was not available until 17:00, 3 hours after the development of cardiac symptoms*

Wrong patient details supplied to laboratory in a major obstetric haemorrhage

- *A woman in her 20s had a postpartum haemorrhage leading to MHP activation*
- *The midwife gave the wrong patient details to the laboratory staff which was not recognised until the red cells (incompatible ABO group) arrived in the maternity unit*
- *They were returned and correct details applied but this resulted in a 25-minute delay to provision for the group O patient*

Lack of knowledge about emergency blood provision in patients with alloantibodies leads to delayed transfusion

- *A man in his 50s with variceal haemorrhage related to alcoholic liver disease was admitted to the ED*
- *A MHP call was instigated at 01:40*
- *The patient had alloantibodies, anti-K and anti-C^w*
- *The biomedical scientist (BMS) was reluctant to issue the shock pack (four units of red cells and four of FFP) and informed the ED not to use the emergency O D-negative blood in the local refrigerator*
- *A consultant haematologist was contacted 25 minutes after the MHP call and authorised the transfusion*
- *Blood was collected at 02:16*
- *The patient was admitted to ITU and eventually made a full recovery*

Change in status of the patient and poor communication compound the delay (1)

- *A young man was admitted with trauma from a road traffic accident with closing speed of 70 miles per hour*
- *He was initially stable; four units of blood were requested urgently to be available at 18:55*
- *The BMS acknowledged that these would be available in 10 minutes*
- *However, the blood sample was not taken until 19:00, was booked into the laboratory at 19:20 but had to be reprocessed at 19:47 as the antibody screen had not been done*
- *During computerised tomography (CT) scanning the patient started to deteriorate with an increase in pulse rate to 135 beats/min such that the internal bleeding was now thought to be greater than it seemed at first*

(continued)

Change in status of the patient and poor communication compound the delay (2)

- *A porter was sent to collect the blood and a telephone request was made for platelets and plasma as indicated by thromboelastogram (TEG) testing*
- *Although there was an agreed TEG protocol in place for a 1:1 red cells to plasma ratio the BMS noted that this request would require authorisation by the haematology registrar (as this had not triggered the MHP)*
- *The BMS did not inform the ED staff that there had been a problem with the antibody screen*
- *The MHP was called at 20:37 when blood and plasma were issued and collected*
- *Plasma was infused at 21:15 and platelets at 22:15*
- *The ED staff could have used the emergency O D-negative units*

Telephone check prior to high risk surgery detects failure of process

- *A woman was scheduled for elective caesarean section for placenta praevia; blood samples were sent for group and crossmatch four units of red cells 2 days prior to the procedure*
- *At the time of surgery, after the spinal anaesthetic had been placed, a telephone call to the laboratory established that no units were available due to a laboratory error in processing the request*
- *The request form had been put in the wrong location for crossmatch requests at the time of a shift changeover*
- *The four units were made available within 40 minutes*
- *The start of surgery was delayed but the red cells were not used*

Refrigerator incorrectly stocked for remote electronic issue (EI)

- *Two high-risk cases, both blood group A, were anticipated to require significant amounts of blood during surgery*
- *The group A drawer of a remote electronic issue refrigerator was full so additional units were put in the 'crossmatched blood' drawer*
- *As expected the group A blood was rapidly depleted and the clinicians were warned by the EBMS that the supplies were low*
- *However, the BMS viewing the stocks remotely could see that there were plenty of group A units remaining*
- *These were not available for remote electronic issue and had to be issued from the laboratory*

Avoidable Transfusion



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WBIT with failure to verify unexpected results

- *A nursing home resident in her 70s was reviewed in the community*
- *A blood sample taken by the general practitioner (GP) showed a platelet count of $6 \times 10^9/\text{L}$ with a white cell count of $1.98 \times 10^9/\text{L}$*
- *She was admitted to hospital later that day for a platelet transfusion*
- *Blood sampling was repeated on arrival to hospital prior to transfusion; the platelet count was $186 \times 10^9/\text{L}$ and white blood count was $11.7 \times 10^9/\text{L}$*
- *These results were not reviewed by the admitting doctor and a unit of platelets was prescribed and administered*
- *The error was detected by laboratory staff*

Poor management leads to excessive transfusion

- *An elderly man required a revision hip replacement (40-year-old prosthesis)*
- *At preoperative assessment a week before surgery his Hb was 127g/L*
- *He bled during the technically difficult and long procedure (about 5 hours) and received six units of red cells before the Hb was checked and found to be 170g/L*

Inappropriate transfusion in a patient with iron deficiency and failure to check response to transfusion

- *A woman in her 50s with iron deficiency anaemia and Hb of 57g/L presented with fatigue as her only symptom*
- *She weighed 54kg and was prescribed a five-unit red cell transfusion by a junior doctor*
- *All five units were transfused with a repeat full blood count (FBC) only checked after the fifth unit had been given*
- *The post-transfusion Hb was 131g/L*

Perioperative transfusion of red cells due to failure to manage iron deficiency anaemia preoperatively

- *A man in his 70s was found to be iron deficient 6 months prior to an elective abdominal aortic aneurysm repair (AAA)*
- *The iron deficiency was not managed adequately*
- *Preoperatively, the Hb was 106g/L but it was felt that surgery could not be deferred*
- *The Hb fell to 83g/L following the procedure and four units of red cells were transfused*

Delayed provision of red cells for postpartum haemorrhage caused by miscommunication by the clinical team and failure to check sample validity in the laboratory

- *A young woman had an estimated 3.6L blood loss from a vascular tear following vacuum-assisted vaginal delivery at 07:45*
- *A valid sample was available for EI from the previous day*
- *Two litres of fluid were infused and another transfusion sample was sent to the laboratory at 08:00 with a request for two units of red cells to be crossmatched*
- *The urgency of the request was not conveyed to the laboratory*
- *The laboratory staff then failed to check for sample availability and therefore unnecessarily processed the new sample*
- *This caused additional delay, preventing EI from the existing sample*
- *Crossmatched blood was issued at 09:22 after one unit of emergency O D-negative blood had been transfused at 08:30*

Unexpected severely abnormal results should be checked prior to release by the laboratory

- *A man with alcoholic liver disease undergoing surgery was reported to have INR >11 with an abnormal fibrinogen result and was transfused FFP and cryoprecipitate on the basis of this result which should have been repeated by the laboratory*

Avoidable transfusion of FFP associated with poor communication and the distance of surgical treatment centre from transfusion laboratory (1)

- *A patient at a local treatment centre (TC) (12 miles away) was bleeding following emergency evacuation of a haematoma two weeks following a hip replacement*
- *This emergency surgery took place at a weekend*
- *The patient required four units of group O D-negative red cells*
- *There was no group and screen sample at the main hospital as the procedure was considered low risk for bleeding (the TC keeps O D-negative red cells as stock)*
- *At 12:00 a request for FFP was referred to the on-call consultant haematologist who advised that due to the clinical situation and distance two units of plasma should be thawed and sent*

(continued)

Avoidable transfusion of FFP associated with poor communication and the distance of surgical treatment centre from transfusion laboratory (2)

- *He also requested that FBC and clotting samples were taken as soon as possible, but there was a significant delay in taking these samples*
- *At 14:00 the consultant haematologist was contacted by the anaesthetist to inform him that the patient was in recovery, and was now 'haemodynamically stable' although hypotensive with a tachycardia*
- *Four units of red cells had been transfused*
- *The haematologist advised that given this information and in the absence of the clotting results that the previously authorised FFP be transfused*
- *At 15:30 the clotting results (all parameters within normal limits) were telephoned to the haematologist but not conveyed to the TC*
- *Although no further red cells were transfused two units of FFP were transfused, at 17:30 and 18:00, despite the patient being stable and 2 hours after clotting results were available showing normal parameters*

Excessive platelets requested to cover a procedure that was subsequently cancelled

- *A patient with myelofibrosis and a chronically low platelet count was due to undergo a liver biopsy*
- *The platelet count was stable at around $40 \times 10^9/L$*
- *Six units of platelets were requested to cover the procedure by a consultant haematologist*
- *Two units were transfused prior to the procedure, which was subsequently cancelled, following concerns raised by a junior doctor and interventional radiologist who had not been consulted in advance and considered the procedure too risky*
- *The laboratory staff had also raised concerns regarding this request*
- *There was a comment made in relation to this event, that due to the culture at the hospital, laboratory staff did not feel empowered to act further*

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Under or Overtransfusion



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Undertransfusion in a patient with GI bleeding probably contributes to death

- *A man in his 50s presented with postural hypotension*
- *It was not initially recognised to be secondary to GI bleeding as initially he was physiologically well-compensated*
- *On decompensation it came apparent that he had had a significant GI bleed*
- *Two units of red cells were transfused but the patient died and was probably under filled*

Failure to check response to transfusion led to overtransfusion and possibly contributed to a poor outcome

- *A man in his 70s had a cardiac arrest, while in a CT scanner, following an endovascular aneurysm repair (EVAR)*
- *The arrest was thought to be secondary to major haemorrhage and the MHP was initiated*
- *Four units of red cells and two units of FFP were transfused*
- *The pre-transfusion Hb was 154g/L*
- *No repeat FBC was taken before transfusing a further four units of red cells*
- *The post-transfusion Hb was 269g/L*
- *The patient required venesection but subsequently died*

Inadequate clinical monitoring leads to overtransfusion and contributes to intensive care admission

- *A woman in her 70s was admitted with a chest infection and Hb 66g/L due to suspected myelodysplastic syndrome (MDS)*
- *She also had a history of chronic obstructive pulmonary disease and ischaemic heart disease*
- *A chest X-ray (CXR) on admission suggested a left lower respiratory infection*
- *Four units of red cells were given over a 9-hour period; unit one was given over 60 minutes, units two and three over 90 minutes and unit four over 120 minutes*
- *There was no recorded clinical review or repeat Hb between the units*
- *The patient deteriorated and required admission to intensive care for ventilator support*
- *Case review by respiratory and ITU consultants with the post-transfusion CXR concluded this was primarily left lobar pneumonia and not TACO*

Inadequate monitoring and overtransfusion for iron deficiency in a patient with low body weight

- *A woman in her 40s was admitted with severe iron deficiency and Hb 28g/L*
- *She weighed 33.4kg and was haemodynamically stable*
- *Over the course of 3 days she received nine units of blood*
- *A FBC was not repeated until all units had been given at which point the Hb was 171g/L*

Miscommunication and failure to challenge an unusual order leads to massive overtransfusion of cryoprecipitate

- *A man in his 70s was admitted with a stroke requiring thrombolysis*
- *He later deteriorated with suspected (intracranial?) haemorrhage*
- *The on-call haematology registrar advised cryoprecipitate if the fibrinogen level was less than 1.5g/L*
- *Ten units of cryoprecipitate were requested and transfused*

Incidents Related to Prothrombin Complex Concentrate (PCC)



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PCC algorithms should state maximum dosage

- *A woman in her 40s, weight 138kg, with a retroperitoneal haematoma was prescribed (by a foundation year 2 doctor) and given a PCC dose in the ED based on her weight (4140 units) which exceeded the maximum recommended dose of 3000 units for that particular PCC*
- *This resulted in revision of the PCC algorithm to add the maximum dose and a notice was added to the refrigerator in transfusion to ensure more than the maximum dose could not be issued*

Guidelines are not rules

- *A woman in her 70s who was very unwell with INR 1.3 required an urgent laparotomy for bowel resection*
- *She was on warfarin for atrial fibrillation and had a previous pulmonary embolism*
- *She had initial surgery some days earlier and had been restarted on warfarin*
- *The consultant anaesthetist refused to take her to theatre without PCC; 500 units were authorised by a consultant haematologist*
- *This was against hospital and anaesthetic policy for the management of INR results, but the anaesthetist had good reasons for giving the PCC on this occasion*

FFP should not be used to reverse warfarin

- *A woman in her 70s who was on warfarin for atrial fibrillation (INR 3.7) developed a rectus sheath haematoma*
- *FFP (two units) was given for warfarin reversal instead of PCC*
- *These were prescribed by a surgical registrar*
- *The patient had a mild allergic reaction*
- *As a result of this case, the PCC pathway was made more accessible to clinical staff*

Read the results carefully

- *A man in his 80s on warfarin for bilateral pulmonary emboli, was admitted with abdominal pain and distension*
- *He was treated with PCC (3000 units) based on an erroneous blood result reported from a point-of-care test where the doctor misread the result (reporting that the Hb had fallen from 145g/L to 45, but this was the %; actual Hb was 90-102g/L)*
- *The patient had already received vitamin K*

Consider the timing carefully

- *A man in his 60s on warfarin received PCC in advance of a renal transplant, but the interval between admission and transplant was sufficient that the INR was corrected to 1.2 by vitamin K and stopping the warfarin so the PCC was unnecessary*

Near Miss (NM)



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Routine non-application of an identification band contributes to a WBIT incident

- *Patient 1 was due to attend for an outpatient assessment, but nursing staff had used Patient 2's details to admit Patient 1 to the hospital system, because Patient 2 had the same last name, forename and year of birth, although a different day and month of birth*
- *There was then failure to check that the patient identity and records matched on admission, because day case attenders are not issued with an identification band*
- *The blood request form was generated with Patient 2 details and the doctor took a group and save sample from the intended Patient 1 having verbally confirmed the name only, without checking the date of birth*
- *Ward staff realised the identification error when other pathology results were not available for the expected patient*
- *A contributory factor was that the ward clerk was on long-term sick leave and had not been replaced, so there was no one to check if correct documentation had been supplied for the patient*
- *An additional factor was the lack of procedure to check if new doctors have completed a phlebotomy assessment on appointment*

WBIT incident after failure to put correct equipment in place

- *A sample and form were both correctly labelled with Patient 2 demographics, but the sample-taker later realised the sample was actually taken from Patient 1*
- *A doctor, who was already under extreme pressure due to workload, was called to an outpatient area to take a transfusion sample and a nurse provided verbal details of Patient 1 identity*
- *The doctor could not print the request form due to the lack of an enabled printer and there were no paper forms available*
- *Therefore, the doctor took the unlabelled sample back to the ward and mistakenly printed a form for Patient 2, then used Patient 2 demographics to label the sample*
- *This task is undertaken infrequently in the outpatient department and the process for obtaining transfusion samples is different from other pathology samples because transfusion is not part of the electronic requesting system*
- *The department manager was aware of a previous incident caused by having no printer for transfusion requests, but the correct equipment had not been installed due to lack of space*
- *An interim supply of paper request forms has been provided*

Group-check policy detects WBIT incident

- *A patient was bled twice prior to surgery*
- *One sample was taken by a phlebotomist in the early morning and the other sample was taken by a member of the ward staff approximately 2 hours later*
- *One of the samples grouped as A D-negative and the other was group A D-positive*
- *The group of a further sample showed the original sample taken by the phlebotomist contained the wrong patient's blood*

WBIT incident uncovers department-wide circumvention of group-check policy

- *Two WBIT samples were detected from the same department*
- *The investigation identified that a member of staff took two samples at the same time for two different patients*
- *The second samples from each patient were given to another member of staff to label and these were mislabelled*
- *These two patients required two samples under the group-check policy for patients who do not have a historical blood group on the system*
- *On further investigation it was established that this practice was common within a selected group of staff from this department*
- *The staff were taking two samples at the same time and asking another member of staff to complete the details on the second sample*
- *Although the staff had been trained they felt that this process was kinder to the patient as they did not have to be bled twice and did not need to stay for the second sample to be taken*
- *All staff involved were prevented from taking samples until retrained with further emphasis on the reason for the group-check rule included in the training*

Results from neonatal samples may not provide a valid historical group

- *A sample received from the antenatal clinic correctly grouped as AB D-negative, but the historical group was recorded as B D-negative*
- *However, this historical sample was taken many years ago, when the patient would have been a neonate*
- *It was not possible to determine whether the historically incorrect group was due to a clinical sampling error or a laboratory processing error*
- *The criteria for acceptance of a historical group as the first sample are being reviewed*

Anti-D Immunoglobulin (Ig)



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RAADP not given: erroneous cffDNA testing result

- *The cffDNA testing predicted a fetus to be D-negative but at delivery the cord sample was shown to be D-positive*
- *RAADP had not been administered during the pregnancy because of the cffDNA result*
- *Further testing revealed that the likely cause of the discrepancy was very low levels of fetal DNA in the maternal plasma, below the limit of detection*

Decanting of anti-D Ig to give a smaller dose than the one in the vial

- *A woman was due 250IU anti-D Ig, however no 250IU or 500IU vials were available in the laboratory, therefore 1500IU was issued*
- *Clinical staff decanted the pre-filled syringe into a graduated syringe, and gave a third of the amount*
- *This is against the manufacturer's recommendations*

Decanting of half a vial of anti-D Ig to achieve the recommended dose

- *250IU anti-D Ig was prescribed following an ectopic pregnancy at less than 20/40 for a D-negative woman*
- *The 250IU dose is no longer supplied by the manufacturer therefore the smallest dose available in the organisation was 500IU*
- *The doctor overseeing the care of the woman noted that 250IU was the correct dose according to the departmental guidelines and the nurse was instructed to draw up half of a 500IU vial issued by the laboratory and administer it to the woman*
- *The nurse did this despite objecting and informing the doctor of the smallest dose of anti-D Ig available*

Anti-D Ig issued from pharmacy for a woman with immune anti-D

- *RAADP was administered to a woman at 28/40*
- *However, she was already alloimmunised with an anti-D level of 4.9IU/mL*
- *In this organisation anti-D Ig is currently issued by pharmacy not the blood transfusion laboratory but plans are in place for the blood transfusion laboratory to take over the issue and distribution of anti-D Ig prophylaxis in the near future*

Historical records not available results in inappropriate administration of anti-D Ig

- *Anti-D Ig was administered to a patient at 28/40 without checking the historical record of her blood group as her notes were not available at the time*
- *The midwife did not look for the notes, or access them via the electronic report browser*
- *The woman had been provided with an appointment in the 28-week RAADP clinic for blood sampling to determine her known immune anti-D level at 28/40*
- *The woman confirmed that her blood group was D-negative verbally with the midwife and anti-D Ig was given*
- *When the midwife was placing the administration record in the woman's notes once they became available, they realised that the patient had immune anti-D (reported levels between 0.1IU/mL and 0.8IU/mL) and anti-D Ig was not indicated*

Biomedical scientist (BMS) did not understand notes on the laboratory information management system (LIMS) related to the antibody result

- *An inexperienced BMS did not understand the significance of the notes against the woman's records on the LIMS*
- *The woman had a complex antenatal history with anti-G being detected as well as anti-D*
- *As a result, anti-D Ig was issued without the BMS seeking advice from a senior member of staff*

RAADP given at 29/40 because the midwife failed to check results of cffDNA

- *A D-negative woman with a predicted D-negative fetus based on cffDNA results was administered 1500IU RAADP anti-D Ig at 29/40 weeks gestation because the midwife failed to check the results of the cffDNA testing*

Consultant administered anti-D Ig to a D-negative woman despite cffDNA results predicting fetus to be D-negative

- *Following external cephalic version (ECV) the midwife noted that the woman was D-negative and the fetus was predicted to be D-negative*
- *The midwife informed the consultant obstetrician that there had been a previous case on the postnatal ward where the cffDNA results predicted a D-negative fetus but once born the baby typed as D-positive*
- *Following this information, the consultant telephoned the haematology consultant and discussed the case and was advised 'to do what you think is clinically appropriate'*
- *The consultant decided to give the anti-D Ig*

Request, issue and administration of anti-D Ig unnecessarily

- *A woman was undergoing an appendectomy at 22/40*
- *The clinical staff on the ward requested a Kleihauer test and the laboratory issued the anti-D Ig as the BMS incorrectly thought that an appendectomy was a PSE*
- *The anti-D Ig was administered to the woman without there being a clinical need for it*

A string of errors lead to a D-positive (variant) woman getting anti-D Ig

- *A pregnant woman with an anomalous D group was assigned a D-negative blood group pending reference testing*
- *The reference report confirmed a D-variant and recommended that she should be managed as D-positive*
- *This report was uploaded to her hospital LIMS record, which was in her maiden name*
- *Subsequent tests were performed under her married name and the records were not merged or linked*
- *A midwife used the report of the initial D-negative blood group in the maternity record and allocated the woman to an anti-D Ig prophylaxis regime as well as issuing the patient a D-negative card*
- *Anti-D Ig was given without accessing the updated original record or the correct record in her married name*

Delayed administration of anti-D Ig to a woman with an anomalous D group

- *A woman had a surgical termination of pregnancy and the D group was anomalous and referred for further testing*
- *Although she was assigned a D-negative blood group, the laboratory staff were unable to issue anti-D Ig through the LIMS because the initial reference laboratory report stated that she was D-variant and should be treated as D-positive*
- *Subsequently, after genotyping, she was found to have a D-variant associated with some D-sensitisations so the advice was to treat as D-negative for the purposes of anti-D Ig prophylaxis*
- *Anti-D Ig was given but she had to return to hospital following discharge and administration was outside the 72-hour window*

Midwife fails to check blood group result of a woman who informs her she is 'Rhesus Positive'

- *A woman was admitted to hospital at 19/40 following a potentially sensitising event (PSE)*
- *She informed the midwife that she was 'Rhesus Positive' but the midwife failed to check the blood grouping results and did not request any anti-D Ig*
- *The woman then later received an appointment to attend clinic for routine antenatal anti-D prophylaxis (RAADP) at 28/40 and was told that her blood group was AB D-negative, she should therefore have been given anti-D Ig following the PSE at 19/40*

Failure to identify the need for anti-D Ig prophylaxis on multiple occasions throughout pregnancy

- *A woman was admitted to hospital in labour at 40⁺⁷/40*
- *The midwife checked her notes and noticed that the woman was D-negative but had not received any RAADP at all throughout her pregnancy*
- *On review it was noted that the woman had been seen on 7 different occasions by 5 hospital-based midwives and once by a community midwife but none of them had realised that she required anti-D Ig and she had therefore not been offered RAADP*

Failure to give anti-D Ig following the transfusion of a unit of D-positive platelets to a D-negative woman

- *During the activation of a massive haemorrhage protocol (MHP) for a postpartum haemorrhage a patient with D-negative blood group was issued and transfused with D-positive platelets*
- *Anti-D Ig was issued by the hospital transfusion laboratory for the patient, however the requirement for the administration of anti-D Ig was not communicated to the clinical area*
- *Additionally, there was no documentation in the laboratory communication book to alert the laboratory staff that this required following up*

Late administration of anti-D Ig following a PSE

- *A woman had a scan at 15/40 following a PSE*
- *She did not know that she was D-negative and should have attended earlier for anti-D Ig*
- *In this organisation the community midwives check booking blood results but do not discuss them with the women until their 16/40 appointment*
- *As a result of the woman not knowing her booking blood results anti-D Ig was not given until 10 days following the PSE*

Late administration of anti-D Ig due to misinterpretation of results

- *A midwife misread results on the electronic patient record*
- *They looked at the results for Kleihauer test and the direct antiglobulin test (DAT) which were both recorded as 'negative'*
- *The midwife misinterpreted this result as they thought this meant that the blood group of the baby was D-negative and therefore anti-D Ig was not needed*
- *The error was noticed and anti-D Ig was administered 10 days post delivery*

Delay in administration of anti-D Ig over a holiday weekend

- *A transfusion sample was received for a D-negative woman following a PSE which occurred over a holiday weekend*
- *An appointment for the woman to attend the early pregnancy assessment unit was made for 3 days later as it was not open during the holiday period*
- *The woman attended this appointment and a sample was taken for Kleihauer testing*
- *Anti-D Ig was administered the following day, more than 72 hours after the PSE, and she was discharged back to the care of the midwifery team*
- *The blood group and Kleihauer samples were not taken at the time the PSE originally occurred thus creating a longer than acceptable timescale between PSE and anti-D Ig administration*

Anti-D Ig administration overlooked at delivery due to major obstetric haemorrhage (MOH)

- *A D-negative woman delivered a D-positive baby by caesarean section (c/s) at 27/40*
- *The woman had had a cell free fetal deoxyribonucleic acid (cffDNA) test performed and the results predicted the baby to be D-positive*
- *No prophylactic anti-D Ig was administered post delivery and no samples were sent to the hospital transfusion laboratory for fetomaternal haemorrhage (FMH) testing post delivery*
- *The baby was subsequently tested and confirmed to be D-positive*
- *The transfusion laboratory was made aware when a midwife telephoned as she could not find any evidence of prophylaxis having been given*
- *Anti-D Ig prophylaxis was overlooked at time of delivery due to urgency of clinical situation; the woman had placenta accreta, and was having an emergency c/s at 27/40 that led to a MOH*

Anti-D Ig administered intramuscularly (IM) to a patient with severe thrombocytopenia

- *Anti-D Ig was administered IM to a patient with idiopathic thrombocytopenic purpura (ITP) in antenatal clinic despite this route of administration being contraindicated*

Administration of anti-D Ig prior to checking blood group

- *A woman underwent an external cephalic version (ECV) procedure to turn a breech baby*
- *The midwife asked the consultant what the woman's blood group was and was told 'RhD-negative' so the midwife gave an anti-D Ig injection*
- *The blood group of the woman was not checked using her clinical record*
- *Anti-D Ig is not issued by the blood transfusion laboratory in this organisation so there was no check performed when it was issued*
- *The woman was subsequently found to be D-positive*

Anti-D Ig administered following a wrong blood in tube (WBIT) sample

- *A woman's booking sample group was reported as O D-negative*
- *An appointment was made for anti-D Ig clinic at 28/40 and anti-D Ig was administered*
- *Her 28/40 group and screen sample result was O D-positive*
- *A repeat sample was checked which confirmed that the woman's booking sample was a WBIT that had resulted in her inappropriately receiving anti-D Ig*

Failure to check historical records results in anti-D Ig being administered to a woman with known immune anti-D

- *An incorrect decision was taken by a consultant obstetrician to administer RAADP to a D-positive woman*
- *In a busy clinic she did not see the woman but was giving advice to several trainees about other women and was also herself seeing other women*
- *She reported that her error was due to the number of patients and skill mix of staff at the clinic*
- *If she had looked closer she would not have prescribed anti-D Ig but did not have the time to check*
- *The patient was known to have immune anti-D from records dated February 2008 (2nd pregnancy)*
- *The woman has had 2 miscarriages since and this is now her 5th pregnancy*
- *The woman underwent a caesarean section at 34/40 due to poor fetal growth and increased fluid levels*
- *No anti-D Ig was given post delivery*

Immune Anti-D in Pregnancy



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Ideal care and delivered at term

- *Primipara (primip) in her 30s*
- *Booking weight 59kg*
- *Received RAADP (single dose of 1500IU anti-D Ig at 28 weeks)*
- *There were no PSE*
- *Alloimmune anti-D detected at term delivery (2.7IU/mL)*
- *The baby required no interventions for haemolytic disease of the fetus and newborn (HDFN)*

Gestation >40 weeks

- *Primip in her 30s*
- *Booking weight 61kg, body mass index (BMI) 24*
- *Received RAADP (single dose of 1500IU anti-D Ig at 28 weeks)*
- *Delivered at 42 weeks*
- *Alloimmune anti-D detected at delivery (2.4IU/mL)*
- *There were no PSE*
- *The baby required no interventions for HDFN*

Gestation >40 weeks

- *Primip in her 20s*
- *Booking weight 64kg, BMI 22*
- *Received RAADP (single dose of 1500IU anti-D Ig at 28 weeks)*
- *There were no PSE*
- *Delivered at 42 weeks*
- *Alloimmune anti-D detected at delivery (7.4IU/mL)*
- *The baby required no interventions for HDFN*

Ideal care in previous pregnancy, alloimmune anti-D present at booking (11 weeks) in index pregnancy

- *Multiparous (multip) in her 40s*
- *Booking weight in previous pregnancy 50kg*
- *RAADP (1500IU anti-D Ig) given into deltoid at 28 weeks*
- *No PSE*
- *Delivered vaginally at 40 weeks with no complications*
- *Postpartum prophylaxis (500IU anti-D Ig) given*
- *Found to have all immune anti-D at 11-week booking appointment in index (next) pregnancy*
- *Fetus required intrauterine transfusion and exchange transfusion was given after birth at 36 weeks gestation*

Ideal care with no complications

- *Multip in her 20s*
- *Booking weight 72kg, BMI 26.1*
- *Four previous pregnancies*
- *In index pregnancy, no alloantibodies detected in booking or 28-week samples*
- *Received RAADP (single dose of 1500IU anti-D Ig at 28 weeks IM into deltoid)*
- *No PSE*
- *Delivered healthy baby at 39 weeks and found to have alloimmune anti-D*
- *The baby required no interventions for HDFN*

Stillbirth at 34 weeks gestation given correct dose of anti-D Ig

- *Multip in her 40s*
- *Booking weight 67kg, BMI 27*
- *Seven previous pregnancies*
- *In the pregnancy immediately prior to index pregnancy she received RAADP (single dose of 1500IU anti-D Ig at 28 weeks)*
- *No PSE until stillbirth at 34 weeks gestation, cause unknown – not HDFN*
- *Kleihauer negative*
- *Given single dose of 1500IU anti-D Ig*
- *Antibody screen at booking of index pregnancy negative, alloimmune anti-D detected at 28 weeks*
- *There were no PSE*
- *The baby required no interventions for HDFN*

Large FMH

- *Multip in her 20s*
- *Previous pregnancy ended as intrauterine death at 40⁺⁶ weeks following placental abruption*
- *Kleihauer showed large FMH and the Blood Centre confirmed bleed of 165mL*
- *The Blood Service recommended the woman should receive anti-D Ig 15000IU intravenous (IV) and 2000IU IM*
- *She was given 20,000IU IV in total*
- *Follow up Kleihauer at 72 hours showed full clearance of fetal cells*
- *Alloimmune anti-D was detected at 9 weeks in the booking sample of the index pregnancy, which was terminated as woman required chemotherapy*

Obese

- *Multip in her 20s*
- *Booking weight in previous pregnancy 100kg*
- *Received RAADP (single dose of 1500IU anti-D Ig IM at 28 weeks)*
- *No known PSE*
- *Delivered spontaneously at 42 weeks*
- *Kleihauer negative*
- *500IU anti-D Ig as postpartum prophylaxis (PPP)*
- *Booking weight of index pregnancy 98kg*
- *APH at 17 weeks for which she received 1500IU anti-D Ig IM*
- *Alloimmune anti-D detected at 27 weeks gestation*
- *The baby required no interventions for HDFN*

Variant D typed as D-positive in previous pregnancies

- *Multip in her 20s*
- *In her first pregnancy she was typed as D-positive (strong reaction) so received no anti-D Ig as RAADP or PPP*
- *She received transfusion with D-positive blood for PPH*
- *In her next pregnancy at booking she was again typed as D-positive with no antibodies so received no anti-D Ig as RAADP or PPP*
- *In her index pregnancy alloimmune anti-D was detected at 6 weeks in the booking sample and she was subsequently investigated by the International Blood Group Reference Laboratory which showed her to have a D-variant (weak D type 1 and 2 alleles were not detected by deoxyribonucleic acid (DNA) amplification)*

Early miscarriage of a non-viable pregnancy with repeated bleeding (1)

- *Multip in her 30s*
- *First pregnancy, D-negative baby*
- *Second pregnancy resulted in an early miscarriage of a non-viable pregnancy*
- *She then bled for 5 weeks but received no anti-D Ig*
- *Review of BSH guidance (BSH Qureshi et al. 2014) shows that there is potential for confusion in such cases as the key recommendations section states:*

‘In pregnancies <12 weeks gestation, anti-D Ig prophylaxis is only indicated following ectopic pregnancy, molar pregnancy, therapeutic termination of pregnancy and in cases of uterine bleeding where this is repeated, heavy or associated with abdominal pain. The minimum dose should be 250IU. A test for fetomaternal haemorrhage (FMH) is not required’

Early miscarriage of a non-viable pregnancy with repeated bleeding (2)

- *This would suggest that as the bleeding was repeated in this case anti-D Ig may have been indicated, although the pregnancy was very early and non-viable.*
- *By contrast, in the same guideline, the relevant section of PSE <12 weeks gestation states:*

‘In cases of spontaneous complete miscarriage confirmed by scan where the uterus is not instrumented, or where mild painless vaginal (PV) bleeding occurs before 12 weeks, prophylactic anti-D immunoglobulin is not necessary because the risk of FMH and hence maternal exposure to the D antigen is negligible’

APH at 6 weeks, developed alloimmune anti-D in third trimesters

- *Multip in her 30s, obese*
- *APH at 6 weeks in index pregnancy*
- *No anti-D Ig indicated or given*
- *Received RAADP at 29 weeks*
- *Alloimmune anti-D found at 34 weeks gestation*
- *The baby required no interventions for HDFN*

External cephalic version (ECV)

- *Multip in her 30s, obese 119kg, BMI 39.9*
- *RAADP 500IU anti-D Ig x 2 (at 29 and 36 weeks gestation)*
- *ECV at 38 weeks gestation*
- *Given 500IU anti-D Ig IM but no test for FMH performed*
- *Baby delivered by elective CS at 40 weeks, Kleihauer negative, 500IU anti-D Ig given*
- *Alloimmune anti-D found at booking in her subsequent pregnancy*
- *The baby required intrauterine transfusion and exchange transfusion after delivery at 36 weeks gestation*

Alloimmunisation after correctly managed FMH

- *Multip in her 20s*
- *Obese 96kg*
- *Received RAADP (1500IU anti-D Ig at 30 weeks IM)*
- *Delivered by emergency CS in index pregnancy and had 4mL FMH and received postpartum prophylaxis (1500IU anti-D Ig IM)*
- *FMH volume was checked by flow cytometry and clearance of fetal cells was checked at 72 hours and was complete (as per guidelines)*
- *Follow up at 6 months showed woman had developed alloimmune anti-C, anti-D and anti-G*

Placenta accreta

- *Multip in her 30s*
- *Previous pregnancy managed correctly with no PSE, and anti-D Ig given as RAADP and PPP following emergency CS at 36 weeks*
- *In index pregnancy anti-D was detected at 28 weeks but mistakenly assumed to be due to anti-D Ig given for RAADP (in fact the blood sample had been taken before anti-D Ig was given)*
- *Placenta accreta was diagnosed at 36 weeks and the woman was found to have a significant titre of anti-D (21.7IU/mL)*
- *The baby required phototherapy*

Multiple risk factors: twin pregnancy, APH, obesity

- *Multip in her 30s*
- *Weight 95kg, BMI 34*
- *Index pregnancy complicated by twins, APH at 21 and 22 weeks for which she received anti-D Ig 500IU*
- *RAADP given IM at 29 weeks (1500IU anti-D Ig)*
- *Alloimmune anti-D was first detected at 36⁺⁵ when the babies were delivered*
- *The babies required phototherapy*

Failed prophylaxis after TOP 10 years ago

- *Multip in her 20s*
- *Weight 74.2kg, BMI 25.4*
- *Surgical TOP 10 years previously, given anti-D Ig 250IU*
- *Index pregnancy managed correctly with no PSE, and anti-D Ig given as RAADP (1500IU at 28⁺⁶ into deltoid muscle)*
- *No alloantibodies detected in booking or 28-week samples*
- *Alloimmune anti-D was detected at delivery at 40⁺⁴*
- *The baby required no interventions for HDFN*

Febrile, Allergic and Hypotensive Reactions (FAHR)



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A febrile reaction appropriately treated with paracetamol

- *A patient in their 80s received a red blood cell transfusion to treat ongoing non-severe bleeding associated with a haemoglobin (Hb) of about 80g/L*
- *After 100mL had been transfused (30–60 minutes) the patient experienced rigors, an increase in respiratory rate and the temperature was noted to have risen from a baseline of 36.6°C to 38.3°C*
- *There were no other symptoms or signs*
- *The transfusion was initially slowed and then discontinued*
- *Paracetamol was prescribed and the patient's observations returned to baseline*
- *Bacterial cultures from the patient at the time of the reaction were negative*
- *No change in management was planned for any subsequent blood transfusion*

A febrile reaction to red cells. To receive iron as future management of iron deficiency anaemia

- *A patient with menorrhagia and Hb of 50g/L was transfused with red cells. After the first unit her post-transfusion observations identified a pyrexia of 39.6°C (an increase of more than 2°C from baseline) and tachycardia of 120 beats/minute*
- *She was given treatment which included paracetamol and made a complete recovery with observations returning to baseline over 1-4 hours*
- *Repeat serology was negative and future management was planned with intravenous iron and avoidance of blood transfusion*

Allergic reaction to apheresis platelets with planned transfusion of pooled platelets suspended in PAS for future management

- *A child with reversible bone marrow failure and thrombocytopenia received apheresis platelets prior to an operation*
- *Within 10 minutes of the start of the transfusion, periorbital oedema, wheezing and a fall in oxygen saturations to 92% on air occurred*
- *Oxygen therapy, hydrocortisone, chlorphenamine and salbutamol nebuliser were given with complete recovery within 1-4 hours*
- *Investigation did not identify IgA deficiency and mast cell tryptase remained within the normal range*
- *The patient had experienced previous mild reactions to apheresis platelets and so it was agreed that in future platelets suspended in PAS would be used to reduce the risk of a further allergic reaction*

Transfusion-Transmitted Infections (TTI)



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Bacterial transmission: Possible case

- *A 3-day old pooled platelet unit was transfused to a female patient in her 50s who was receiving a second cycle of chemotherapy for relapsed acute myeloid leukaemia (AML)*
- *She had a history of a perianal abscess and neutropenic fever, was reported as pyrexial prior to transfusion, and had been given antibiotic prophylaxis*
- *Four hours post transfusion her condition worsened, she was found collapsed, confused, septic with a temperature of 40°C, hypoxic, and hypotensive with a tachycardia*
- *She remained pyrexial over the following week and was treated with broad spectrum antibiotics; she continued to improve and recovered well*
- *Bacterial screening signalled a reactive result after the pack had been transfused, and Staphylococcus capitis was isolated from the initial pouch sample and the anaerobic culture bottle, but the transfused unit was unavailable for culture*
- *Blood cultures were taken from the patient but these results were not available to the Blood Service*
- *The significant symptoms and persistent fever post transfusion resulted in the case being reported as a bacterial TTI although the symptoms may have been related to the patient's underlying condition*
- *On the basis of these results this incident is reported as a possible TTI*

Probable viral transmission case 1: HEV (1)

- *A male patient in his 60s received a transfusion of one platelet pool and one apheresis platelet in mid-2015 prior to a prostate biopsy*
- *Platelets were given due to the patient's low platelet count ascribed to significant alcohol intake*
- *The patient developed acute hepatitis 2 months later and was found to have chronic liver disease with portal hypertension*
- *Further investigations revealed hepatocellular carcinoma*
- *The patient deteriorated due to liver failure and died 2 months after the transfusion*
- *A blood sample which was taken a day prior to the patient's demise was confirmed to be anti-HEV IgM positive and IgG positive, indicating recent HEV infection*

(continued)

Probable viral transmission case 1: HEV (2)

- *Archive samples of the five donations (four donors from the platelet pool donation and one from the apheresis pool donation) were retrieved and tested for HEV ribonucleic acid (RNA)*
- *The four platelet pool donation samples were confirmed as HEV RNA-negative, but the apheresis platelet donation was HEV RNA-positive, with a viral load of 2044IU/mL*
- *The associated platelet split had been transfused and the clinical team looking after this patient were informed of the potential risk of HEV transmission*
- *Since there was no remaining blood sample from the patient to refer for HEV RNA testing, it was not possible to prove conclusively that the recipient virus was identical to the donor virus*
- *Therefore, it has been concluded that the infection was probably acquired through transfusion*

Confirmed viral transmission case 2: HEV (1)

- *A male patient in his 60s received multiple plasma exchanges with fresh frozen plasma (FFP) as treatment for focal segmental glomerulosclerosis which he developed after renal transplant in November 2014*
- *Between January and July 2015, he received 238 units of FFP*
- *He was discharged to his home country*
- *In March 2017 the patient was noted to have developed ascites over 6 months and portal hypertension was diagnosed*
- *On further investigation the patient was found to be HEV RNA-positive*
- *A sample was referred to the Virus Reference Department at Public Health England which confirmed the HEV RNA result with a viral load of 1,500,000IU/mL, and a genotype 3 virus*

(continued)

Confirmed viral transmission case 2: HEV (2)

- *The patient was also found to be HEV IgM positive and IgG positive*
- *Testing of stored patient samples confirmed that the HEV infection was present at completion of, but not prior to, the plasma exchange therapy*
- *The patient had therefore developed chronic HEV infection, dating from at least August 2015, on a background of immunosuppression following a renal transplant*
- *The patient subsequently developed multi-organ failure and died*
- *Patient samples predating each cycle of plasma exchange were tested for HEV RNA; it was found that all samples up to mid-March were HEV RNA-negative, whereas those from May 2015 were HEV RNA-positive*

(continued)

Confirmed viral transmission case 2: HEV (3)

- *An investigation was therefore carried out into the 59 units of FFP transfused in late March*
- *Archive samples were retrieved and tested: 57 were HEV RNA-negative, one sample was insufficient for testing and one was identified as HEV RNA-positive, IgM- and IgG-negative, indicating early acute HEV infection in the donor at the time of donation*
- *Sequence analysis indicated that the viruses in the donor and recipient samples (both genotype 3c) were likely to be linked and therefore this case is confirmed as a TTI*
- *An associated red cell pack from the same donation did not result in transmission, probably due to low levels of virus in the pack*

Confirmed viral transmission case 3: HAV (1)

- *An apheresis platelet donor felt unwell 2 days prior to donation but recovered and attended to donate*
- *The following day the donor again felt unwell and developed dark urine but no jaundice*
- *A week after donation the donor was hospitalised with acute hepatitis A infection*
- *On investigation, it was found that the donor had visited the bakery linked to a hepatitis A outbreak*
- *Investigation of the issued platelet doses was carried out*

(continued)

Confirmed viral transmission case 3: HAV (2)

- *One recipient, a female in her 50s with renal cancer, neutropenic sepsis and a low platelet count, was transfused with one apheresis platelet unit*
- *Post transfusion, the patient had evidence of hepatitis A immunity (HAV IgG, but no HAV IgM detected), with transient HAV RNA positivity*
- *Sequence analysis indicated that the viruses in the donor and recipient samples were likely to be linked and therefore this TTI is confirmed*
- *Sadly, the patient died of her underlying disease*

Probable HEV transmission 2016 case 1: (1)

- *A male patient in his late teens received blood transfusions between December 2013 and January 2014 in association with a liver transplant*
- *He received four units of red cells, 12 units of FFP, two units of apheresis platelets and two platelet pool donations, equivalent to 26 donor exposures*
- *In 2015, the patient developed persistent transaminitis and tested HEV RNA-positive in October 2015*
- *Records of all donors were examined; all except two had donated at least once since the donation transfused to the patient*
- *An archive sample of a follow-up donation from each of the 24 returning donors was retrieved: 18 tested HEV IgG-negative and six were HEV IgG-positive, indicating prior HEV infection*

(continued)

Probable HEV transmission 2016 case 1: (2)

- *For two of these donors the index archive was available and tested HEV RNA-negative*
- *Given the time elapsed since the transfused donations there was no index archive sample available for the other four donors whose follow-up sample was HEV IgG positive, nor for the two donors who did not re-attend*
- *Therefore, it was possible to eliminate 20 of the 26 donors as a source of HEV infection*
- *Five of the six remaining donors contributed FFP and the final one contributed platelets as part of a platelet pool*
- *Due to lack of archive samples for these six donors it was not possible to assess when the four donors known to have become HEV IgG-positive may have acquired their hepatitis E infection, nor confirm if they were the source of the hepatitis E infection in the patient, however it was assessed that this was likely to be a probable transfusion-transmitted infection*

Confirmed HEV transmission 2016 case 2: (1)

- *A male in his 60s diagnosed with myelodysplastic syndrome (MDS), had an allogeneic stem cell transplant, and received blood transfusions from late 2014 to mid-2015*
- *A deterioration in liver function test results in early 2016 led to HEV testing; the patient was HEV IgM-positive, IgG not detected*
- *The patient received 66 units of red cells, 33 units of apheresis platelets and 14 platelet pools during this time, with 155 donor exposures*
- *Archive samples of all the donations were retrieved and tested for HEV RNA*

(continued)

Confirmed HEV transmission 2016 case 2: (2)

- *One donation was identified as HEV RNA-positive with a viral load of 2,000,000IU/mL*
- *The platelets and plasma from this donation were used in preparation of a platelet pool which was transfused to the patient*
- *Sequence analysis indicated that the viruses in the donor and recipient samples were likely to be linked and therefore this TTI is confirmed*
- *The associated red cell unit was transfused to an immunocompetent patient; the clinical team looking after this patient was informed of the HEV status of the donation*

Pulmonary Complications



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Transfusion-Related Acute Lung Injury (TRALI)



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Antibody-negative TRALI - a possible role for HLA cross-reactivity?

- *A <10-year-old girl with acute lymphocytic leukaemia (ALL) attended as an outpatient for a prophylactic platelet transfusion*
- *Thirty minutes after transfusion of a unit of pooled platelets, the patient suffered acute vomiting, abdominal pain, acute tachypnoea, and desaturated to 70% on air*
- *The chest X-ray showed a complete white-out*
- *The patient required intubation and ventilation but subsequently made a complete recovery*
- *The patient had previously been well and there were no clinical features of fluid overload or additional fluids*

Probable TRALI

- *A female teenager developed acute respiratory deterioration, hypoxia and bilateral patchy air space shadowing 4 hours after transfusion of red cells*
- *The transfusion was given for anaemia 2 days after a liver transplant for Alagille syndrome*
- *She had a positive fluid balance and impaired renal and cardiac function secondary to the underlying syndrome although these had not caused functional compromise*
- *She required ventilation but made a complete recovery*

Equivocal TRALI

- *A female patient in her 60s was already under prolonged ventilation following oesophageal surgery complicated by a perforated oesophagus and splenic rupture and she was also recovering from postoperative sepsis*
- *She developed increased oxygen requirements and deterioration in the chest X-ray (CXR) following a transfusion of two units of red cells*
- *There was pre-existing pulmonary oedema on a CXR prior to the transfusion, but this was worse after transfusion and a computerised tomography (CT) scan showed patchy ground-glass shadowing within the lung fields in keeping with acute respiratory distress syndrome (ARDS)*

Transfusion-Associated Circulatory Overload (TACO)



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An inappropriate transfusion leading to TACO and cancelled elective surgery

- *A patient in their 90s was admitted for an elective total knee replacement*
- *The patient's haemoglobin (Hb) was 95g/L and weight was 73kg*
- *Two units of red cells were prescribed for preoperative Hb optimisation*
- *A Hb check was not performed between units and a fluid balance chart was not in place*
- *At the end of the second unit the patient had dyspnoea and was hypoxic, with hypertension and tachycardia*
- *The chest X-ray was suggestive of pulmonary oedema and the post-transfusion Hb was 128g/L*
- *The patient responded to diuretic therapy*
- *The patient's surgery was cancelled due to TACO*

Lack of attention to appropriate red cell dose leads to TACO

- *A patient in their 90s weighing 75kg with a newly diagnosed haematological condition was admitted with sepsis and a Hb level of 79g/L*
- *The patient was known to have heart failure, renal impairment and peripheral oedema and therefore had risk factors for circulatory overload*
- *Two units of red cells were prescribed with prophylactic diuretics*
- *During transfusion of the second unit the patient became breathless, began coughing up frothy sputum, developed bilateral crackles, tachycardia and hypertension*
- *The chest X-ray was consistent with pulmonary oedema*

Inappropriate and excessive transfusion causing TACO in a patient without risk factors for circulatory overload

- *A patient in their 50s weighing 67kg was prescribed six units of red cells for iron deficiency anaemia after being admitted with Hb 37g/L*
- *The patient had no risk factors for TACO except for profound anaemia*
- *During the fifth unit the patient became dyspnoeic, hypoxic and hypertensive*
- *The patient recovered after diuretic therapy and had a post-transfusion Hb level of 100g/L*

Transfusion-Associated Dyspnoea (TAD)



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Acute severe reaction to transfusion

- *A lady in her 80s was transfused for anaemia after a fall and minor head injury resulting in bleeding from the scalp (on a background of iron deficiency anaemia)*
- *The plan was to give a single unit of red cells then follow this with an iron infusion the next day*
- *She was being treated for an infective exacerbation of chronic obstructive pulmonary disease*
- *She had renal impairment and a low albumin*
- *Within 5 minutes of transfusion starting she developed a worsening wheeze and became agitated, had an increase in respiratory rate from 24 to 44 breaths per minute (/min), and was immediately treated for anaphylaxis with adrenaline, hydrocortisone and chlorphenamine, and intravenous (IV) fluids with some improvement, and later given furosemide with further improvement*
- *She died 2 days later*

A frail elderly woman developed pulmonary symptoms related to transfusion

- *A woman in her 90s received regular red cell transfusions for myeloproliferative disease*
- *She had community-acquired pneumonia with acute kidney injury*
- *She was already very frail, and was drowsy on admission with Hb 59g/L*
- *The respiratory rate was 25-26/min, oxygen saturation was 94-95% on 2L of oxygen*
- *Blood pressure (BP) was 110/60mmHg and she had tachycardia 100-105/min*
- *At the end of the second unit the respiratory rate increased to 30/min with a fall in oxygen saturation to 76% but no significant change in BP or pulse*
- *She was reviewed by the doctor who reported peripheral oedema and raised jugular venous pressure*
- *Furosemide treatment did not give any benefit*
- *She died the following day and transfusion was considered as a possible contributing factor*

A man with leukaemia and fungal chest infection died after transfusion

- *An elderly man with acute myeloid leukaemia (AML) received a unit of red cells and a unit of platelets as part of a regular transfusion regime. He had received six cycles of chemotherapy*
- *He also had interstitial lung disease was very unwell with pulmonary aspergillosis with a progressive cavity, new consolidation, poor left ventricular function (ejection fraction 22%) with a pericardial effusion and cardiac failure*
- *He went home after the transfusion, and 9 hours after the end of the transfusion (01:25) the patient became breathless and was coughing*
- *He arrested and was pronounced dead in hospital at 03:09*

A man with liver disease reacted to cryoprecipitate (transfer from TRALI) (1)

- *A man in his 40s with a known history of alcohol abuse and liver cirrhosis was admitted to the intensive therapy unit with a variceal bleed*
- *His Hb was 71g/L and platelet count was 43×10^9 /L with coagulopathy*
- *He received several blood components (three units of red cells, two units of platelets, four units of fresh frozen plasma (FFP)) prior to two units of cryoprecipitate (cryo)*
- *Before he received the cryo he was self-ventilating on room air, respiratory rate was 25/min and oxygen saturation was >94%*
- *After starting the cryo there was an abrupt deterioration in his gas exchange resulting in emergency intubation and ventilation*
- *His post-intubation CXR showed marked (new) bilateral interstitial infiltrates*

(continued)

A man with liver disease reacted to cryoprecipitate (transfer from TRALI) (2)

- *Prior to the transfusion of cryo the central venous pressure (CVP) was 13mmHg and his fluid balance was 3L positive over 36 hours*
- *He had received a total of 1.4L of crystalloid in the 24 hours prior to his intubation*
- *The remainder of his positive fluid balance represented blood component support*
- *An echocardiogram performed later in his admission showed a normal left ventricle with an estimated ejection fraction of 60% and normal right ventricular function*
- *He received a total of 300mg of furosemide in bolus doses over the 24 hours after intubation*
- *This had no appreciable effect on his gas exchange and he continued to require very high levels of ventilatory support with FiO_2 consistently greater than 60% with mean airway pressures around 20cm of water*

A complex case with sudden deterioration in relation to transfusion requiring admission to ITU and ventilation (1)

- *A man in his 60s with peripheral vascular disease received a postoperative (debridement of necrotic foot) transfusion for anaemia (Hb 76g/L)*
- *He was already on antibiotics and was a known diabetic*
- *Transfusion of the first unit was uneventful*
- *Three hours after starting the second unit his heart rate rose from 125 to 142/min, blood pressure increased from 120/65 to 154/83 and oxygen saturation fell from 98% to 95% with increase in respiratory rate from 20 to 29/min*
- *His temperature increased from 36.5 to 37.5°C*
- *A doctor found him to be breathless, with audible wheeze, no crepitations on auscultation but pulse irregularly irregular and vomiting*
- *Electrocardiogram (ECG) confirmed fast atrial fibrillation*

(continued)

A complex case with sudden deterioration in relation to transfusion requiring admission to ITU and ventilation (2)

- *Critical care outreach review took place and blood tests including cultures were taken*
- *Portable CXR: consolidation of right middle lobe. He had a metabolic acidosis*
- *IV fluids were given, 1000mL over 4 hours, together with IV chlorphenamine, IV paracetamol, and salbutamol nebuliser*
- *He was transferred to the high dependency unit (HDU) for haemofiltration and noradrenaline infusion and was put onto nasal high flow the following day*
- *He was treated for diabetic ketoacidosis*
- *He was noted to be struggling with breathing*
- *At 07:30 he was started on continuous positive airway pressure (CPAP)*
- *At 11:20 he needed intubation; during this his cardiac output stopped and he could not be resuscitated*

(continued)

A complex case with sudden deterioration in relation to transfusion requiring admission to ITU and ventilation (3)

- *He died 3 days after the transfusion reaction which was considered contributory*
- *The CXR was normal preoperatively*
- *After the reaction 'there are florid ground-glass changes affecting both lungs with upper zone predominance*
- *There is relative sparing of the lung bases*
- *No pleural effusion or obstructing endobronchial lesion*
- *Conclusion: Florid pulmonary abnormalities are visible*
- *These could represent infection, adult respiratory distress syndrome, or possibly other entities such as drug reaction or other rarer causes of interstitial lung disease*
- *These may well be contributing to the patient's metabolic instability'*

Transfusion reaction on a background of autoimmune disease

- *A woman in her 70s underwent insertion of a permanent pacemaker for heart block*
- *She had a background of autoimmune disease (systemic lupus erythematosus, immune thrombocytopenia and autoimmune haemolytic anaemia)*
- *She developed a transfusion reaction resulting in admission to the ITU*
- *She became clammy with increasing shortness of breath (respiratory rate increased from 18 to 32/min), wheeze and tachycardia of 129/min*
- *She improved with diuretic treatment*

Acute hypoxia follows transfusion (transfer from TRALI) (1)

- *A woman in her 60s received a blood transfusion without complications following coronary artery bypass surgery and observations were stable during transfusion*
- *She had diabetes and known ischaemic heart disease*
- *She developed rigors (but no measurable increase in temperature) after blood transfusion with a tachycardia of 199/min, BP 175/77 and decreased oxygen saturation*

(continued)

Acute hypoxia follows transfusion (transfer from TRALI) (2)

- *The CXR showed bilateral alveolar infiltration, and she was readmitted to intensive care shivering and shaking uncontrollably*
- *IV fluid and antibiotics were started*
- *This was thought to be TRALI because of acute hypoxia and bilateral infiltrates seen on CXR after one unit of blood with normal echocardiogram and no suggestion of fluid overload*
- *A Blood Centre was informed but no TRALI investigations were suggested*

Breathlessness after transfusion (transfer from TRALI) (1)

- *A woman in her 50s was receiving a course of chemotherapy for myelodysplasia in leukaemic transformation and was also on IV antibiotics for infection (but she was not neutropenic)*
- *These had been started earlier on the same day as her transfusion when she had fever 38.3°C associated with a fall in oxygen saturation to 86% requiring oxygen*
- *She recovered from this*
- *Later the same day she started feeling breathless following the end of the red cell transfusion and this increased over the following 6 hours with worsening hypoxia and increasing oxygen requirement*

(continued)

Breathlessness after transfusion (transfer from TRALI) (2)

- *She required admission to the ITU*
- *Her antibiotics and other drugs were given in a total infusion volume of about 1600mL plus blood components to 700mL during the same day*
- *The CXR showed clear evidence of opacification which was not present before transfusion*
- *She did not improve after treatment with diuretics*
- *The TRALI panel considered TACO more likely but this reaction did not meet the TACO criteria*

Bronchospasm under anaesthetic (transfer from TRALI) (1)

- *A young woman underwent emergency caesarean section at around 03:30 for placental abruption under general anaesthesia*
- *She was difficult to ventilate and she developed respiratory failure with profound bronchospasm*
- *It was not clear what the cause was and she was initially treated for possible acute exacerbation of asthma, but an acute reaction to blood transfusion was possible (she had received four units of red cells, two units of FFP and one unit of platelets) or an allergic reaction*
- *Postoperatively she was transferred to ITU and remained intubated and ventilated*
- *She improved after a few hours and was extubated*

(continued)

Bronchospasm under anaesthetic (transfer from TRALI) (2)

- *Overnight she was stable and was discharged to the labour ward at 07:00 for removal of uterine packs and tamponade balloon*
- *Following removal of the balloon she started to complain of difficulty breathing*
- *She was coughing and her saturation dropped to 88%*
- *Her oxygen requirement continued to increase and she required transfer back to the critical care unit for nasal high flow oxygen therapy and CPAP*
- *Acute respiratory distress syndrome (ARDS) was noted, but the clinicians were unsure whether this was from treatment or the smoking history that predisposes to this, or this might be TRALI or TACO (her mast cell tryptase was normal)*
- *She made a full recovery*

An elderly man with respiratory symptoms after transfusion (1)

- *A man in his 90s developed fever during transfusion of red cells (2 units for anaemia, and 3 units of platelets) from 36.7 to 37.9°C but after medical review they decide to observe more carefully and slow the rate*
- *After approx. 30-40 minutes he was heard to be working hard to breathe with wheezing, the respiratory rate had increased to 48/min so the transfusion was stopped*
- *On examination he was found to have an upper airway wheeze, oxygen saturation of 96% on air, unable to talk due to increased respiratory rate, but no stridor*
- *He was started on 1L of oxygen*

(continued)

An elderly man with respiratory symptoms after transfusion (2)

- *He was very clammy, tachycardia of 120/min, an increase from the baseline of 100/min*
- *This patient was under urgent medical review in the medical admissions unit. He had a very complex medical history with multiple problems including dizziness and confusion*
- *Investigations for several conditions were underway: possible opioid overdose, immune thrombocytopenia, possible intracranial haemorrhage, haematuria and non-ST-elevation myocardial infarction (NSTEMI)*
- *After review of patient notes it was noted he had multiple episodes of shortness of breath (SOB) after exertion which settled with rest, oxygen and continued observation*

An elderly woman with reduced oxygen saturation during transfusion

- *A woman in her 80s with chronic obstructive airways disease, ovarian carcinoma receiving chemotherapy, ischaemic heart disease and hypertension was on treatment for a chest infection (baseline saturation 91% on 1L oxygen)*
- *She developed a reaction 15 minutes into the transfusion with a fall in her oxygen saturation to 80%*
- *There was no change in respiratory rate; pulse increased from 75 to 90/min*
- *After increased oxygen her saturation improved and she recovered*
- *She had a moderate positive fluid balance of about 1L and was treated in addition with diuretic but there is no record of the impact of this*
- *The Chest X-ray (CXR) before and after transfusion did not support a diagnosis of TACO*

A young woman reacts to a granulocyte infusion (1)

- *A teenage girl, underlying diagnosis acute myeloid leukaemia with neutropenia and sepsis (positive blood culture before transfusion), had a reaction to a granulocyte infusion*
- *She had already received 23 units in the previous 2 weeks*
- *She was on IV antibiotics and had serious perianal inflammation*
- *She developed a reaction to two units of granulocytes, given in one transfusion episode*
- *She was pyrexial pre transfusion and her temperature was broadly unchanged during the reaction 38.0 to 38.2°C at time of reaction (38.3 at 15 minutes)*
- *Her pulse rate did not change, pre 118 to 117 at time of reaction*

(continued)

A young woman reacts to a granulocyte infusion (2)

- *Her blood pressure rose from 118/68 to 138/90 and her respiratory rate increased from 20 to 24/min*
- *Oxygen saturation reduced to 95%. She reported chest tightening*
- *There was no serological evidence of red cell incompatibility*
- *Blood culture was negative post transfusion*
- *The clinical team felt that the signs and symptoms were related to the granulocyte transfusion and not to underlying condition/infection*
- *She made a full recovery*
- *This was not reported to the Blood Service. (Another reaction to granulocytes was reported separately as an allergic/febrile reaction)*
- *The outcome was to cease giving granulocytes 3 days later*

A young man with underlying lung disease (transfer from transfusion-associated circulatory overload (TACO))

- *A man in his 20s with a history of acute lymphoblastic leukaemia received a sibling allograft in 2010 complicated by chronic graft versus host disease (GvHD)*
- *He suffered a severe gastrointestinal (GI) bleed requiring transfusion support*
- *Over a 16-hour period he received 6 units of red cells, 7 units of platelets, 4 units of fresh frozen plasma (FFP) and 1 unit of cryoprecipitate*
- *He developed a tachycardia of 130/min and an increased respiratory rate to 40/min. His oxygen saturation (SaO_2) was 96% on 3L of oxygen which differed from baseline of P 100, SaO_2 96%*
- *His respiratory rate was 18 after initial 4 units of platelets and 2 units of red cells. He was sedated and ventilated*
- *He continued to have large GI bleeds*
- *He had multiple existing lung pathologies related to GvHD and was ventilator-dependent until his death 9 days later*

An elderly man with underlying lung disease developed dyspnoea during transfusion (transfer from TACO)

- *A man in his 70s was transfused after 5 days of haemoptysis*
- *He was known to have pulmonary fibrosis diagnosed in 2015, which was progressive on CXR, and iron deficiency*
- *Two thirds of the way through a third bag of red cells he complained of chest tightening and started to experience rigors, became short of breath, hypertensive, with pyrexia*
- *His oxygen saturation dropped to 85% and crepitations could be heard on auscultation*
- *The transfusion was stopped*
- *He received 40 mg of IV furosemide with improvement, and 10 litres of oxygen*
- *He recovered within 6 hours*

Non-specific reaction to transfusion (transfer from TACO)

- *A woman in her 70s with known carcinoma of the lung was admitted after falling at home due to a stroke*
- *She was bleeding from fungating lesion on the buttock*
- *She was transfused (Hb 78g/L) 2 units of red cells*
- *She developed an increase in pulse and blood pressure and but with no change in oxygen saturation or respiratory rate after the first unit*
- *She had no specific treatment other than transfusing the second unit at a slower rate*
- *She was in positive fluid balance to 500mL*

An elderly woman develops respiratory problems postoperatively (1)

- *A woman in her 90s with fractured neck of femur received a red cell transfusion for intraoperative bleeding (Hb 75g/L)*
- *She had pre-existing cardiac failure and was already in the intensive therapy unit (ITU)*
- *Ten minutes following the start of the unit she developed dyspnoea with a fall in oxygen saturation from 95% to 78%, rise in respiratory rate from 18 to 30/min and an increase in blood pressure (BP)*
- *Her temperature increased from 36.5 to 37.4°C but pulse rate changed from 100 to 80/min*

(continued)

An elderly woman develops respiratory problems postoperatively (2)

- *The transfusion was stopped, the doctor attended, who noticed decreased air entry but no ankle oedema*
- *She received furosemide with no change*
- *She appeared agitated*
- *The unit was stopped and returned to the laboratory for investigation but no abnormality was found*
- *Diuretic therapy had no effect and the following day she was found to have a pulmonary embolus (PE) on computerised tomography (CT) scanning*

A sick woman develops respiratory symptoms

- *An overweight (110kg) woman in her 30s, previously treated for acute promyelocytic leukaemia in 2006 (which might have resulted in some cardiac toxicity) was admitted to ITU after an out-of-hospital cardiac arrest related to myocarditis*
- *She was intubated but not ventilated*
- *She had renal failure, cardiac failure and was receiving total parenteral nutrition*
- *She experienced a transfusion reaction with fever (38.4°C), increased respiratory rate (18 to 24/min), decreased oxygen saturation to 90%, increased systolic BP and a rash*

Chest pain and breathlessness during platelet transfusion (1)

- *A man in his 60s with acute myeloid leukaemia (AML) was receiving frequent platelet and red cell transfusions and was on ITU*
- *He was being treated for sepsis with IV antibiotics and antifungal agents*
- *The pre-transfusion CXR showed 'widespread infiltrate and patchy consolidation' the same as on the previous day*
- *He had a reaction to platelets 3 days before of a similar nature and has since been premedicated with chlorphenamine and hydrocortisone*
- *A platelet transfusion was started 20 minutes after premedication*
- *The baseline observations were: temperature 36.6°C, BP 145/79; the respiratory rate was 20/min on 70% oxygen; pulse 65/min*
- *Ten minutes after starting, the patient had chest pain*
- *The respiratory rate increased from 20 to 44/min and the oxygen saturation dropped to 86%*

(continued)

Chest pain and breathlessness during platelet transfusion (2)

- *Oxygen was increased to 100%*
- *A doctor was informed and the platelet transfusion was stopped 15 minutes after the start*
- *No other treatment was given and the patient stabilised within 30 minutes*
- *The patient is known to be platelet refractory but has had no human leucocyte antigen (HLA) antibodies identified*
- *The pre- and post-transfusion samples were compatible*
- *The direct antiglobulin tests were positive both pre and post transfusion with IgG being weaker in the post result*
- *Culture of the pack has shown no growth and patient blood cultures were negative*
- *He recovered after increasing oxygen flow only*

An elderly lady becomes unwell during transfusion

- *A woman in her 80s with severe left ventricular failure and pericardial effusion was transfused as a day case*
- *She became breathless with rise in respiratory rate from 16 to 35/min, her pulse rate increased from 88 to 94/min and she had a slight increase in BP (systolic 114 to 121) and a fever of 38.2°C*
- *Blood culture was negative*
- *She was admitted and remained dyspnoeic for 9 hours and improved with furosemide*
- *Fluid balance was not recorded and there was no evidence of pulmonary oedema on the CXR*
- *The heart was noted to be extremely large but no change from 3 months previously*
- *She died 4 days later unrelated to the transfusion*

A reaction that might have been TACO

- *A man in his 90s developed dyspnoea while waiting for transport home following transfusion so was admitted*
- *He had received 2 units of red cells each over 2 hours*
- *He had renal impairment, peripheral oedema and heart failure*
- *His pulse increased from 71 to 86/min, his systolic BP 143 to 191, his oxygen saturation fell from 100 to 80% and his respiratory rate increased from 20 to 26/min*
- *Crackles were heard on auscultation of the lungs*
- *He improved after antihistamines and steroids and did not require diuretics*
- *The outcome was to transfuse more slowly in future*

Haemolytic Transfusion Reactions (HTR)



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Death following emergency transfusion of a patient in sickle crisis

- *A pregnant patient in her 40s with SCD in sickle crisis and symptoms of acute chest syndrome received an urgent red cell exchange transfusion prior to emergency caesarean section*
- *During the transfusion the patient developed symptoms of a transfusion reaction and the transfusion was stopped*
- *The patient had a history of anti-U and possible anti-Jk^a, however due to the emergency nature of the transfusion and the rarity of U-negative, Jk^a-negative red cells, Jk^a-negative units were not selected and units negative to the U antigen only were transfused*
- *The justification given for this was that the presence of anti-Jk^a had not been positively confirmed*
- *The patient developed disseminated intravascular coagulation (DIC) and possible hyperhaemolysis syndrome*
- *At post mortem the death was attributed to acute chest syndrome related to SCD*

Hyperhaemolysis in patient with variant Rh phenotype and known alloantibodies (1)

- *A patient with SCD received an elective ten-unit exchange transfusion prior to surgery*
- *The patient was known to have allo anti-Ce, anti-s, anti-K and anti-Jk^b*
- *The patient also had a previously reported auto anti-e*
- *The patient was genotyped as part of the Blood Service genotyping project for haemoglobinopathy patients and found to have a variant D- and e-genotype*
- *The previously reported auto anti-e was therefore recharacterised as allo anti-e*
- *Due to the unavailability of D- C- E+ c+ e- s-K-Jk^b- red cells the decision was made not to provide e-negative units*

(continued)

Hyperhaemolysis in patient with variant Rh phenotype and known alloantibodies (2)

- *The rationale for excluding the anti-e for the purposes of blood selection was that the patient had been transfused e-positive units prior to the identification of the variant e-genotype without symptoms of haemolysis and also that data collected by National Health Service Blood and Transplant (NHSBT) for transfusion of antigen-positive units to patients with variant phenotypes had no reports of haemolysis in e-variant patients with anti-e*
- *Five days post transfusion the patient developed haemoglobinuria and was readmitted to hospital and required ventilation*
- *The Hb fell from 83g/L to 48g/L and the bilirubin and LDH were raised The patient was transfused three units of D+ C- E+ c+ e- s- K- Jk^b- red cells*
- *However, monitoring of HbS levels demonstrated that these transfused cells were also haemolysed*
- *No new antibodies were detected on serological investigation and the DAT was positive pre and post transfusion with no change seen in the reaction strength*

DHTR due to anti-c

- *A patient receiving chemotherapy was transfused two units of red cells issued by electronic crossmatch following a negative antibody screen using a fully automated system*
- *The following week the patient returned to hospital with discoloured urine and anaemia*
- *The patient's bilirubin had risen from 10 to 40micromol/L and her Hb had dropped from 102g/L to 88g/L*
- *The antibody screen on the new samples was positive and anti-c was identified*
- *The transfused units were confirmed as c-antigen positive*

DHTR due to anti-Fy^a

- *A renal patient with history of a negative antibody screen was transfused two units of red cells*
- *Eleven days later the patient returned for their next routine appointment*
- *Investigation of the samples taken during this admission found that anti-Fy^a was now detectable in the plasma*
- *Anti-Fy^a was also eluted from the patient's red cells*
- *The patient had reported no clinical symptoms but laboratory tests indicated the Hb had not incremented following the transfusion and she had now developed a positive DAT*

Failure to identify previous antibody history available in a patient treated across multiple hospitals (1)

- *Anti-C and anti-S were confirmed in a patient in 2000 by the Blood Service and a report and antibody warning card for the patient issued to the referring hospital (Hospital 1)*
- *In 2015 the same patient was seen in Hospital 2 and samples referred to the International Blood Group Reference Laboratory (IBGRL) for red cell genotyping*
- *In February 2017 the patient was seen in Hospital 3 and another sample was sent to the IBGRL for genotyping*
- *At this time both the report from 2000 and the genotype report from 2015 were available on Sp-ICE*
- *In May 2017 the patient was seen at a 4th hospital (Hospital 4)*

(continued)

Failure to identify previous antibody history available in a patient treated across multiple hospitals (2)

- *Samples were again referred to the Blood Service reference laboratory and this time anti-Lu^a and anti-Fy^a were detected*
- *A report was issued to Hospital 4 stating the new antibodies and also the previously detected anti-C and anti-S*
- *A new antibody card for the patient, listing all four antibody specificities was sent with the report*
- *This new report was also uploaded to Sp-ICE*
- *In July 2017 the patient presented again to Hospital 1*
- *An antibody screen was performed and found negative and ABO, Rh and K group-matched blood was issued*
- *Approximately 5 days later, the patient was admitted to a 5th hospital (Hospital 5) with symptoms of a HTR including an acute drop in Hb and positive DAT*

Transfusion of emergency O D-negative red cells later found to be incompatible

- *A patient suffered a major gastrointestinal arterial bleed and required immediate transfusion*
- *The two emergency O D-negative units were taken from the hospital transfusion laboratory refrigerator and a further three uncrossmatched group O units were provided*
- *Subsequent testing of the pre-transfusion sample identified anti-Jk^b in the patient's plasma*
- *Three of the units issued were confirmed to be positive for the Jk^b antigen*
- *The patient developed fever and jaundice and laboratory tests confirmed haemoglobinuria, raised bilirubin, raised LDH, a rapid drop in Hb and positive DAT*
- *The patient recovered and survived*

Issue of 'best match' in major haemorrhage

- *A major haemorrhage alert was called on a bleeding patient with cholecystitis and the emergency O D-negative units were collected*
- *Part of the first unit was transfused before the transfusion laboratory staff were able to inform the clinical area that the patient had a history of anti-E, anti-Fy^a and anti-Jk^a*
- *On discussion with the consultant haematologist it was agreed to crossmatch two E-negative Fy^a-negative, Jk^a-untyped units as no suitable Jk^a-negative units were available in the hospital transfusion laboratory*
- *These units were subsequently confirmed as Jk^a-positive*
- *The patient did not suffer any clinical symptoms of a HTR but laboratory tests showed a positive DAT and rapid fall in Hb*
- *The patient recovered and survived*

New or Unclassifiable Complications of Transfusion (UCT)



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Transfusion-associated necrotising enterocolitis

Case 1

- *A red cell transfusion was given to a fully fed 25-week twin for anaemia (haemoglobin (Hb) 88g/L)*
- *During transfusion the baby became unsettled but no change in observations*
- *Within a short time, the baby's abdomen became distended and she had features of NEC and required ventilation*
- *The baby was treated conservatively and made a full recovery*

Transfusion-associated necrotising enterocolitis

Case 2

- *A baby born at 28 weeks developed signs of NEC within 24 hours of a red cell transfusion (Hb 72g/L)*
- *The baby was managed conservatively and made a full recovery*

Transfusion-associated necrotising enterocolitis

Case 3

- *A 27-day-old baby developed signs of NEC within 24 hours of a red cell transfusion*
- *No further details were given*

Unexplained transfusion reaction

- *A male in his 60s with a primary diagnosis of sepsis, who was very unwell and already on a noradrenaline infusion, developed sudden onset of dyspnoea*
- *About 40 minutes into a transfusion of a unit of fresh frozen plasma (FFP) (following one unit of platelets) his blood pressure fell from 120/60 to 80/40mmHg with red flushing of face and neck and upper chest*
- *His heart rate increased from 90 to 130 beats per minute (/min) and his oxygen saturation fell from 95 to 83%; temperature increased from 36 to 38.9°C*
- *He developed wheezing and difficulty in ventilation requiring 100% oxygen*
- *He was treated with adrenaline, salbutamol nebuliser, noradrenaline infusion was continued*
- *The patient died, unrelated to the transfusion, and interval between this reaction and death is not reported*

Sudden reaction to platelets

- *A man in his 70s on regular transfusion for aplastic anaemia felt unwell during a platelet transfusion (he had received chlorphenamine 30 minutes prior because of previous platelet reactions)*
- *He felt 'strange' and had sudden onset of shortness of breath within 5 minutes of starting, became cyanosed, grunting, and unresponsive*
- *An emergency call was put out and he was given 100mg of intravenous (IV) hydrocortisone*
- *However, he recovered quickly without further support*
- *He had a history of ventricular tachycardia (VT) arrest (August 2016), severe left ventricular systolic dysfunction and unstable angina*
- *He was admitted from the day-case unit and given washed platelets for subsequent transfusions*

Severe pain during transfusion

- *A woman in her 80s had transfusion reactions with each of three transfusions (2014, 2016 and this episode); her red cells were crossmatched at a Blood Centre*
- *She had known anti-E found in 2016*
- *Her Hb was 65g/L related to gastric carcinoma with radiotherapy*
- *She had iron deficiency anaemia but could not tolerate IV iron*
- *She received premedication with hydrocortisone and chlorphenamine*
- *The first observations during transfusion at 35 minutes were stable but an hour later she developed severe loin and back pain*
- *Transfusion was stopped and she received hydrocortisone 200mg and a further dose of chlorphenamine together with analgesia (codeine and oral morphine)*
- *The pain resolved and she went home the same day. Relevant investigations gave negative results*
- *The future plan was to give washed red cells, but she was admitted to a hospice for end of life care*

Dyspnoea after a very small amount of transfusion associated with IgA deficiency

- *A man in his 40s with pancytopenia and jaundice following a viral illness developed shortness of breath requiring oxygen following a very small amount of transfusion (3-5mL) resulting in discontinuation of transfusion*
- *He was IgA deficient $<0.02\text{g/L}$ with a raised lactate dehydrogenase (LDH) 4681U/L*
- *No search for anti-IgA antibodies was done*
- *At discharge the diagnosis was pyrexia of unknown origin and pancytopenia possibly secondary to B12 deficiency*
- *He is improving and under continued follow up by haematologists*
- *He did not have sepsis although he received IV antibiotics because of fever and neutropenia*

Pain during transfusion

- *A woman in her 60s with newly-diagnosed acute promyelocytic leukaemia developed chest and back pain requiring analgesia with morphine during infusion of cryoprecipitate and again on restarting more slowly two further times so it was discontinued*
- *At local review the clinicians thought that this might be a reaction to all-trans retinoic acid (ATRA) which had been started before the cryoprecipitate*
- *She also received 2 units of platelets and 4 units of FFP over a three-day period without other reactions*

Pain during transfusion with respiratory symptoms

- *A man in his 50s with chronic monocytic leukaemia developed chest and abdominal pain together with dyspnoea and fall in oxygen saturation 30 mins into a red cell transfusion*
- *Emergency life support was needed; he received adrenaline, hydrocortisone and chlorphenamine and was intubated. He was already on the intensive therapy unit*
- *Blood cultures from the patient grew vancomycin-resistant enterococci from both bottles*
- *He recovered within 6 hours*
- *He was noted to have had a reaction to platelets previously so the decision was made to premedicate with hydrocortisone and chlorphenamine for future platelet transfusions*

Hypotension following transfusion

- *A woman in her 80s developed hypotension (from 106/48 to 83/50) and became pale and clammy following a red cell transfusion*
- *She had collapsed at home and was found to have sepsis, atrial fibrillation and pulmonary oedema*
- *She received hydrocortisone and oxygen with discontinuation of the transfusion (1.5 hours)*
- *She recovered over a period of an hour*

Sudden deterioration during transfusion

- *A man in his 60s had received two units of red cells and was receiving FFP*
- *During the second unit he became acutely hypoxic, sweaty, clammy and shocked requiring cessation of infusion and resuscitation*
- *He had chronic liver failure (hepatitis C) and had been found collapsed*
- *He had acute kidney failure and possible sepsis (but blood and unit cultures gave no growth)*
- *He was treated with IV antibiotics, diuretic and oxygen*
- *His IgA level was normal with no antibodies*
- *He made a full recovery*
- *No further information given*

Cell Salvage (CS)



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Possible allergic reaction to salvaged red cells

- *A patient undergoing emergency caesarean section developed anaphylactic-like symptoms within a few minutes of commencement of reinfusion of salvaged red cells*
- *The patient reported difficulty in breathing and tongue swelling and the infusion was stopped with a prompt resolution of symptoms*
- *When reviewed the following day the patient revealed that the effects of a high epidural had caused numbness in her face and hands, she panicked and this affected her breathing*
- *She also stated this reaction started before the infusion of the salvaged red cells commenced*

Hypotension on reinfusion of salvaged red cells

- *A patient with placenta praevia underwent elective caesarean section with cell salvage*
- *Intraoperative blood loss was approximately 800mL and a reinfusion of 200mL of salvaged red cells was commenced using a leucocyte-depletion filter*
- *The patient experienced a sudden and profound hypotension and the infusion was stopped*
- *The patient's blood pressure was normalised with vasoconstrictors and other obvious causes of hypotension ruled out*
- *The leucocyte-depletion filter was removed and the remainder of the autologous red cells reinfused without further incident*

Hypotension resulting from reinfusion of salvaged red cells confirmed by a secondary challenge (1)

- *A patient with a grade IV placenta praevia underwent elective caesarean section*
- *As the patient was being transferred from theatre, reinfusion of 361mL of autologous red cells via a leucocyte-depletion filter commenced*
- *The patient then complained of nausea and vomiting, looked unwell and became slightly less responsive*
- *Monitoring revealed sinus tachycardia with a heart rate of 165 beats per minute (bpm) with systolic blood pressure (BP) of 78mmHg*
- *The red cell infusion was stopped and the symptoms resolved with a bolus infusion of 60 micrograms of phenylephrine*

(continued)

Hypotension resulting from reinfusion of salvaged red cells confirmed by a secondary challenge (2)

- *Having stabilised the patient in the recovery area (heart rate 78bpm, systolic BP 98mmHg), the autologous red cell transfusion was recommenced*
- *This resulted in rapid rise in heart rate to 150bpm with concomitant hypotension*
- *The infusion was stopped immediately with rapid resolution of symptoms*
- *The remaining 150mL of autologous red cells was then discarded*
- *The reporter noted that cell salvage was carried out following standard protocols, however, at the end of the case a partial bowl was washed without using the 'concentrate' function and the saline wash volume was not increased to compensate for this*

Paediatric Summary



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Emergency units in the satellite blood refrigerator became unavailable due to 'misuse' of the blood refrigerator

- *A neonate born with Hb 41g/L following a fetomaternal haemorrhage required emergency transfusion*
- *A single unit of neonatal emergency blood was taken from the satellite blood refrigerator but the drawer and refrigerator doors were not closed by the staff member who went immediately to the neonate*
- *The refrigerator process was therefore not completed and the remaining member of staff repeatedly selected the only option available to them: 'press if tray empty' until the refrigerator stated there was no emergency blood available*
- *Approximately 15 minutes later the neonate required more blood so other units had to be obtained from the blood transfusion laboratory*
- *The baby died 2 days later (it is not clear if the delay contributed)*

Unnecessary overtransfusion of a child with red cells following trauma required venesection

- *A child was punched in the abdomen and the next day seen in the emergency department with haemodynamic instability presumed due to intra-abdominal bleeding*
- *As there was delayed access to the paediatric surgical team due to difficulties with telephone reception and although the Hb was 176g/L, the child was 'resuscitated' with two units of red cells*
- *The Hb rose to 208g/L and the child was venesected*

Lack of understanding causes overtransfusion of an infant

- *A young child with sepsis, skin necrosis and renal failure weighing 12kg was transfused with two adult units of red cells (approximately 560mL) for postoperative anaemia*
- *The Hb rose from 70g/L before the transfusion to 177g/L after the transfusion*
- *There were no serious sequelae*

Overtransfusion of red cells in a child during major haemorrhage

- *An infant with acute lymphoblastic leukaemia (ALL), weight 9kg, on enoxaparin, suffered major gastrointestinal bleeding with an unrecordable blood pressure and tachycardia of 190 beats per minute triggering activation of the major haemorrhage protocol*
- *The child received 400mL of red cells (44mL/kg)*
- *The pre-transfusion Hb was 111g/L and post was 194g/L*
- *In addition, the child received FFP, platelets and cryoprecipitate*
- *The child was endoscoped, intubated and ventilated related to the major haemorrhage and not the overtransfusion of red cells*

Transcription error in the weight results in excessive red cell transfusion

- *A child weighing 33kg with sickle cell disease was overtransfused due to a transcription error with the wrong weight*
- *The amount was challenged by nursing staff but they were advised to carry on as a haematology registrar had written the prescription*
- *Nobody noticed the wrongly transcribed weight*

A junior doctor's order inappropriately overruled by registrar resulting in undertransfusion

- *A child weighing 22.5kg was oozing from a gastrostomy site and had Hb 77g/L*
- *The junior doctor ordered one adult unit but the surgical registrar insisted on changing this to two paedipacks, despite advice from the BMS that the original request was more appropriate*
- *The post-transfusion Hb was 71g/L and the child required a second transfusion of an adult unit resulting in an increase to 117g/L*

Blood from two packs mixed in a syringe for an infant transfusion

- *An infant was prescribed 58mL red cells*
- *Two paedipacks from the same donor were ordered from the laboratory*
- *The nurse administering the blood mixed both bags into a 50mL syringe and started the transfusion*
- *The remaining 8mL were left in the medication tray out of a temperature-controlled environment and without a label ready to be administered after completion of the first 50mL*
- *Once the error was noted, the 8mL were discarded*

A teenager on haemodialysis received rapid red cell infusion as line not clamped

- *Prior to haemodialysis for a teenager, the dialysis lines were primed with blood*
- *However, the line was not clamped before starting dialysis, so the patient received one unit of red cells in the first 5 minutes*
- *The staff member giving the transfusion had never given blood before and the unit was extremely busy with a high patient to staff ratio*

Probable TACO in a child with newly-diagnosed leukaemia

- *A young child with probable newly diagnosed ALL was admitted with bleeding and coagulopathy*
- *Prior to diagnostic procedures and line insertion the child was given platelets and cryoprecipitate, and platelets rose to $>100 \times 10^9/L$*
- *The child also required hyperhydration to reduce the risk of tumour lysis syndrome*
- *As the line was oozing overnight further platelets were transfused as the instructions in the notes had said to transfuse platelets if bleeding (and had omitted to say 'if platelets <50 ')*
- *This was despite the child being in significant positive fluid balance at the time*
- *Subsequently the child became acutely unwell, requiring oxygen and admission to the paediatric intensive care unit (PICU) for non-invasive ventilation*
- *The child responded to diuretics and was diagnosed with TACO*