7.1 Errors Relating to IT Systems (IBCT IT)

In 2009, there were 61 reported incidents of IBCT errors relating to IT systems, compared with 44 in 2008 and 25 in 2007 (see Table 23). Forty-six incidents originated in the transfusion laboratory. Forty-seven cases involved red cells, 10 platelets and 2 plasma components. Six of the 61 cases occurred in children (1–8 years) and 3 in infants.

Table 23
IT Systems Errors
NB some reports involved more than 1 category of error

Error	Reports	Non-irradiated component transfused	Antigen positive unit transfused	Non-CMV neg unit transfused	Wrong group after SCT	Electronic issue error	Other
Failure to consult historical record	4	1	3				
Historical record not identified	1		1				
Ignored/missed warning flag	20	6	3		9		1 (red cells crossmatched on outdated sample) 1 (failure to issue platelets in PAS)
Failure to update warning flags	5	1	1		2		1 (failure to update product code led to issue of adult FFP for child)
Computer system 'down'	1						1 (manual component selection error – cryo instead of FFP)
Data not transferred from old system	3		3				
Electronic blood tracking system errors/misuse	9			1			7 (out of expiry date/ time components issued – see text) 1 IBCT
Failure to merge or reconcile records	5		4	1		2	1 (unable to issue red cell unit c/o discrepant ID numbers)
Error/deficiency in computer system or misuse	13	1	4	1		3	8 (miscellaneous – see text)
TOTAL	**61**	**9**	**19**	**3**	**11**	**5**	**21**

Cases

Case 1

Data not transferred from old system therefore 'antigen positive' unit transfused

A patient had a history of anti-C and anti-E on a previous computer system. This information was not checked prior to issuing blood on the new system. As a result the patient was transfused blood which was not negative for the C and E antigens.

Case 2

Not checking historical record leads to transfusion of 'antigen positive' red cell unit by EI

A sample was received from the ED from a patient with a GI bleed. The 'ED number' was used as a unique identifier on the sample. An on-call BMS, who works routinely in the transfusion laboratory, did not consult the historical record, which showed the presence of anti-E in the patient. Antibody screen was negative on this occasion and 2 units of red cells were issued electronically without selection for absence of E-antigen or serological crossmatch. There were no clinical sequelae.

Case 3

Not responding to warning flag leads to transfusion of inappropriate group after stem-cell transplant

An RhD positive patient received a bone marrow transplant from an RhD negative donor ('minor' RhD mismatch transplant). The protocol specifies the transfusion of RhD negative blood components post-transplant and a note to this effect was placed on LIMS. A BMS, working routinely in the transfusion lab during normal working hours, missed or ignored the warning flag and issued 2 units of RhD positive red cells.

Case 4

Manual editing of abnormal results leads to issue of potentially incompatible red cell units

A non-urgent request for 2 units of red cells was made for a patient with melaena. The BMS, on an overnight shift but working regularly in the transfusion laboratory, performed the group and screen on the autoanalyser. A 'wrong liquid level' (WLL) flag in one column of the antibody screen indicated a possibly invalid result that should be repeated. The result was manually edited to 'negative' and a crossmatch set up on the same autoanalyser. All crossmatch results were flagged as 'WLL'. These were, again, manually edited to 'negative' and 2 units issued and transfused. When the error in procedure was identified the following day, repeat testing confirmed the negative antibody screen and compatibility of the issued red cell units.

Case 5

Inappropriate access to electronically locked CTS leads to giving adult red cell unit to a neonate

A baby delivered by emergency Caesarean section had an Hb of 6.2 g/dL and required urgent transfusion. A staff grade doctor, who had not been trained or competency-assessed in using the electronic fridge control system, 'borrowed' the access card from a midwife and selected an emergency group O D negative red cell unit intended for adult patients (not CMV screened). This was noticed by the nurses performing the bedside administration check but their concerns were overridden.

Case 6

Expired unit removed from blood tracked fridge and not detected at bedside check

A unit of red cells was collected from a blood fridge with electronic tracking. The device produced an audible and visual alert that the unit had passed its expiry date. The porter ignored the alert and took the unit to the ward. Nursing staff failed to note that the unit was expired when the porter delivered it and again when performing the pre-transfusion check.

Case 7

Delayed communication between laboratories in the same hospital group, compounded by clinical error

A patient was attending haematology clinics at 2 hospitals in the same NHS Trust. His requirement for irradiated blood components was flagged on the LIMS system at hospital A, but not passed on to the transfusion laboratory at hospital B in a timely fashion, in breach of local protocol. The patient subsequently received 2 units of non-irradiated red cells at hospital B. The error was subsequently identified when transfusion laboratory A communicated the special requirement

to laboratory B. The clinical request and transfusion prescription at hospital B did not specify the requirement for irradiated components.

Case 8

Use of NHS number leads to failure to identify need for CMV negative components

The warning flag on the LIMS was only present in a patient record identified by the hospital ID number. On this occasion, the transfusion sample was labelled with the NHS number and the historical record was not identified. This incident was compounded by clinical failure to indicate special transfusion requirements on the request form or prescription sheet.

Case 9

Bedside computer access leads to misidentification and ABO-incompatible transfusion

An agency nurse was looking after patients 1 (group O D positive) and 2 (group AB D positive) in ITU. For convenience she accessed the details of patient 2 on the computer at patient 1's bedside and left the screen open at this page. When patient 1 needed transfusion, she asked another member of staff to print a blood collection form for her. The blood collection form was printed according to the current screen and red cells were collected for patient 2. When the red cells arrived the agency nurse went to patient 1's bed and was not able to locate a name band on the wrist (the patient was wearing a legible name band on the ankle) so she checked the red cells against the computer, which was opened at the bedside (still patient 2's information) and set up the transfusion. Patient 1 developed respiratory difficulties, and was cold, clammy, sweaty and distressed. The transfusion was stopped and symptoms resolved after 30 minutes. It was then that the agency nurse noticed that the red cells taken down from patient 1 were crossmatched and labelled for patient 2.

COMMENTARY

As in previous SHOT reporting years, common causes of IBCT are: failure to update warning flags on the LIMS or transfer patient data from legacy computer systems, failure to notice (or heed) warning flags, and failure to consult the historical record. Component selection and manual transcription errors remain a risk when the LIMS is off-line. Failure to merge or reconcile LIMS records in patients with multiple hospital ID numbers and case records led to transfusion errors in 5 patients. There were several cases where laboratory scientists deliberately overrode warning flags or results from automated analysers in non-emergency situations, seemingly without understanding the significance of their action and the potential for harm. This is especially dangerous where electronic issue of red cells is performed. It is essential that all staff are fully trained and competency-assessed *before* using laboratory IT systems and automated analysers.

There were 9 cases where IT errors contributed to failure to transfuse irradiated blood and 3 cases involving transfusion of a CMV unscreened blood component. The 2 most common adverse outcomes reported were transfusion of antigen positive (or unscreened) red cells in patients with known alloantibodies (19 cases) and administration of components of the wrong group after SCT (11 cases, compared with 2 in 2008). Selection of the correct blood group for component transfusion after SCT can be complex and the reports reveal deficiencies in the knowledge of both BMSs and clinicians, often compounded by poor communication. It is good practice to produce, in advance, a clear post-transplant transfusion plan for each patient, place appropriate notes on the LIMS and the case record, and ensure that transfusion request forms indicate that the patient has undergone SCT. This report repeats the recommendation to exhibit all clinically essential warning flags on the opening screen.

Forty-six of the IT-error cases reported to SHOT this year originated in the laboratory (75%). Twelve (20%) of IT-related IBCT occurred outside 'core' laboratory working hours. Eight (13%) occurred in emergency situations but 40 (66%) involved staff working regularly in the laboratory. This distribution is almost identical to 2008. For comparison, a large survey of transfusion practice in two UK regions also showed that 25% of transfusion requests are processed 'out of hours'.[25] The survey showed that 20% of requests in normal working hours and 37% of out-of-hours requests were 'urgent' (required within 1 hour). Although most errors are made by regular transfusion laboratory staff during 'normal working hours', 5 of the 12 incidents (42%) occurring outside core laboratory hours involved scientists who do not work routinely in the transfusion laboratory (a locum in one instance) and most of these cases involved failure to notice or heed warning flags.

As electronic 'blood tracking' systems enter more general use, SHOT is receiving reports of their misuse leading to IBCT. The case of a clinician, not trained or competency-assessed in the process, who accessed the electronically controlled blood fridge and transfused an inappropriate blood component is included to highlight how the 'human element' can compromise transfusion IT systems. There were 7 other cases where clinical staff or porters ignored warning notices when removing red cells from a blood fridge with electronic tracking. In 3 cases, red cells were transfused after their expiry date (not identified on the bedside check). The recent BCSH Guideline on Administration of Blood and Blood Components[19] emphasises the importance of reporting errors relating to blood tracking and bedside IT systems to haemovigilance schemes.

Problems with temperature monitoring systems leading to IBCT

Eleven cases (not included in Table 23) were reported in which problems with electronic temperature monitoring systems, or failure to respond correctly to alarms, led to the transfusion of blood components that had been stored out of controlled temperature range. Ten cases involved red cells stored in blood refrigerators and 1 case involved platelets. Although these cases do not fit into our usual definition of 'IT errors leading to IBCT' they exhibit common features worthy of comment.

In 5 cases the door of a blood fridge had been left ajar but had not been open far enough to trigger a door alarm (where fitted). In most of these the fridge was fitted with an air temperature alarm designed to trigger at 8°C, which was not exceeded, but no core temperature alarm was fitted. Subsequent temperature chart analysis showed that the core temperature had exceeded 6°C. Discovery of the rise in core temperature was delayed by failure to follow local SOPs in some cases. In 2 cases an alarm was activated but only rang in the local area where staff did not take appropriate action or alert the transfusion laboratory. This led to the wastage of large quantities of blood and the transfusion of 9 units of red cells that had been out of temperature control for short periods of time (none resulted in a clinical adverse reaction). In a report involving platelets, air-conditioning in the transfusion laboratory failed on a hot night and corrective action was delayed. A pack of platelets on the laboratory agitator overnight was erroneously issued, contrary to local SOP. The laboratory has since purchased a platelet agitator with a temperature-controlled incubator.

In response to clarification by MHRA, blood fridges are now being fitted with core temperature monitors designed to alarm immediately at 2°C and 6°C. Wherever possible, fridge alarms should be designed to alarm in a permanently manned location, preferably the transfusion laboratory. All relevant staff must be aware of the significance of fridge alarms and take immediate action according to local protocols. Alarms should be tested regularly. As well as a check on audibility and visibility, appropriate response to the alarm should be tested. Components that have been exposed to temperatures outside the designated range should be removed from accessible storage locations immediately to prevent inappropriate transfusion. 'Mock recalls' of units should take place regularly to ensure a functional process is in place.

Improving Laboratory Standards (based on data from 2009 and previous reporting years)

- SHOT endorses the recommendations of the UK Transfusion Laboratory Collaborative with regard to hospital transfusion laboratory staffing, technology, training and competencies.[10,11] Incidents analysed in this and previous SHOT reports add weight to the Collaborative's recommendations for training programmes and annual competency-assessment for all staff who work at any time in the transfusion laboratory. There is emphasis on maintaining competency, including familiarity with local protocols and systems, of staff working intermittently in transfusion. SHOT fully supports the routine use of 'walk away' automation, used 24/7, to eliminate manual errors and the use of 'electronic issue' of red cells, where the LIMS fully meets national guideline standards. Full 'vein to vein' electronic blood tracking where remote issue of blood components is introduced, will make a significant contribution to transfusion safety. Adequate resources will need to be made available for these improvements to occur.

- Work should continue with suppliers of laboratory information management systems to improve the capability of IT systems to generate warning flags and implement component selection algorithms based on data incorporated in the component label.

- Frequent reconciliation, or linking, of multiple computer records on the same patient is important for safe practice (a clear historical trail of all amendments to the records must be maintained to comply with BSQR). This should be a routine laboratory process that can be performed by appropriately trained and competency-assessed senior staff.

- The problem of multiple hospital numbers and case records could be reduced by routine use of the unique NHS number as a primary patient identifier in line with the recommendation from NPSA Safer Practice Notice 24.[18]

- When new laboratory IT systems are installed, patient data from the old system should be transferred to the new system. Wherever possible this should be done electronically to avoid transcription errors.

- When laboratory IT systems are 'off-line' non-essential transfusions should be avoided. Robust manual back-up procedures and recovery plans must be in place and tested. Manual transcription of results should be held to an essential minimum.

- Laboratory IT systems should ensure that 'warning flags' are prominently displayed, preferably on the opening screen. Where appropriate (e.g. criteria for electronic selection) it should not be possible to override or bypass flags. Alert systems should not prevent the issue of clinically appropriate components of a different group to the patient (such as after stem-cell transplantation).

- Transfusion laboratories should have access to the hospital Patient Administration System (PAS) and the ability to review haematology results on-line (ideally on the same screen).

- All laboratories using electronic selection to issue red cells must ensure that their SOPs are consistent with national guidelines and followed fully by all laboratory staff.[23] The computer algorithms in use must prevent issue outside the guidelines.

- IT systems to support transfusion safety, monitoring and traceability outside the laboratory (e.g. blood tracking systems and bedside ID systems) should integrate with laboratory systems and processes. Laboratory staff must understand the working of these systems and be trained and competency-assessed to react appropriately to alarms and warnings and provide support and advice to clinical areas on a 24/7 basis. All clinical staff using these systems must be trained and competency-assessed. This is crucially important in clinical areas, such as operating theatres and delivery suites, where rapid access to emergency blood stocks is essential.

RECOMMENDATIONS

Recommendations for this year's report

- Failure of laboratory staff to identify or heed the historical record on LIMS remains an important cause of IBCT. There are a worrying number of cases reported to SHOT where laboratory staff are able to override a warning flag or a result on an automated analyser without clearly understanding the significance of their action or the potential for harm – a particular problem when blood is released by electronic issue. Lead BMSs for the transfusion laboratory, with appropriate support from senior management in the organisation, must ensure that all users of laboratory information management systems are trained and competency-assessed before using laboratory IT systems or automated analysers.

  Action: Lead BMS for hospital transfusion laboratories, transfusion laboratory managers

- Selection of blood components of appropriate blood group after allogeneic stem-cell transplantation can be complex. The recommendation is that transplant teams, in collaboration with the transfusion laboratory and/or transfusion centre, produce a post-transplant transfusion plan for each patient, ensure appropriate notes on the LIMS and the case record, and ensure that transfusion request forms indicate that the patient has had a transplant.

  Action: Transplant teams, hospital transfusion laboratories, HTTs

Recommendations from previous years

Year first made	Recommendation	Target	Progress
2008	Standardisation of IT systems is required across the UK. A national minimum specification for hospital transfusion laboratory IT systems should be developed. This would then be used when working with individual suppliers of LIMS systems.	**NBTC and equivalents in devolved administrations**	The recommendation is now re-targeted to the newly formed IT subgroup of the NBTC.
2008	Chief Executive Officers of hospitals and Trusts must use the National Transfusion Laboratory Collaborative report as a basis for achieving the minimum standards recommended for staffing, skill mix, automation, training and competency in their hospital transfusion laboratories.	**Trust CEOs, HTTs**	NTLC Report circulated to all CEOs in England, Wales and Northern Ireland in 2009, and under consideration by SCTAC. Report published in *Transfusion Medicine*, September 2009.
1998	IT as an aid to transfusion safety should be assessed and developed at national level.	**NBTC IT WG, NPSA/NBTC/ SHOT initiative, CfH**	Coordination now achieved between NBTC, NPSA, CfH. National standard specification under development. Implementation is dependent on central funding through CfH or by individual Trusts.