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GUIDELINES

The administration of blood and blood components and the management of transfused patients

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Errors in the requesting, supply and administration of blood lead to significant risks to patients. A survey of hospital blood transfusion laboratories in the UK in 1993 revealed 111 instances of blood being transfused to the wrong patient in an 18-month period (an incidence of 1 in 30 000 units transfused); 6 patients died and another 6 had serious morbidity associated with ABO-incompatible transfusions (McClelland & Phillips, 1994). A similar fatality rate was found in the United States (equivalent to approximately 1 in 500 000 units of blood transfused) (Linden *et al*., 1992). These deaths were due to errors either in the collection or labelling of the sample for blood grouping and compatibility testing, or in the laboratory, or to failure of the final pretransfusion checks. The incidence of 'wrong blood' episodes has changed little over several decades. This contrasts with the dramatic reductions in other hazards of transfusion such as viral transmission (Aubuchon & Kruskall, 1997).

Variation in the practice of the administration of blood is becoming increasingly evident from audit, both local and national (Waters *et al*., 1998), and from the first report of the Serious Hazards of Transfusion (SHOT) initiative (Williamson *et al*., 1998). There are no recognized guidelines on which to base local procedures for the ordering and administration of blood and the management of transfused patients. In some hospitals, written procedures do not exist at present (Waters *et al*., 1998). Advice on some aspects of the administration of blood can be found in other British Committee for Standards in Haematology (BCSH) guidelines (BCSH, 1990, 1996a), and elsewhere (Blood Transfusion Services of the United Kingdom, 1996; Mallett & Bailey, 1996), but there is no single authoritative and comprehensive source supported by medical and nursing professional opinion.

This is a document produced by the BCSH in collaboration with the Royal College of Nursing and the Royal College of Surgeons of England to set out the principles from which local policies and written procedures can be developed for:

- requests for blood transfusion and the collection of blood samples for pretransfusion compatibility testing
- the collection of blood and blood components from the hospital blood bank or other storage site and their delivery to the ward, operating theatre or other clinical area where the transfusion is to be given
- the administration of blood and blood components
- the documentation of transfusions
- the care and monitoring of transfused patients
- the management and reporting of adverse events
- the staff responsible and the training required for these procedures

It should be emphasized that there is little evidence to prove the efficacy of specific procedures to improve the safety of blood ordering and administration. The following represents a summary of current professional opinion.

(A) REQUESTS FOR BLOOD TRANSFUSION AND THE COLLECTION OF BLOOD SAMPLES FOR PRETRANSFUSION COMPATIBILITY TESTING

Inadequate patient identification or sample labelling may lead to ABO-incompatible transfusions (Williamson *et al*., 1998; Sazama, 1990). Mistakes made in requesting blood may result in failure to provide the correct type of blood component, e.g. gamma-irradiated, CMV-seronegative (Williamson *et al*., 1998).

Common errors occur in:

1 Patient identification, leading to a blood sample for blood grouping being taken from the wrong patient, or

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blood being transfused to the wrong patient, because of:
• failure to ask the patient for his/her identification details
• the use of secondary identifiers such as bed number, or the hospital notes or the request form the patient is carrying
• failure to use patient identification wristbands
• the failure to issue a patient identification number at the patient's initial contact with the hospital
2 Sample labelling
• prelabelling of the sample tube
• failure to label the sample from one patient before taking the sample from the next
3 Requesting blood
• failure to indicate special blood requirements on request forms, e.g. gamma-irradiated
4 Blood bank records
• failure to check the previous patient record for blood group or for the presence of antibodies
• failure to check the previous patient record for any requirement for special blood components, e.g. gamma-irradiated
5 Telephone requests
• failure to provide adequate information in terms of patient identification, number and type of blood or blood components required.

Recommendations

Hospitals must have policies for blood transfusion requests and the collection of blood samples for pretransfusion compatibility testing. They must cover the following items:
1 Definition of the staff authorized to request blood and to take and submit samples for pretransfusion testing.
2 Request form

The request form must contain full patient identification details, i.e. surname, first name, date of birth, the gender of the patient, and a **patient identification number**, which depending on the circumstances will be a hospital, accident and emergency number or major accident number (BCSH, 1996a). Even better would be use of a unique number for patient identification such as the NHS number.

It is recommended that hospitals should avoid issuing more than one patient identification number during one admission to hospital. If a new patient identification number is issued, a new sample should be sent for pretransfusion compatibility testing and the laboratory informed so that the blood bank computer records of the patient can be merged.

The request form should also contain other information, including:
• the **location of the patient** at the time of the request, and also where the blood should be sent, if different
• the **number and type of blood or blood components**, including any special requirements, and the time and date they are required
• information about the **past obstetric and transfusion history** of the patient should be provided wherever possible, and is essential when there are anomalous pretransfusion testing results
• the patient's **diagnosis**
• the **reason for the request**

It is also recommended that request forms should incorporate guidelines for the indications for the use of blood, and blood components to facilitate education of clinicians ordering transfusions and improve compliance with clinical transfusion guidelines (Cheng *et al*., 1996b).
3 Requesting of special blood requirements

Special blood requirements should be stored on the hospital blood bank computer, and hospital blood bank staff should check whether there are any special requirements whenever blood or blood components are requested.

Hospitals must have a policy for the requesting of special blood requirements. In general, it is preferable that any special blood requirements are indicated on the blood transfusion request form each time blood or blood components are requested. However, the responsibility for providing special blood could be devolved to the hospital blood bank for transfusions to patients where special blood is always required, e.g. gamma-irradiated for intrauterine transfusions, and for transfusions to patients requiring special blood or blood components on a regular basis, e.g. haematology patients.
4 Patient identification

Positive identification of the patient is essential, based on:
• questioning the patient by asking their surname, first name and date of birth in the case of patients who are judged capable of giving an accurate, reliable response
• checking that the details on the patient's identification wristband match those on the request form and the answers to the questions above

It is recommended that hospitals should have a policy for identifying inpatients, and patients undergoing daycase procedures such as blood transfusion or surgery with identification wristbands. The wristband should contain the patient's surname, first name, gender, date of birth and patient identification number. If the wristband is removed, for example to insert a cannula, it should be the responsibility of the person removing the wristband to resite the identification band.

All patients including unconscious patients must have a patient identification number and

identification wristbands including this number and the gender of the patient as minimum patient identifiers. When additional identification details become available, the hospital blood bank must be informed.

5 Venepuncture

Only one patient should be bled at a time to minimize the risk of error.

6 Sample labelling

• **the sample tube must be labelled immediately after the blood has been added** by the person taking the sample

• **sample tubes must not be prelabelled**

• **the sample tube must be labelled with the minimum patient identification** of surname, first name, date of birth, the gender of the patient, and patient identification number, and be signed by the person taking the sample, as set out in the BCSH Guidelines for Pre-Transfusion Compatibility Procedures in Blood Transfusion Laboratories (1996a)

• **addressograph labels must not be used for sample labelling** as these are more likely to result in inadequate patient identification (Lumadue *et al*., 1997; Cummins *et al*., 1998; Sharp & Cummins, 1998)

• date sample collected

7 Inadequately completed request forms, inadequately labelled samples, and discrepancies between the information provided on the request form and sample

• **the hospital blood bank should have policies for dealing with inadequately completed request forms, inadequately labelled samples, and discrepancies between the information provided on the request form and sample,** involving the retaking of the sample or providing additional information

• if one or more of the patient identifiers is not provided on the sample in a life-threatening situation, group O blood should be issued until a correctly labelled sample is provided. If the patient is a premenopausal female, O RhD-negative blood should be issued (BCSH, 1996a)

8 Blood Bank patient records

Duplicate patient records must be avoided in the hospital blood bank otherwise essential transfusion requirements may be overlooked (BCSH, 1996). If a computer system is in use, the user must be alerted at the entry of the request that there is an existing record for a patient with the same name and date of birth; if a computer system is not in use, manual records should be checked by name and date of birth.

The hospital blood bank must verify the patient's ABO and RhD group against previous records for the patient, and any discrepancies should be resolved before blood or blood components are issued.

9 Telephone requests

• the hospital blood bank should have a policy for documenting telephone requests

• the identity of the person making the request and the person receiving it should both be recorded

• the following information should be provided: (i) patient's surname, first name, patient identification number; (ii) location; (iii) the number and type of blood or blood components required, including any special requirements; (iv) the reason for the request; (v) the time and date the blood or blood components are required

(B) COLLECTION OF BLOOD OR BLOOD COMPONENTS FROM THE HOSPITAL BLOOD BANK OR BLOOD TRANSFUSION ISSUE REFRIGERATOR AND ITS DELIVERY TO THE WARD OR OPERATING THEATRE

Withdrawal of blood and blood components from the storage location was identified as a major source of error in the transfusion of the wrong blood in the 1996/97 SHOT report (Williamson *et al*., 1998). Multiple errors were found to contribute to two-thirds of such incidents, and collection of the wrong blood was the most frequent site of the first error. Most errors at the time of collection occurred because the blood was not checked for identity with the patient, but there were some even when it was personally handed from blood bank staff to a porter or a member of the clinical team.

Recommendations

Hospitals should have a policy for the collection of blood or blood components from the hospital blood bank or other blood transfusion issue refrigerator and its delivery to the ward, operating theatre or other clinical area where the transfusion is to be given, and it should cover the following items:

1 The staff responsible for this procedure.

2 Blood must be stored only in blood transfusion refrigerators, and not in ward or domestic refrigerators.

3 Blood must only be stored or transported in boxes designated for this purpose and which have been verified as satisfactory for transporting blood, including the time for which storage is satisfactory. It is good practice for hospital blood banks to record the time when blood was placed into a box, the time for which storage will be satisfactory and to indicate that blood should be returned to a blood transfusion refrigerator if it is not used within that time.

4 Patient and blood/blood component identification check

• **the staff member removing blood from the hospital blood bank or other blood transfusion issue refrigerator must have documentation containing the**

patient's identification details (surname, first name, date of birth and patient identification number), by means of a blood collection slip, prescription chart or the patient's notes

• if a telephone request is given to a porter to collect blood, the porter must be given the patient identification details so that he/she can write these on to a blood collection slip, and in addition should be given the location of the patient and the degree of urgency that the blood or blood component is required

• **the patient identification details** (surname, first name, date of birth and patient identification number) **on the collection slip, prescription chart or in the patient's notes must be checked** by the staff member removing blood from the hospital blood bank or other blood transfusion issue refrigerator with: (i) the patient identification details on the blood transfusion compatibility report form; (ii) the patient identification details on the compatibility label attached to the pack

• **the blood or blood component unit identification details** (blood group and unit number) **must be checked** with: (i) the details on the blood transfusion compatibility report form; (ii) the details on the compatibility label attached to the unit

• **withdrawals of blood from each blood transfusion issue refrigerator should be documented**, including the name of the staff member and the time the blood was removed

• **when blood and blood components are delivered to a ward or operating theatre, a member of appropriately trained staff should check that the correct blood has been delivered** and sign the blood collection slip including the time of delivery

• the blood collection slip should be retained for at least 1 month

5 Commencement of transfusion following its delivery to the ward or operating theatre

The transfusion of blood and blood components should begin as soon as possible after delivery to the ward or operating theatre. If this is not possible, it should be returned to a blood transfusion refrigerator with the time of return documented. The transfusion of platelet concentrates and fresh frozen plasma should commence as soon as possible to preserve the maximum activity of the platelets or coagulation factors.

If a unit of blood has been out of the refrigerator for more than 30 min and there is no prospect of its imminent transfusion, the hospital blood bank should be informed that it has been unrefrigerated for more than 30 min, and the blood returned to the hospital blood bank for disposal because of the risk of bacterial growth (Blood Transfusion Services of the United Kingdom, 1996).

To avoid wastage of red cell concentrates, only one unit of blood should be removed from a blood transfusion refrigerator at a time for each patient unless extremely rapid transfusion of large quantities of blood is needed.

(C) ADMINISTRATION OF BLOOD AND BLOOD COMPONENTS

Errors at the time of administration of blood or blood components are the most frequent documented site of error culminating in the transfusion of the wrong blood (McClelland & Phillips, 1994; Sazama, 1990), However, preceding errors in blood sampling, laboratory procedures and especially in withdrawal of blood units from storage fridges were found to be an important contributory factor in many of the incidents (Williamson *et al.*, 1998).

Recommendations

Hospitals should have a policy for the administration of blood and blood components which should cover the following items:

1 The staff responsible for different aspects of this procedure. Blood and blood components are viewed as medicines for administration purposes, and prescribed medicines should only be administered by a doctor, or a nurse holding current registration of the UKCC Professional Register as a Registered General Nurse (RGN), Registered Sick Children's Nurse (RSCN) or Registered Midwife (RM).

2 Prescription of blood and blood components

The prescription of blood and blood components is the responsibility of a doctor. Blood and blood components should be prescribed on prescription sheets for intravenous fluids or on special transfusion prescription sheets; it is essential that the prescription sheet should contain the patient identification details (surname, first name, date of birth, the gender of the patient, patient identification number).

The prescription must specify:

• the blood or blood component to be administered, including any special requirements, e.g. gamma-irradiated, CMV-seronegative

• the quantity to be given

• the duration of the transfusion (usually 2–3 h for red cell concentrates, and 30 min for an adult therapeutic dose of platelets or a unit of fresh frozen plasma)

• any special instructions, e.g. any medication required before or during the transfusion

3 Patient information

Blood transfusion must be treated like any other prescription, i.e. patients should be informed of the indication for blood transfusion, its risks and benefits

and have the right to refuse to receive it. The patient should be given information about alternatives to blood transfusion, including autologous transfusion. However, signed consent is not required.

It is helpful to provide patients with an information sheet outlining the risks and benefits of blood transfusion. For example, the National Blood Service has produced a patient information leaflet, but locally produced information has the advantage of taking into account the local availability of services such as autologous transfusion.

4 Inspection of the blood or blood component

It has been recommended (BCSH, 1996) **that the hospital blood bank staff should check the expiry date and inspect blood and blood components before issue** with particular attention to:

- the integrity of the pack by checking for leaks at the ports and the seams
- evidence of haemolysis in the plasma or at the interface between red cells and plasma
- evidence of unusual discoloration or turbidity
- the presence of large clots

If there is evidence of any of the above, the unit should not be used and should be returned to the issuing Blood Transfusion Centre.

It is good practice for the staff administering blood or blood components to inspect each unit in a similar way before its transfusion, and to return the unit to the hospital blood bank if any defects are found.

5 Identity check of patient and unit of blood

The bedside check is a vital step in preventing transfusion error, and staff must be vigilant in checking the patient's identification details match those on the blood transfusion report form, and the compatibility label attached to the blood pack. This procedure has traditionally involved two members of staff, with at least one being a qualified nurse or doctor. However, this is a controversial area, and it has been argued that one responsible member of staff would more reliably carry out the procedure correctly than two (Linden & Kaplan, 1994). Two members of staff may rely upon the other to be rigorous, resulting in neither giving the task their full attention.

It is recommended that one member of staff should be responsible for carrying out the identity check of the patient and the unit of blood at the patient's bedside. The member of staff must be a doctor, or a nurse holding current registration of the UKCC Professional Register as a Registered General Nurse (RGN), Registered Sick Children's Nurse (RSCN) or Registered Midwife (RM).

It is recommended that the procedure should have the following steps:

- **the patient must be positively identified** by asking his/her surname, first name and date of birth (whenever possible) and make sure that the surname and first name are the same as on the patients identity bracelet. **It is essential that any patient having a blood transfusion has an identification wristband** with the patient's surname, first name, gender, date of birth and patient identification number.
- **the following details (surname, first name, gender, date of birth, patient identification number) must be checked** and found to be **identical** on: (i) **the patient's identification wristband; (ii) the blood transfusion compatibility report form; (iii) the compatibility label attached to the blood pack; (iv) the prescription chart; (v) the medical notes**
- the **blood group** and **unit number** put by the Transfusion Service on **the unit of blood or blood component** must be checked and found to be identical to that on the blood transfusion **compatibility report form**
- the **blood group on the unit** must be compatible with **the blood group of the patient indicated on the compatibility label attached to the blood pack**. If the blood group of the unit and the patient are not identical, e.g. group O blood to a group A patient or RhD-negative blood to an RhD-positive patient, the hospital blood bank should make a specific comment on the compatibility report form to indicate that the blood is compatible
- the unit of blood or blood component must be checked for compliance with any **special requirements** on the prescription sheet, e.g. gamma-irradiated, CMV-seronegative
- the unit of blood or blood component must be checked to ensure it has not passed its **expiry date**, or expiry time in the case of components with a short shelf-life, e.g. washed red cell and platelet concentrates
- the **blood transfusion compatibility report form and/or the blood transfusion prescription sheet** must be signed by the member of staff carrying out the identity check and the date and time of the commencement of the transfusion of each unit of blood or blood component indicated on both

If any discrepancies not covered by a comment on the blood transfusion compatibility report form are found during the bedside identity checking procedure, the unit of blood or blood component must not be transfused. The hospital blood bank should be informed and the unit and the blood transfusion compatibility report form returned to the blood bank.

6 Location of the blood transfusion compatibility report form

The blood transfusion compatibility report form must be readily available during the transfusion; the ideal location may vary from one clinical area to another, but each should have a policy for the location of the compatibility report form until the transfusion is

completed, when it must be fixed in the patient's medical notes as a permanent record of the transfusion.

(D) SOME TECHNICAL ASPECTS OF THE ADMINISTRATION OF BLOOD AND BLOOD COMPONENTS

1 Blood should be transfused through a sterile giving set designed for the procedure. A standard blood or platelet administration set should be used for the transfusion of platelet concentrates. Platelets should not be transfused through giving sets which have been used for blood. Special paediatric giving sets should be used for transfusions to infants, or a screen filter used if the transfusion is being administered by syringe.

Electronic infusion pumps may damage blood cells, and should not be used for the administration of red cells unless they have been verified as safe to use for this purpose according to the manufacturer's instructions.

2 There is no minimum or maximum size of cannula for transfusion. The size of cannula chosen should depend on the size of the vein and the speed at which the blood is to be transfused.

3 Blood should only be warmed using a specifically designed commercial device with a visible thermometer and audible warning; blood and blood components must not be warmed using improvisations such as putting the pack into hot water, in a microwave or on a radiator (Blood Transfusion Services of the United Kingdom, 1996).

A blood warmer is indicated:

- at flow rates of $>50\,mL\,kg^{-1}\,h^{-1}$ in adults, $>15\,mL\,kg^{-1}\,h^{-1}$ in children, and for exchange transfusions in infants
- when transfusing patients with clinically significant cold agglutinins

4 Drugs must not be added to blood under any circumstance.

5 Changing the giving set

- a new giving set should be used after the transfusion has run for more than 12 h in order to prevent bacterial growth
- a new giving set should be used if another infusion is to continue after the transfusion

6 Completing the transfusion

- the empty bag should be discarded according to the hospital policy for disposing of clinical waste. Retention of empty blood bags for a period of 48 h after transfusion has been previously recommended (BCSH, 1990), so that they are available if a severe transfusion reaction occurs some hours after discontinuation of the transfusion. This can be considered to be good practice, but it is cumbersome to implement and the benefits are uncertain
- the blood transfusion compatibility report form should be filed in the patient's notes

(E) THE CARE AND MONITORING OF TRANSFUSED PATIENTS

The most basic principle of patient care during transfusion is to ensure the patient's safety. Patients receiving transfusions should be monitored for signs of the potential complications of transfusion and any suspected problems dealt with swiftly and efficiently. There is wide variation in the frequency of nursing observations during transfusion (Waters *et al*., 1998), and it is not clear what the optimum type and frequency of observations should be. Severe reactions are most likely to occur within the first 15 min of the start of each unit, and patients should be most closely observed during this period.

Recommendations

Hospitals should have a policy for the care and monitoring of patients receiving transfusions of blood and blood components. The policy should clearly define the following:

1 The staff responsible for the care and monitoring of transfused patients.

2 The information to be given to patient about possible adverse effects of transfusion, and the importance of reporting immediately any adverse effects, including shivering, rashes, flushing, shortness of breath, pain in extremities or in the loins.

3 Visual observation of the patient is often the best way of assessing patients during transfusion. Transfusions should be given in clinical areas where patients can be readily observed by members of the clinical staff.

4 The start and finish times of the infusion of each unit should be clearly indicated on observation charts.

5 Vital signs (temperature, pulse and blood pressure) should be measured and recorded before the start of each unit of blood or blood component, and at the end of each transfusion episode.

6 Vital signs related to transfusion should be recorded separately from routine observations and clearly dated to enable the information to be retrieved later, if necessary. Routine observations should be continued on unconscious patients in operating theatres and ITU.

7 Temperature and pulse should be measured 15 min after the start of each unit of blood or blood component.

8 Further observations during the transfusion of each unit of blood or blood component are at the discretion of each clinical area and need only be taken should the patient become unwell or show signs of a transfusion reaction.

9 Unconscious patients are more difficult to monitor for signs of transfusion reactions. Routine observation

patterns should continue. Transfusion reactions should be considered when assessing a change or deterioration in the patient's condition, particularly during the first 15–20 min following the start of a unit of blood or blood component. Hypotension, uncontrolled bleeding due to disseminated intravascular coagulation, haemoglobinuria or oliguria may be the first indications of an acute haemolytic transfusion reaction in these patients.

(F) THE MANAGEMENT AND REPORTING OF ADVERSE EVENTS

Many of the serious adverse events following blood transfusion are unpredictable. The most important are acute and delayed haemolytic transfusion reactions, febrile (nonhaemolytic) transfusion reactions, urticaria and anaphylaxis, transfusion-related acute lung injury (TRALI), post-transfusion purpura (PTP), transfusion-associated graft-vs.-host disease (TA-GvHD) (BCSH, 1996b), and transmission of infection (Appendix 1).

Recommendations

Hospitals should have a policy for the management and reporting of adverse events following transfusions of blood and blood components, and it should include the following:

1 The staff responsible for this procedure.

2 If a transfusion reaction is suspected because the patient complains of symptoms or there are changes in observations, a member of the medical staff should be contacted immediately, and the patient's temperature, pulse and blood pressure should be recorded. Further management depends on the type and severity of the reaction. Some examples of transfusion reactions and their management are given in Appendix 1.

3 If a severe reaction is suspected:

- the transfusion should be stopped and urgent medical advice sought
- the blood administration set should be changed and venous access maintained using normal saline running slowly to keep the vein open
- the reaction should be reported immediately to the hospital blood bank. The laboratory will request the return of the implicated unit and further blood samples from the patient
- nursing observations should be carried out at regular intervals
- the volume and colour of any urine passed should be recorded

4 Reporting of adverse events

Hospitals should have a policy for recording and reviewing adverse events related to blood transfusion, including 'near misses', which should take into account:

- all adverse events related to blood transfusion should be reported to the hospital blood bank
- if a severe reaction is suspected, medical advice from a haematologist should be sought
- adverse events related to blood transfusion should be reviewed by the Hospital Transfusion Committee
- serious noninfectious adverse events (incorrect blood or blood component transfused, acute and delayed transfusion reactions including anaphylaxis, TA-GvHD, TRALI, PTP) should be reported to the SHOT scheme
- suspected cases of transfusion-transmitted infection should be reported immediately to the local Transfusion Centre

(G) THE DOCUMENTATION OF TRANSFUSIONS

Good documentation of transfusions is essential, for example so that the cause of serious adverse effects can be adequately investigated and audit of the indication for transfusions can be carried out.

Recommendations

1 Medical notes

A permanent record of the transfusion of blood and blood components and the administration of blood products must be kept in the medical notes including:

- **the blood transfusion compatibility report form**
- **the sheets used for the prescription of blood or blood components and for nursing observations during the transfusion**
- **an entry in the case notes, describing the indication for the use of blood or blood components, the date, the number and type used, whether or not it achieved the desired effect and the occurrence and management of any adverse effects**

2 Audit trail

All documentation related to the administration of blood other than that held in the medical notes (see above) must be retained for at least 1 month, including the request form (Working Party of the Royal College of Pathologists, 1995); the same should apply to the documentation used for the collection of blood from a blood bank refrigerator. The blood sample for compatibility testing should be kept for 1 week. Hospital blood banks are required to keep records such as worksheets, blood bank registers and refrigerator and freezer charts for at least 11 years (BCSH, 1991).

(H) THE STAFF RESPONSIBLE FOR BLOOD TRANSFUSION AND THE HANDLING OF BLOOD

Many groups of staff are involved in one or more aspects of blood transfusion. Some procedures are specific to one

staff group, but many can be carried out by more than one. Local guidelines should define the responsibilities of each staff group, and the skills required including basic literacy and numeracy.

A typical definition of responsibilities could be that:

1 Medical staff are solely responsible for prescribing blood, blood components and blood products and for ensuring adequate documentation of blood transfusion in the medical notes.

2 Medical and/or nursing staff may carry out the following actions (depending on local guidelines) and be responsible for:

- requesting blood, blood components and blood products
- taking blood samples for compatibility testing
- explaining the risks and benefits of blood transfusion to patients
- carrying out the procedure for the administration of blood and blood components
- monitoring patients during transfusion, and carrying out the appropriate actions in the event of adverse effects
- reporting of transfusion reactions or other incidents related to transfusion

3 Phlebotomists' responsibilities are restricted to:

- taking blood samples for compatibility testing

4 Porters' responsibilities are restricted to:

- the collection of blood, blood components and blood products. **It is emphasized that this is a vital role, and errors in blood collection have been identified as an important cause of administration of the wrong blood** (Williamson *et al*., 1998).

5 Staff in the hospital blood bank are responsible for:

- ensuring that the labelling of request forms and blood samples comply with local guidelines
- blood grouping and compatibility testing
- checking whether there are any special requirements whenever blood or blood components are requested
- ensuring that blood and blood components are properly labelled, and the identification details of the patient and the blood to be transfused are the same on the compatibility label attached to the pack and the blood transfusion report form
- the investigation and reporting of transfusion reactions or other incidents related to transfusion

6 The Trust Management Board is responsible for:

- ensuring that health care professionals are informed of and follow Trust policies on blood transfusion through its arrangements for clinical governance (Department of Health, 1998). One identifiable member of staff should be appointed by the Board to be responsible for setting local policies for blood transfusion and organizing the training of the staff involved in transfusion policies and procedures

7 The Hospital Transfusion Committee is responsible for:

- reviewing transfusion policies and procedures
- reviewing the arrangements for training of staff in transfusion policies and procedures
- reviewing adverse transfusion events including 'near misses'
- reviewing the appropriateness of blood transfusion, and making recommendations about the proper use of blood and blood components
- recommending corrective action in transfusion practice, where indicated
- promoting continuing education in transfusion medicine for all relevant members of staff

(I) TRAINING

To be effective, local blood transfusion guidelines must reach the staff groups for whom they are intended.

Recommendations

1 One identifiable member of staff should be responsible for setting local policies for blood transfusion, and ensuring that staff involved in blood transfusion receive adequate training. This process should be subject to regular quality assurance.

2 Training in blood transfusion policies and procedures must be included in induction programmes for medical and nursing staff, porters, hospital blood bank laboratory staff, and any other staff involved in transfusion such as operating department personnel.

3 Regular updates should occur for all staff as part of the hospital's training and risk management programmes.

4 A register of staff attending induction programmes and updates should be held and monitored by the risk management team.

5 Regular audit should be carried out using random questionnaires that tested staff knowledge of transfusion policies. Any deficiencies should be remedied by a specific training programme.

(J) USE OF INFORMATION TECHNOLOGY TO IMPROVE THE SAFETY OF THE ADMINISTRATION OF BLOOD

There has been considerable interest in the use of information technology to prevent errors in the clinical transfusion process, and in particular in the use of barcode labelling of patient identification wristbands to enable patient identification by hand-held scanners at the time of collection of samples for compatibility testing and at the time of administration of blood and blood components.

Additional refinements to such systems could include the identification of staff carrying out the administration of blood, the recording of nursing observations before and during the transfusion, and the printing of a report for the medical notes (Jensen & Crosson, 1996). Other possibilities for the increased use of information technology in blood transfusion include electronic ordering and remote electronic release of blood (Cheng *et al*., 1996a; Cox *et al*., 1997; Shulman, 1997).

These new developments have the potential to offer considerable gains in the security of the administration of blood. It is recommended that priority should be given to evaluating the suitability of these systems for introduction into routine transfusion practice in hospitals.

(K) OUT-OF-HOSPITAL BLOOD TRANSFUSION

A small number of transfusions are being carried out in community hospitals and in patient's homes. The following points should be considered in the planning of an out-of hospital transfusion service:

- a policy for community transfusion should be drawn up taking into account the recommendations made in this document for hospital transfusion
- the responsibilities for the various aspects of the transfusion must be set out, including overall responsibility for the service
- patients must be allocated a patient identification number to be used throughout the process of blood transfusion, including sample collection and the administration of blood
- patients receiving blood must have an identification wristband
- there must be a clear plan of action to be followed in case of an emergency or transfusion reactions
- training must be provided to all staff involved in out-of-hospital transfusion

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APPENDIX 1

*Complications of transfusion**

Problem	Cause	Timing in relation to transfusion and frequency of occurrence	Severity of resulting clinical condition, management and prevention
Acute complications			
Acute intravascular haemolysis of transfused red cells	ABO-incompatible transfusion, e.g. Group A blood into Group O recipient. Usually occurs due to simple clerical errors e.g. taking samples for compatibility testing from the wrong patient or transfusing blood to the wrong patient.	Often during first few mL of transfusion. Reported to occur in about 1 in 600 000 units transfused.	Mortality approx. 10% due to DIC and acute renal failure. Management: consider possibility of DIC and renal failure. Maintain the blood pressure and renal perfusion. Transfuse compatible red cells. Prevention: use safe documentation and checking systems for blood administration.
Febrile nonhaemolytic reactions	(1) Antileucocyte antibodies in patient, who has been pregnant or previously transfused, reacting against leucocytes in the transfused blood. (2) Cytokines in stored platelet concentrates.	Towards end of infusion or within hours of completing the transfusion. Frequency: 0·5–1% of red cell transfusions (more often in multitransfused patients). Becoming less frequent with increased use of blood and blood components with low leucocyte levels.	Unpleasant but not life-threatening. Treatment: paracetamol or other antipyretic.
Urticaria	Antibodies in patient to infused plasma proteins or infusion of allergens which react with IgE antibodies in the patient. More likely to occur with transfusions of platelets or plasma than with red cells.	During the transfusion. Frequency: 1–2% of transfusions.	Unpleasant but not life-threatening. Treatment: give chlopheniramine 10–20 mg i.v./i.m. Prevention: premedicate with chlorpheniramine 10–20 mg before transfusion in patients having recurrent episodes.

Anaphylaxis	In some cases antibodies are found in patient against IgA in the transfused blood; these patients are often deficient in IgA.	Very rare.	May be life threatening Management: maintain airway. Give adrenaline 0·5–1 mg i.m. and chlorpheniramine 10–20 mg by slow i.v. injection. Repeat the injection of adrenaline every 10 min until improvement occurs. Prevention: use washed red cells and platelets, plasma from IgA-deficient donors, or autologous blood.
Infective shock	Bacterial contamination of red cells or platelets with e.g. *Pseudomonas*, *Yersinia*, *Staphylococci*.	Usually during infusion of first 100 mL of the contaminated pack. Rare: 2 per million blood components transfused.	Very high mortality. Treatment: management of septicaemia. Fluids and intravenous antibiotics.
Transfusion-related acute lung injury (TRALI). Noncardiogenic pulmonary oedema	Donor plasma (usually from multiparous women) has antibodies to patient leucocytes. Clinically, there is an acute respiratory reaction with fever, cough, shortness of breath and typical appearances on the chest X-ray.	During or soon after transfusion. Rare.	May be life threatening Management: maintain airway. Manage as for acute respiratory distress syndrome.
Delayed complications Delayed haemolysis of transfused red cells	Patient has IgG antibodies to red cell antigens such as Rh, Kidd, Kell, Duffy because of previous pregnancies or transfusions. The antibodies are undetectable in the crossmatch, but further transfusion causes a secondary immune response resulting in delayed haemolysis.	5–10 days after transfusion. Less than 1 in 500 red cell transfusions.	Poorer than expected response to transfusion. Treatment: no treatment needed *per se*, but antibodies will be a problem for further transfusion. The hospital blood bank should record the presence of red cell antibodies in the patient's records, and this information should be available when compatibility testing is carried out in the future.
Transfusion-associated graft-versus-host disease (TA-GvHD)	Immune reaction of donor T cells against the recipient who is often immunodeficient, e.g. bone marrow allograft recipient, Hodgkin's disease, fetus receiving intrauterine transfusion. Clinically, there is fever, skin rash, liver and renal failure, and pancytopenia	4–30 days after transfusion Rare: approximately 1 in 750 000 units of cellular blood components transfused.	Usually fatal. Treatment: seek specialist medical advice. Prevention: gamma-irradiation of cellular blood components for susceptible recipients (see BCSH, 1996b).

Post-transfusion purpura	Immune-mediated thrombocytopenia, usually occurring in parous women. Antibodies against human platelet antigens (HPAs) are detectable in the patient's serum, usually anti-HPA-1a.	5–12 days after transfusion. Rare.	Thrombocytopenia is usually severe and may cause bleeding. Treatment: platelet transfusions are ineffective and the treatment of choice is high-dose intravenous immunoglobulin $0{\cdot}4\ g\ kg^{-1}$ body weight of the patient for 5 days. Prevention: for future transfusions, use HPA-1a-negative red cell and platelet transfusions. If HPA-1a-negative red cells are unavailable, use leucocyte-depleted red cells.
Post-transfusion viral infection	Viral infection in donor not detected by donor screening and testing.	Depends on virus: weeks or months post-transfusion. Frequency: <1 in 3 million for HIV, and <1 in 200 000 both for HBV and HCV.	Depends on virus. Management: seek specialist medical advice.
Iron overload	One unit of red cells contains 250 mg of iron. Patients receiving multiple transfusions are at risk.	After several years of frequent transfusions.	Causes liver and cardiac damage. Prevention: use desferrioxamine to increase iron excretion in patients likely to receive long-term transfusions.

*Adapted from *Handbook of Transfusion Medicine*, 2nd edn.