Chapter 28. Blood Banking and Transfusion Medicine

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This chapter discusses current practice in blood banking and transfusion medicine. The most contentious issues on this subject are safety of blood transfusion and availability of blood components for transfusion. Obviously, these two discussion points carry a different significance to medical practitioners in developed and developing countries, and this point should be kept in mind when interpreting transfusion-related literature. This chapter is divided into two sections. The first section deals with issues around blood donors, testing and processing of blood donations. The second section covers the use of blood components in a clinical setting and potential complications of transfusion. The chapter concludes with a brief list of further readings, which have also been used to compose this work.

Collection, Testing and Processing of Blood Donation

Blood Donors

The safety of blood transfusion starts from the selection of blood donors. Ideal blood donation is obtained from a panel of voluntary non-remunerated donors. This is the recommendation of the World Health Organisation, the International Federation of Red Cross and Red Crescent Societies. Voluntary donors are altruistic and their only motivation to donate is the desire to help potential recipients of transfusion. This ensures donor cooperation during the donor selection interview, where donors answer questions related to lifestyle and previous exposure to infections. Donor selection is considered a very important step in blood transfusion safety and voluntary donors guarantee this to a great extent. Another advantage of having a donor panel is that the same donors are repeatedly donating. Repeated testing of
subsequent donations ensures safety from microbial risks and also confirms blood groups.

Other less satisfactory types of donation include replacement donation where family and friends are asked to replace blood that was transfused to a particular patient and directed donations, where friends and family of a patient donate specifically for that patient’s use. Replacement and directed donations are not as safe as donations obtained from repeat voluntary donors and positive microbiology markers are more likely to be present in the former group. The practice of sending blood collection teams to busy places such as a University Campus or a crowded retail park requires careful consideration. This arrangement does not establish a relationship between donors and the collecting blood service. Blood services cannot obtain details of contacts and donors may not be available for future donations. In general, donor sessions should be predictable, accessible and targeting a reliable group of donors to ensure the development of a stable panel of donors over time. The retention of donors will depend on provision of pleasant session environments, expert and sympathetic staffs, who can gain donors’ trust and answer their concerns and queries.

Recruitment and retention of donors in enough numbers and management of donor panels, remain a major challenge not only in developing countries but also in some advanced societies. Difficulties include cultural beliefs towards blood donations, under development of altruism and charity work within the society, busy lifestyle and inaccessibility of donation sessions, and more importantly, the cost of such a programme. Implementation of an ideal system of safe blood donation requires a great deal of public awareness, Health Authority commitment and professional expertise. Such an ideal system has been achieved in the UK and France. It
is not complete in some other developed countries such as the USA, where paid donors are used for plasma collection and it is almost completely lacking in the majority of developing countries.

**Criteria for Donor Selection**

Donors are selected according to predetermined selection criteria. The purpose of these criteria is to ensure donor safety and minimise risks to recipients. These criteria vary slightly from one society to another to reflect local circumstances and potential health risks. Donor safety criteria include minimal body weight, age range, minimum donation interval, enquiries about cardiovascular disease and other health problems. Other criteria are used to ensure recipient safety. This type of criteria excludes donors who have hepatitis, HIV, other chronic infections or lead a high risk lifestyle, which includes homosexuality and IV drug abuse. Successful donor selection requires not only donor co-operation but also good communication from the blood services. Donors should be aware of the selection criteria and pre-donation information should be provided to allow self exclusion. At the donation sessions, donors are taken through a questionnaire based on the donor selection criteria and their haemoglobin is estimated. In the UK, physical examination of the donors is not carried out and donor sessions are not attended by medical staff. Donor selection guidelines, used in the UK, are available in the Red Book which is cited in the further reading section below.

**Complications of Donation**

Blood donation is usually safe and does not carry much pain to properly selected donors. However, possible complications include bruising at the venepuncture site. Risk of bruising could be reduced by improving staff
skills in venepuncture technique and the application of immediate sustained pressure at the needle site soon after the donation. Injuries to nerves and arteries are rare but more serious. However, long term sequels to these injuries do not usually follow. Faints following blood donation is common, especially in first time donors who have a low body weight. Faints usually respond to simple measures such as lying flat for a few minutes. Delayed faint sometime occurs after the donor leaves the donation session. This is more serious as it may expose the donors to environmental risks such as road traffic accidents. Such donors may not be allowed to donate.

**Donation Using Apheresis Technology**

Using apheresis machines, donors can donate specific blood components such as red cells, platelets or plasma. This technique is used to collect platelet concentrates and in the UK about 50% of the platelets used for transfusion are apheresis platelets. Apheresis is also used to collect plasma for the production of coagulation factors and immunoglobulin preparations. Collection of platelets or plasma by this method is associated with minimal loss of red cells and so the donors can be asked to donate more frequently than whole blood donors. Apheresis based donation takes longer a time than a whole blood donation and it exposes the donor to possible apheresis complications such as citrate toxicity.

**Testing of Blood Donation**

Two groups of laboratory tests are carried out for every donation. These include red cell serology and tests for microbiological markers. The red cell serology tests ensure identification of the donor’s blood group and absence of donor’s antibodies that may cause haemolysis of recipient red cells. These tests include ABO grouping,
RhD grouping, screening for the high titre anti-A and anti-B, especially in blood group O donors and detection of other irregular blood group antibodies that may cause haemolysis when transfused to recipients whose red cells are positive for the relevant antigen.

Blood donation is also subjected to microbiology tests, which usually includes testing for hepatitis B and C, HIV and syphilis. Other less common tests are carried out to detect cytomegalovirus, malaria and varicella zoster. The laboratory tests used for the detection of these infections are usually very sensitive but not necessarily specific; this is why such tests usually generate positive results that require confirmation by a second confirmatory test. The confirmatory test has to be specific enough to determine the fate of the donation. The first group of screening tests either test for the presence of the microbial agent such as HBsAg, or more commonly, to test for the presence of antibody to the microbial agent such as anti-HIV1&2, anti-HTLV and anti-HCV. Blood services now also use nucleic acid amplification technology to test for hepatitis, especially hepatitis C and HIV antigen. Nucleic acid amplification technology is very sensitive and it helps in detecting positive donors donating during the window period.

**Processing of Blood Components**

Blood donation is defined as 450-500mls ±10% of blood collected in citrate anticoagulant, also containing phosphate and dextrose. In modern transfusion practice, whole blood is not usually transfused to patients. Whole blood is processed into components such as red cells, platelet concentrate and plasma. Component production from whole blood involve centrifugation to separate plasma and cells of different densities, followed by manual or automated transfer of components from the primary collection packs to transfer packs. Collection
Transfusion and transfer packs are manufactured as a single closed unit to maintain sterility.

**Leucodepletion of Blood Components**

Many blood services have implemented leucodepletion of blood components. In this process, donor leucocyte is removed from the blood donation before or after processing into components. Leucocyte depletion is usually carried out by filtration. Benefits of leucodepletion include reduction in immune related complication and removal of white blood cell associated viruses. In the UK, one of the drives to implement universal leucodepletion is the belief that leucodepletion can reduce the risk of transfusion related variant Creutzfeldt-Jakob disease, which may be transmissible by leucocytes.

**Red Cell Components**

Red cell components are produced by centrifugation of whole blood followed by the removal of most plasma and platelets. Approximately 100mls of additive solution containing saline, adenine, glucose and manitol (SAG-M) is added to the red cells to maintain cell viability. This component has a shelf life of 35-42 days at a temperature of 2-6°C.

Rarely, red cells are washed in saline prior to transfusion to patients with uncontrollable febrile or other anaphylactic reactions, or patients with IgA deficiency. Red cell washing removes most of the plasma protein, which is believed to be the cause of allergic reactions. The shelf life of washed red cells is usually 24 hours.

**Platelet Concentrate**

Platelets can be produced either from whole blood or by apheresis. Platelet production from whole blood is carried out by centrifugation and further processing of platelet rich plasma or buffy coats. Platelets obtained
from 4-6 whole blood donations are usually pooled together to produce a single adult therapeutic dose of platelets, containing approximately $2.5-3.0 \times 10^{11}$ platelets. A pure platelet concentrate can also be obtained directly from the donor by apheresis technology with little contamination by red cells or granulocytes. Platelets are collected into citrate supplemented with adenosine and dextrose. Both types of platelets are stored at a temperature of $20-24^\circ C$ for up to 5 days and during storage, platelets must be agitated to ensure gaseous exchanges.

Occasionally platelets are suspended in platelet additive solution instead of plasma. This process is usually done to reduce the plasma protein loads in the components. Platelets in additive solution are required for patients with severe febrile or allergic anaphylactic reactions. The shelf life of platelets in additive solution is only 24 hours.

**Fresh Frozen Plasma**

Fresh Frozen Plasma (FFP) is plasma from a single donation, usually 250-300mls, which has been frozen within 8 hours of donation without pooling. FFP is stored at a temperature less than $-30^\circ C$ for up to 24 months. FFP is used primarily as a source of multiple coagulation factors in situations such as massive transfusion, disseminated intravascular coagulation and liver disease. FFP is thawed in a water bath and transfused as soon as possible to the recipient. However, following thaw, FFP can be stored at $4^\circ C$ for up to 24 hours.

To further improve the safety of the plasma component, microbial inactivation steps can be implemented. This includes methylene blue treatment and solvent detergent treatment. Both methods are good protection against certain viruses but are associated with loss of clotting factors. Methylene blue is a dye that when
exposed to light, generates reactive oxygen species, which damages nucleic acid and prevents viral replication. Solvent detergent treatment destroys the lipid envelope in HIV, HBV and HCV viruses. Non lipid coated viruses such as parvovirus B19 and hepatitis A, are not specifically inactivated by solvent detergent treatment. Fresh frozen plasma, methylene blue treated plasma and solvent detergent plasma are all available in Europe. The decision to use one of them depends on the availability, cost and the patient’s clinical need.

**Cryoprecipitate**

Cryoprecipitate is manufactured from a single unit of FFP by rapid freezing to less than -30°C then slow thawing overnight at 4°C. Cryoprecipitate is composed mainly of factor VIII, fibrinogen, fibronectin and factor XIII. Cryoprecipitate is stored frozen for up to 24 months and prescribed mainly to treat congenital or acquired hypofibrinogenemia, usually related to liver disease, disseminated intravascular coagulation or massive transfusion. Cryoprecipitate is usually given as a 1 unit per 7-10 Kgs of patient body weight to raise fibrinogen level to above 1gm/l.

**Granulocyte Transfusion**

Granulocyte is an uncommonly used product for transfusion. The reason is the difficulty in obtaining enough numbers of viable granulocytes to be of clinical benefit. Buffy coats from whole blood donations can be used as a source of granulocytes for transfusion, although it is usually difficult to obtain enough granulocyte numbers using this method. Also the time interval between blood donation and the production of buffy coats usually leaves most of the granulocytes dead. Another issue is the high red cell load in buffy coats, which may cause polycythaemia in patients receiving multiple buffy coat
transfusions. A slightly better product can be obtained by collecting granulocyte directly from donors through apheresis technology. Such collecting can even be made more efficient by administering corticosteroid or cytokine such as granulocyte colony stimulating factor to donors to increase their granulocyte count before apheresis collection. Granulocyte obtained by apheresis technology from stimulated donors contains enough numbers of granulocyte to treat neutropenic patients. If the process from donation to transfusion could be carried out within 12-24 hours, a beneficial clinical effect would be expected. However, there are a lot of ethical issues raised around the potential harm to donors through exposure to cytokine or steroid effects, as well as the lengthy procedure of apheresis. The practice of granulocyte transfusion is still limited and unpopular. Fortunately, these days, most patients are responding to treatment with antimicrobial medications. Granulocyte products for transfusion needs to be irradiated prior to transfusion, to prevent transfusion associated graft-v-host disease.

Management of the Transfused Patient

The decision to transfuse a patient is a critical one. Such a decision should not be taken lightly and blood should only be prescribed when the clinician is satisfied that the risk of not transfusing, is likely to be greater than the risk of transfusing. Once the need for transfusion is confirmed, the clinician needs to decide what blood component is required, in what volume and when the transfusion should commence. Clinicians vary in their use of blood components for transfusion and surprisingly, many of the conventional and widely thought indications for transfusing blood components, are not
supported by reliable evidence of clinical benefits. Therefore, it is important to take a critical approach to prescribing blood components.

The overall aim is to eliminate unnecessary episodes of transfusion which will consequently reduce the risks and complications for the patients and manage blood shortages more effectively. This approach is even more important in developing countries where blood component availability is an issue and the risk of transfusion complications may be higher than the developed countries.

**Interventions to Reduce the Need for Allogeneic Blood**

One of the most effective measures to reduce the need for blood transfusion during, or following, elective surgery is the pre-operative assessment of the patient. Iron deficiency anaemia should be detected and treated well before the operation. Drugs that may impair haemostasis such as aspirin and nonsteroidal anti inflammatory may need to be withdrawn, if safe to do so, to reduce the operative risk of bleeding. Another useful technique is cell salvage. Cell salvage involves the collection and processing of blood lost during, or following, the operation and then returned to the patient. Red cell salvage now seems to offer the most cost effective method of autologous transfusion. Intra-operative or postoperative cell salvage depends on the type of operation. Intra-operative cell salvage is indicated if the expected operative blood loss is likely to be in excess of 500mls. It is associated with a considerable reduction in allogeneic blood usage, in cases where blood loss is large (more than 2 litres). This procedure should be considered for operations such as open heart surgery, aneurysm surgery and rupture ectopic pregnancy. It requires committed and highly skilled staff and the investment in
safe and efficient cell salvage machines. Relative contraindications to intra-operative cell salvage include the presence in the operative field of malignant cells, significant infection, ascetic fluid or amniotic fluid, which may cause embolism or disseminated intravascular coagulation. Cell salvage is also not recommended for sickle cell disease, as cells may sickle in the low oxygen tension of the machines. Postoperative cell salvage involves the re-infusion of blood cells lost in the wound drainage. It is particularly useful following orthopaedic knee surgery.

Other pharmacological agents are used to reduce the need for allogeneic blood, either by increasing haemoglobin levels such as recombinant erythropoietin or by decreasing the risk of bleeding such as recombinant factor VIIa. Erythropoietin is a cytokine that stimulates the bone marrow to produce red blood cells. It is of proven benefit in alleviating anaemia associated with renal failure and some malignancies such as multiple myeloma. Factor VIIa is an activated clotting factor that has been used to control massive surgical, traumatic or obstetric bleeding. These pharmacological agents carry their own risk and side effects and their use needs to be assessed within the context of the patient’s clinical needs.

Health services need to assess the safety and the cost effectiveness of interventions to reduce the need for allogeneic blood transfusions. This may be particularly important in areas of the world where transfusion practice is less developed. Such interventions may be very useful where blood components are not easily available and/or they carry a relatively higher microbial risk.

**Indications for Red Blood Cell Transfusion**

There is no universal trigger for red cell transfusion, i.e. a given concentration of haemoglobin at which transfu-
sion of red cells is appropriate for all patients. Clinical judgement plays a vital role in the decision to transfuse red cells. Important factors to be taken in consideration include the risk of recurrence of bleeding and patient tolerability to reduced oxygen carrying capacity. Indications for red cell transfusion include:

**Acute blood loss:** a blood sample should be sent to the hospital blood bank for compatibility testing and for urgent provision of blood. Crystalloids or synthetic colloids, not blood, should be used for initial rapid acute volume replacement. The need for transfusion can be assessed based on estimation of blood loss, or be based on the concentration of haemoglobin.

- 15% loss of blood volume (750 ml in an adult) does not necessitate transfusion unless the patient suffers from pre-existing anaemia, cardiac or respiratory diseases.
- 15-30% loss of blood (750-1500 ml in an adult) needs infusion of crystalloids or synthetic colloids but does not require blood transfusion in patients without pre-existing morbidity.
- 30-40% loss of blood volume (1500-2000 ml in an adult) requires rapid volume replacement with crystalloids or colloids and red cell transfusion will probably be required.
- 40% or more of blood loss requires rapid volume replacement including red cell transfusion.

The concentration of haemoglobin is usually used to guide the need for red cell transfusion. It should, however, be considered along with other factors such as rate of blood loss and patients tolerability to anaemia. Red cell transfusion is not indicated when haemoglobin concentration is above 10 g/dl. Red cell transfusion is indicated when the haemoglobin concentration is less than 7 g/dl. Two units of red cells should be transfused in adults and the situation reassessed again. Patients
with haemoglobin concentration between 7-10 g/dl require careful clinical assessment; most do not require blood transfusion. 

Anaemia in critical care: the same target values should be applied as for acute blood loss. Over-transfusion may increase mortality in this group. Patients should be considered for transfusion only if their haemoglobin is less than 7 g/dl, unless there are other complicating clinical factors. Careful consideration should be paid to fluid replacement, maintenance of blood pressure and the use of inotropic drugs to optimise cardiac output.

Peri-operative transfusion: All possible measures should be taken so that transfusion is not needed. See above interventions to reduce the need for allogeneic blood. The same approach to the management of acute haemorrhage during surgery should be applied as for acute blood loss. Patients must not be transfused back to a normal haemoglobin level either before or after surgery. Continuous auditing of the use of blood by various surgical teams performing different surgical procedures, may inform decisions, educate staff and standardise practice.

Chronic anaemia: All correctable causes of chronic anaemia should be sought and corrected. Treatment, other than blood transfusion, such as the suitability of recombinant erythropoietin use, should be considered. Red cell transfusion for patients with chronic anaemia should be given at intervals to maintain the haemoglobin just above the lowest concentration that is not associated with symptoms of anaemia. Most patients are asymptomatic with a haemoglobin concentration above 8 g/dl, however, patients transfused to haemoglobin above 12g/dl reported less fatigue and better quality of life. Transfusion programmes for chronic anaemia should be tailored to patient
clinical needs and the availability of a reliable supply of red cells. Chronic transfusion for thalassaemia and sickle cell disorders requires the expertise of a specialised haematologist.

**Indications for Platelet Concentrate Transfusion**

Platelet transfusions are indicated for the prevention and treatment of haemorrhage in patients with thrombocytopenia or platelet function defects. Platelet transfusions are not indicated for all causes of thrombocytopenia and may indeed be contraindicated in certain conditions. The cause of the thrombocytopenia should be established before a decision to transfuse plateles is made. Any decision must also be based on an assessment of risk versus benefit. Risks associated with platelet transfusions are discussed below. Potential benefits include reducing morbidity associated with minor haemorrhage and reducing morbidity/mortality resulting from major bleeding.

Thrombocytopenia due to bone marrow failure or chemotherapy should be managed with platelet transfusion if count dropped below $10 \times 10^9 /l$. This threshold may be increased in the presence of other bleeding risk factors such as infection or other haemostasis abnormalities. A specific threshold for transfusion may not be appropriate for patients with chronic stable thrombocytopenia, who are best managed on an individual basis depending on the degree of haemorrhage. Although bone marrow aspiration and biopsy can be performed without platelet support, providing that adequate surface pressure is applied, these patients should be maintained at a higher platelet level before undergoing surgical procedures. For lumber puncture, epidural anaesthesia, gastroscopy and biopsy, insertion of indwelling lines, transbronchial biopsy, liver biopsy, laparotomy or
similar procedures, the platelet count should be raised to at least $50 \times 10^9 /l$. For operations in critical sites such as the brain or eyes, the platelet count should be raised to $100 \times 10^9 /l$.

For patients with thrombocytopenia following massive red cell transfusion, the platelet count should not be allowed to drop below $50 \times 10^9 /l$. A higher target level of $100 \times 10^9 /l$ is recommended for those with multiple trauma or central nervous system injury. For patients with disseminated intravascular coagulation, the platelet count should be maintained above $50 \times 10^9 /l$. In chronic Disseminated intravascular coagulation (DIC), or in the absence of bleeding, a platelet transfusion should not be given merely to correct a low platelet count.

Platelet transfusion is usually not effective in correcting low platelet count or bleeding symptoms in patients with immune mediated thrombocytopenia, such as autoimmune thrombocytopenia, neonatal alloimmune thrombocytopenia and post transfusion purpura. Platelet transfusion is contraindicated in thrombotic thrombocytopenic purpura (TTP) and heparin-induced thrombocytopenia.

**Indications for the Transfusion of Fresh-Frozen Plasma and Cryoprecipitate**

FFP is indicated to manage multiple coagulation factor deficiency associated with severe bleeding. This situation may arise in over-treatment with oral anticoagulant (warfarin), massive blood transfusion, DIC or liver disease. It should be emphasised that FFP should not be given in the absence of significant bleeding or absence of risk of significant bleeding. In the absence of such bleeding risks, most patients with DIC, liver disease or massive blood transfusion do not require FFP. Warfarin
over-treatment without bleeding should be tackled with vitamin K. Large quantities of FFP may be required as a replacement fluid during plasma exchange to treat TTP.

Plasma can be subjected to viral inactivation steps such as methylene blue or solvent detergent treatment. Obviously, such products carry less risk of transmitting microbial infections and if available, should be used in preference to untreated product.

FPP is not indicated in the treatment of hypovolaemia, plasma exchange (except for TTP), reversal of prolonged INR in the absence of bleeding, or replacement of single inherited clotting factor deficiencies in the presence of virus-safe fractionated product.

Cryoprecipitate is mainly used to treat hypofibrinogenemia to maintain a fibrinogen level above 1 g/l. This is usually part of DIC treatment especially in obstetric complications.

Complications of Blood Transfusion

Complications of transfusion can be grouped into three major categories: immunological complications, transfusion transmitted infections and physio-chemical complications.

Immunological complications: From the immunological point of view, blood transfusion involves the delivery of a significant load of foreign antigens and sometime antibodies into the recipient. It is not surprising that immunological complications are the most common hazards of transfusion and some of them are serious or fatal. Immunological complications of transfusion include:

Febrile non-haemolytic transfusion reactions: These are febrile episodes of 1°C or more during or soon after a transfusion and there is no obvious cause such as haemolytic reaction or bacterial contamination. It may be associated with flushing, tachycardia and rig-
ors. This type of reaction is common especially following platelet transfusion. Underlying mechanisms are probably host reactions to transfused granulocytes or effects of transfused pyrogenic cytokines. The rate of occurrence of this type of reaction can be reduced by leucodepletion. Minor reactions can be managed by antipyretics such as paracetamol. More severe reactions requires discontinuation of the transfusion and appropriate investigations to exclude haemolytic reactions or bacterial infection.

**Haemolytic transfusion reactions**: These involve lysis of red cells in a transfused recipient. The haemolysis can be acute, if it occurred during or within 24 hours of transfusion, or delayed if occurred later, usually after 5-7 days of transfusion. Haemolysis can be intravascular or extra vascular. This type of reaction is mainly due to ABO-incompatible transfusion. Less frequently Kell, Kidd and Duffy antibodies can cause haemolytic reactions if missed during pretransfusion compatibility tests. Kidd antibodies are known to cause delayed transfusion reactions a few days after the transfusion is completed. Prevention of this type of reaction involves careful identification of the blood group of both the recipient and the transfused red cell units to avoid wrong blood group transfusion, other prevention measures include implementation of proper policy for pre transfusion testing to ensure detection of other non-ABO antibodies. Treatment of acute haemolytic reaction due to ABO-incompatible transfusion includes urgent management of potential renal damage and associated DIC. Patient should be monitored in intensive care, with fluid and diuretics therapy and possible haemofiltration.

**Transfusion-related acute lung injury (TRALI)**: This reaction is characteristic by respiratory distress, hypoxia and pulmonary infiltrate soon after transfusion
with no other apparent cause. It is a rare reaction to transfusion which usually occurs in patients with other morbidities and it is difficult to distinguish TRALI from other causes of respiratory distress in very ill patient. The underlying mechanism is believed to be a reaction between the patients white blood cells and transfused anti-HLA antibodies. Treatment is supportive.

_Urticarial, anaphylactoid and anaphylactic reactions:_ These are common reactions following transfusion. Some of them are mediated by degranulation of mast cells due to cross-linking of mast cell surface IgE by specific antigen. Clinical features include focal or general urticaria or angiedema, chest tightness or severe breathing difficulty. This type of allergic reaction is usually treated with antihistamine, corticosteroid and or adrenaline as appropriate.

_Post Transfusion Purpura:_ This is a rare complication of transfusion and presents with severe thrombocytopenia and bleeding symptoms 5-12 days following a transfusion. Patients usually lack one of the platelet antigens (HPA1a). Such patients may develop anti-HPA1a antibodies in response to a transfusion. It is not known why these antibodies destroy the patient’s own platelets which lack the corresponding antigen. Treatment is with intravenous immunoglobulin and/or plasma exchange. These patients should receive blood from an HPA1a negative donor for all their future transfusions.

_Transfusion-associated graft-versus-host disease:_ Rarely, viable donor lymphocytes engraft into a transfused recipient, causing a rejection of the recipients tissue, mainly liver, gut, marrow and skin, which gives rise to skin rash, pancytopenia, diarrhoea and abnormal liver function tests. Immunosuppressed patients are more prone to this complication. Treatment
is difficult and prevention is by the use of irradiation of blood products to inactivate the lymphocytes for immunosuppressed patients.

Transfusion transmitted infections: viruses, bacteria, protozoa and prions have been demonstrated to be transmitted by transfusion. A microbial agent is capable of being transmitted by transfusion if it gives rise to asymptomatic infection in the donor, it is present in the bloodstream, transmitted parenterally and is able to survive during storage of the blood. Some viruses cause a direct health threat to all recipients and so are tested for routinely by most blood services. This group of viruses includes hepatitis B and C, HIV and HTLV. Other viruses are tested for only if indicated by the clinical needs of the patient or by the background of the donor. This group includes CMV. Bacterial contamination of blood donation is increasingly becoming a concern, especially for platelet transfusion. The major sources of infection are donor bacteraemia, skin contaminants on the donor’s arm and environmental contamination during collection. Transmission to recipient usually causes an immediate sepsis manifested by fever, hypotension and possibly DIC, renal failure and shock. Yersinia and Pseudomonas are common cause of bacterial contaminations of red cell units. Staphylococcus is common with platelet concentrates. Management is by stopping transfusion, blood cultures and administration of broad spectrum antibiotics and other general supportive measures. Plasmodium spp, that cause malaria, and Trypanosoma cruzi that causes Chagas’ disease, are protozoa that can be transmitted by transfusion. It is possible to test for the presence of such protozoa in donors who might have been exposed to one of these infections.
Physiochemical complications of transfusion: include hypothermia, hyperkalaemia and fluid overload especially when massive transfusion is given to vulnerable recipient such as a neonate. Iron overload is a serious complication of chronic transfusion and it is a major contributor to morbidity and mortality in children with thalassaemia receiving regular red cell transfusion.

Further Reading


Websites

1. www.bcsghguidelines.com
   This is the BCSH Guidelines Home Page: this site contains full text of all haematology guidelines produced by the British Committee for Standards in Haematology, a sub-committee of the British Society of Haematology.
2. www.shotuk.org
   This is the site of Serious Hazard of Transfusion (SHOT): this site contains details of serious hazards of transfusion reported in the UK.
   This is the site of the UK Blood Transfusion & Tissue Transplantation Services. It provides a comprehensive guidance on transfusion and blood banking including the Red Book and the Transfusion Handbook.