

6 Red cell products

1 WHOLE BLOOD

Whole blood is considered to be a complex tissue from which the numerous and clinically appropriate components are processed. In most transfusion services whole blood is scarce, and is reserved for those few clinical situations where it can be best utilised.

Many of the components, particularly clotting factors and platelets, deteriorate within hours of donation. It is necessary to separate, process and store these within 6-12 hours of donation in order to ensure adequate supply of these products for use in the appropriate clinical situation.

a) Indications

- i. Massive haemorrhage with possibility of recurrence or continuation.
- ii. Exchange transfusion in neonates.

NOTE:

In the absence of available whole blood one should not delay transfusion but maintain adequate blood volume and oxygen carrying capacity with packed red cells, crystalloid or colloid solutions.

In massive haemorrhage after one blood volume exchange with banked blood it may be necessary to supplement with fresh frozen plasma and platelet concentrates. Whenever possible the haemostatic profile of the patient should be monitored and the above components transfused only if there is a specific haemostatic defect.

No drugs or solutions other than normal saline should be added to the blood units.

Calcium containing fluids must not be used in the same line as citrated whole blood or plasma.

Infusion with high molecular weight dextran or hydroxyethyl starch may cause problems with the crossmatch. Blood bank should be informed if these solutions have been infused so that appropriate measures can be taken.

2 RED CELL CONCENTRATES (RCC)

This product is prepared from a unit of whole blood from which the plasma has been removed by centrifugation in a closed sterile system. Approximately 110 ml of a licensed nutrient solution is then added to the residual red cells. These nutrient solutions contain glucose, mannitol, and adenine in various concentrations, suspended in sterile saline. This results in maximal plasma removal, a haematocrit of approximately 0.6 (Hb of about 20 g/dl) as well as long-term storage of the red cells for up to 42 days. Most centres also remove the buffy coat which gives a leucocyte poor product

a) Indications:

Red Cell Concentrates (RCC) are used to improve tissue oxygenation where this is impaired by either anaemia or haemorrhage.

Specific indications include:

- i. Normovolaemic anaemia when haematinic therapy is not appropriate - e.g.
 - Defective bone marrow production e.g. myelodysplasias, thalassaemia.
 - Increased red cell destruction e.g. acute and chronic haemolysis.
- ii. Ongoing haemorrhage, where initial volume resuscitation has been carried out with crystalloid solutions.
- iii. For elective surgical operations to replace whole blood loss, using crystalloid as the initial volume replacement fluid.

NOTE:

A dose of 4 ml/kg (approximately 1 unit of RCC) will raise the venous Hb by 1 g/dl. The patient should however be monitored clinically to ensure that the predicted haemoglobin increment has been achieved.

Red cell concentrates are currently suspended in nutrient fluids that contain no citrate. Therefore it is not necessary to give calcium supplements to patients even in massive transfusion situations. It is also unlikely that the minute amount of residual plasma will cause significant allergic reactions.

Do not add any fluid or drugs to the unit.

There is no absolute RCC transfusion "trigger" but the following guidelines are offered:

- i. A minimum Hb of 10 g/dl (Hct 0.3) is required for:
 - Patients unlikely to increase cardiac output or regional blood flow sufficient to compensate for decreased O₂ carrying capacity.
 - Post-operative patients with complications that substantially increase O₂ demand.
 - Patients > 65 years.
- ii. A minimum Hb of 8 g/dl (Hct 0.25) is required:
 - As minimum pre-operative level for surgery in which more than 500 ml loss is expected.
 - As intra-operative and post-operative level for many patients with mild to moderate systemic disease and after cardiac surgery.
- iii. A minimum of 6 g/dl (Hct 0.18) is acceptable for:
 - Well compensated chronically anaemic patients.
 - Healthy patients during intra-operative haemodilution or hypothermic cardiopulmonary by-pass.

3 OTHER RED CELL PRODUCTS

Leucocyte depleted (filtered), washed (plasma free), and irradiated products are appropriate transfusion options in a number of clinical conditions. These may be transfused from the onset of therapy, or alternatively if the patient exhibits reactions to leucocyte or protein antigens as described in *“Transfusion Reactions”* (Section 11). The various alternative red cell products are listed in Table 1 and the indications for use in Table 2.

Table 1: Red cell products

LEUCOCYTE DEPLETED RED BLOOD CELLS	WASHED RED CELLS	FROZEN STORED RED CELLS
Prepared by filtration of red cell concentrate	Prepared by washing red cell concentrate	Prepared by freezing red cells in a glycerol medium
99.9% leucocyte removal	80% leucocyte removal	98% leucocyte/platelet removal
90% red cell recovery	Absolute plasma removal	Absolute plasma removal - 30% red cell loss

Table 2: Clinical indications for other red cell products

LEUCOCYTE DEPLETED RED BLOOD CELLS	WASHED RED CELLS	FROZEN STORED RED CELLS
<ul style="list-style-type: none"> • If recurrent Febrile non-haemolytic transfusion reactions (FNHTR) occur after red cell transfusion, despite the use of buffy coat poor red cell concentrates or bedside filtered concentrates, leucocyte depleted red cell concentrates prepared in the blood bank should be used. In general, it is preferable to use leucocyte depleted red cells prepared in the blood bank since this ensures a more consistent quality product. • Patients with severe aplastic anaemia who are potential stem cell transplant recipients should receive leucocyte-depleted components from the beginning of their transfusion support. • Leucocyte depletion is an effective alternative to the use of CMV seronegative blood components for the prevention of transfusion transmitted CMV infection to at risk patients. • For foetal/neonatal transfusions. These components should be used for intrauterine transfusions and are preferred for infants less than 1 year of age but definitely recommended for infants 4 months and younger. 	<ul style="list-style-type: none"> • History of severe allergic reaction to whole blood, packed cells or plasma products. • Patients with known class or subclass specific anti-IgA antibodies. • Transfusion of neonates with T-cell activation due to necrotising enterocolitis. 	<ul style="list-style-type: none"> • Long term storage of blood units with rare blood groups.

IMPORTANT NOTE:

Preparation of some of these products takes time (eg; washing and thawing of frozen red cells) and clinicians must expect to wait between 1-4 hours depending on the product, and even longer if the product must be transported any significant distance.

The expiry time of some of these products is 24 hours since the process of production involves opening the original red cell unit. Although this is done under aseptic conditions and under laminar flow, one cannot totally exclude the possibility of bacterial contamination. Hence the product should be used as soon as possible to minimise the risk of bacterial growth. However, leucocyte depleted red cells will be prepared pre-storage, using a sterile docking device and be stored for 42 days. Leucocyte depleted red cells must be prepared within 48 hours from collection for greatest efficacy.

4 IRRADIATED BLOOD PRODUCTS

For prevention of Graft-v-Host disease in:

- i. Immune suppressed patients.
- ii. Pre- and post bone marrow transplant patients.
- iii. Patients receiving blood from blood relatives.
- iv. Intrauterine transfusions.
- v. Neonates; exchange transfusions only.

NOTE:

It is not necessary to irradiate fresh frozen plasma, cryoprecipitate or fractionated plasma products if transfused to the above patients.