

Blood Conservation Techniques

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Introduction

- Increasing interest in blood conservation over last 15 years
- Several reasons
 - Significant risks of allogenic blood transfusion
 - Shortage of allogenic blood
 - Patient choice
 - Improvement in availability of transfusion alternatives

Shortage of allogenic blood

- National Blood Service relies on voluntary donors
- Increasing demand for blood products
- Changes in life-style
- Changes in policy

Patient choice

- Jehovah's Witnesses
- Infective risks
- Personal preference

Availability of transfusion alternatives

- Main principles
 - Tolerate & alter management of anaemia
 - Minimising blood loss- team approach
 - Surgeons
 - Anaesthetists
 - Haematologists
 - Alternative to transfusion

Tolerance and altered management of anaemia

- Erythropoetin & haematinics
- Lower haematocrit and haemoglobin levels than previously acceptable
- High flow oxygen to optimise oxygen carriage
- Maintain intravascular volume
- Perfluorocarbon based oxygen carriers

Minimising blood loss- Surgical input

- **Pre-operative management**
 - Ensure optimal clotting studies
 - Boost Hb with haematinics & erythropoetin if appropriate
 - Pre-operative autologous donation
- **Intra-operative management**
 - Meticulous haemostasis
 - Minimally invasive surgery where appropriate
- **Post-operative management**
 - Follow up post-op Hb levels along with any symptoms
 - Continue post-op haematinics

Minimising blood loss- Anaesthetic input

- Hypotensive anaesthesia
- Haemodilution
 - Acute normovolaemic
 - Hypervolaemic
- Normothermia
- Tranexamic acid/ Vit K/ Factor VII

Minimising blood loss- Haematology input

- **Pre-op**
 - Advice on management of pre-op anaemia
 - Involve in logistics of pre-operative autologous donation
- **Intra-op**
 - Rational use of blood and blood products
 - Alternatives to blood products to control bleeding
- **Post-op**
 - Advice on management of post-op anaemia

Alternatives to transfusion- Autologous blood transfusion

- Pre-operative autologous donation
- Acute normovolaemic haemodilution
- Cell salvage

Pre-operative Autologous Donation

● Advantages

- Can provide up to 4 units of blood
- Risk of viral transfusion & immunologically mediated transfusion reaction eliminated
- No immune modulation

● Disadvantages

- Difficult logistics with high risk of clerical error
- Difficult to collect blood if surgery scheduled at short notice
- Some patients may not be able to tolerate donation

Acute Normovolaemic dilution

- Advantages

- Inexpensive
- Blood always with patients so fewer clerical errors
- Produces whole blood with platelets & clotting factors
- Lower haematocrit so dilute blood lost

- Disadvantages

- Acute & significant drop in haematocrit
- Physiological effects of acute haemodilution

Cell salvage

- Involves collection of blood from surgical field
- Can be carried out intra-operatively or post-operatively
- Salvaged blood either filtered or washed and processed for transfusion back to patient

Cell salvage- pros & cons

● Advantages

- ↓ risk of infection
- ↓ risk of transfusion reaction
- Safer in patients with rare blood groups & multiple antibodies
- No immunosuppression
- ? Acceptable to Jehovah's Witnesses
- ↓ demand for allogenic blood products

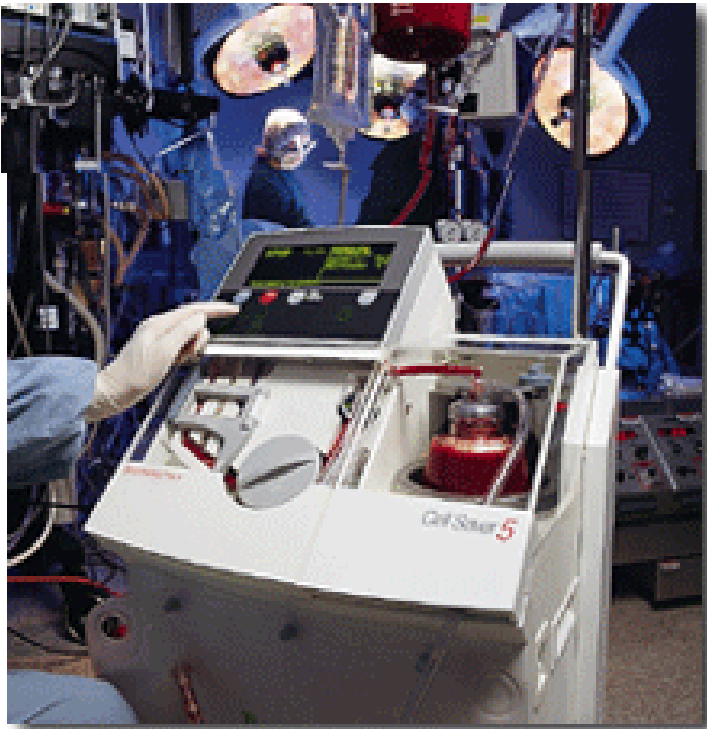
● Disadvantages

- ↑ cost- setup cost inc. staff training
- Unused blood wasted
- ↑ risk of bacterial contamination

Cell salvage

- 3 main techniques
 - Blood collected into from suction into reservoir canisters. Processed in batches of 1000ml producing blood for reinfusion. Repeated when enough blood collected
 - Semi-continuous system where blood is simultaneously scavenged, anticoagulated & washed. Smaller quantities can be processed
 - Single use reservoir bags, attached to surgical drains to collect blood after operation

Cell salvage- Process



- Red cells collected & processed before reinfusion
- Cell separation- RBCs separated by centrifugation
- Salvaged blood washed with 1000-1500ml saline & spun to produce packed RBCs of preset haematocrit
- Concentrate transfused to infusion bags & waste products drained from system

Cell salvage- Variations

- Semi-continuous system
 - Double spiral separation chamber is used
 - Blood pumped into the inner loop where some separation of low molecular weight debris takes place
 - RBCs move by centrifugal force towards outer spiral & are washed with saline
 - Small amounts of blood processed as all steps occur simultaneously

Cell salvage- Variations

- **Single use reservoir bags**
 - Simpler but only suitable for oozing blood rather than brisk haemorrhage
 - Blood collected from wound drains & passes through a filter into a citrate collection/ retransfusion bag
 - Vacuum pressure of 0 to -40 mmHg
 - No other processing
 - Can be carried out for up to 12 hours post-op or until a maximum of 1500ml is transfused
 - Most commonly used in joint replacement surgery

Summary

- Several different techniques for conserving blood developed over last 15 years
- Must be aware of risks of transfusion so only transfuse when required