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 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