# Anaesthetic Guidelines for Rural Hospitals

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*On behalf of the Rural Health Task Group of the Academy of Family Practice/Primary Care.*

*This series is also being produced as a booklet for the use of doctors in rural hospitals and will be obtainable from SA Family Practice in 1997.*

# ANAESTHESIA, FLUID THERAPY AND BLOOD TRANSFUSION

**The series has the following sections:**

1. Introduction to anaesthetics and anaesthetic safety checklist
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The purpose of this chapter is to discuss issues related to intravascular fluids, including blood transfusions.

## FLUID THERAPY

There are three main fluid compartments in the body:

1. Intravascular (within blood vessels).
2. Interstitial (between cells).
3. Intracellular (within cells).

Compartments 1 and 2 together form the extracellular fluid.

Different intravenous fluids spread to different compartments.

### Types of fluid

**5% dextrose** solution can be regarded as water. After it has spread throughout all the three body fluid compartments, only a small proportion remains in the intravascular space and as such is of little use in increasing the circulating blood volume. It is not useful as a source of energy nor of nutrition and will cause a dilutional hyponatraemia (low plasma sodium) if given in excess without saline. Its main use is as part of a fluid maintenance regime in adults.

**Saline containing solutions:** These include solutions that contain 130-150mmol of sodium per litre and include 0,9% saline ('normal saline'), Ringer's lactate and Hartmann's solution. These fluids will hereafter be referred to as 'saline'.

After redistribution among the different body fluid compartments, about a third will remain in the intravascular volume. These solutions are useful to replace saline losses (such as gastrointestinal losses in bowel obstruction, vomiting and diarrhoea) and blood loss.

Some solutions contain potassium which must also be replaced when there are gastro-intestinal losses. You can add 20mmol per litre to non-potassium containing solutions if it is required. Remember, however, that surgery can cause potassium levels to rise and replacement should be guided by plasma potassium measurement. Potassium must always be diluted and never given more rapidly than 20mmol over an hour.

Other solutions contain calcium. Don't run blood through the same intravenous line as calcium containing solutions.

**Colloid solutions:** These include gelatins (Haemaccel), protein (5% albumin), dextran (40 or 70) and starches (Hetastarch). Colloids remain initially within the intravascular space and as such are ideal to restore the circulating blood volume. Colloids carry a small risk of hypersensitivity and anaphylaxis.

### Normal maintenance requirements (for patients with no oral intake)

In adults, use 2-3 litres of fluid per 24 hours, usually with the ratio of 2 dextrose : 1 saline. The patient also requires roughly 60mmols of potassium over this period.

In children, a lower sodium load is preferred and half strength saline solutions such as 'half Darrow's Dextrose' (½ DD), which contains 60mmol of sodium per litre and 5% glucose as well as other ions, are useful for this.

There are various formulas available to calculate fluid maintenance in children and these usually relate to the body weight. A simple guide would be:

4ml/kg/hour for the first 10kg.
2ml/kg/hour for the second 10kg.
1ml/kg/hour for the remaining kg.

For example, a 27kg child would require (4x10) + (2x10) + (7x1) = 67ml/hour.

**Peri-operative fluids**
Surgical patients require fluid therapy to make allowances for both normal maintenance needs AND extra losses that may occur. These losses may be gastrointestinal fluid or blood. In addition, extra fluid is lost during surgery in major procedures such as laparotomy. Allow approximately 5-10ml/kg/hour of operating time to cover this loss (as saline). Fit patients with a short fasting time for minor surgery do not routinely need intravenous fluids. They should all, however, have intravenous access.

Ultimately all formulas and guidelines for estimating fluid requirements are only approximations and fluid therapy must also be guided by clinical parameters such as skin turgor and capillary refill, pulse, blood pressure, urine output, jugular venous pulsation and presence or absence of lung crepitations. Patient thirst is a useful guide if awake, as are serum urea and electrolyte results when available.

**BLOOD REPLACEMENT**
Blood is required to transport oxygen around the body and to enable the heart to create a blood pressure with which to perfuse organs.

**Haemoglobin (Hb) measurement**
Results are obtained in grams per dℓ of total blood volume. This result cannot be used to assess the adequacy of the circulating blood volume, which must be done clinically. A patient can have a normal haemoglobin level in the presence of a grossly depleted circulating blood volume. If a patient loses a litre of blood, the Hb level will not drop until the intravascular space has been expanded either by intravenous fluid (such as saline or colloid) or by the body's own homeostatic mechanisms after 24-48 hours. Always assess the intravascular volume as well as measure a haemoglobin level.

**Circulating blood volumes**
In adults = 70ml/kg (total being about 4-5 litres depending on size).

In children = 80ml/kg.

Most fit adults can lose 400ml of blood with little ill effect (eg blood donation), but loss of 50% of the blood volume (around two litres) acutely with no treatment would be fatal. Replace blood loss initially with saline solution and/or colloids to maintain the intravascular volume and thereafter with blood.

It is generally advised to begin blood transfusion after loss of 20% of the circulating volume in adults and 10% of the circulating volume in children. In a 10kg child with a circulating volume of 800ml, this is only 80ml. However, these figures serve only as a rough guide, and a patient who was initially anaemic would require blood at an earlier stage than a patient who had a higher haemoglobin level pre-operatively.

**Estimation of blood loss**
This can be difficult. You may be able to directly measure blood loss, such as that collected in the suction bottle. Blood soaked swabs and packs can be weighed and the dry weight subtracted from the wet weight to give an estimate of blood loss (allow 1ml of blood per gram of weight). Additionally, look for blood loss from the wound, and on the drapes and floor. This will be a subjective estimate.

**Pre-operative evaluation**
The importance of knowing about low Hb before elective surgery is essentially threefold.

1. The patient is by definition anaemic and should undergo appropriate investigation and treatment of any underlying disorder. Remember that this is simplified if tests can be done before a patient has been transfused.
2. The patient has less haemoglobin, and therefore smaller safety margins, should there be any loss of blood.
3. The compensatory mechanisms which maintain oxygen delivery within the body in the presence of anaemia can be compromised by anaesthesia.

**In elective cases**
As a rule of thumb, avoid embarking on major surgery if the haemoglobin level is <10g/dℓ. If the surgery will be minor and of short duration, it is reasonable to perform careful anaesthesia with a haemoglobin level as low as 8g/dℓ, **provided** that the patient is young and fit and that intravascular volume is normal (not depleted). Anaesthesia and surgery at levels of haemoglobin less than 8g/dℓ is possible, but carries greater and greater risks the lower the haemoglobin and is not recommended.

The decision to transfuse a patient pre-operatively depends on a variety of factors. These include the nature of surgery to be undertaken, expected blood loss, general condition of the patient, chronicity of anaemia (chronically anaemic

patients are better compensated), and the risks of the transfusion itself. Blood availability may be limited and this must also be taken into account.

Ideally transfuse the patient at least 24 hours pre-operatively to gain maximum benefit, as newly transfused blood takes a while to begin working optimally.

**In emergency cases**

If the rate of bleeding is fast, it may not be possible to fully re-expand the intravascular space without obtaining surgical control of the bleeding point(s). In these cases the patient should be taken to theatre after a brief and aggressive period of initial resuscitation. Use of intravenous fluids and blood has to be tailored to an estimation of the blood loss and a continual assessment of clinical signs. Remember that large-bore intravenous cannulae (14 or 16 gauge) should be used when fluid has to be given rapidly.

**Complications of blood transfusion**

1. ***Transfusion reactions***

There are several types of transfusion reactions, some of which can be life threatening. It is extremely important, therefore, that care is taken in following the correct procedures for cross-matching and for checking that the right blood is given to the right patient.

a) *Febrile reactions*

This type of reaction occurs in about 1% of patients being transfused, and is due to host antibodies reacting against foreign antigen. It is not a serious reaction, and is adequately treated with paracetamol and antihistamine. If the reaction is not severe, allow the transfusion to continue slowly. If the reaction is severe, however, consider the possibility of an acute haemolysis reaction (see below).

b) *Acute haemolysis*

Acute haemolysis is *the* serious transfusion reaction which is life threatening and of which most people are aware. It is caused by donor antibody acting on host AB antigen, which can cause disseminated intravascular coagulation (DIC) and renal failure. It should not occur if 'O' donor blood is always used, as is the case with some hospitals in the country. The reaction usually occurs within 50ml of transfusion, and manifests as tachypnoea, tachycardia, chest pain, hypotension and backache. The problem is that many of these signs can be hidden under anaesthesia. Management of this condition is to stop transfusion as soon as possible, cross-match compatible blood, prevent oliguric renal failure, and treat the DIC appropriately.

c) *Delayed haemolysis*

This reaction is due to other antibody-antigen reactions, but is delayed (can be up to 10 days later) and tends to be less severe. The management consists of monitoring the patient's Hb, haematocrit, renal function and coagulation, and treating problems as indicated.

d) *Acute anaphylaxis*

This is a very rare complication which occurs in about one in 150 000 transfusions. It should be managed as for any other anaphylactic reaction.

e) *Urticaria*

This is due to host antibodies reacting to donor plasma proteins. Treat with anti-histamine. It is usually possible to continue the transfusion.

2. ***Transmission of infection***

a) *From a donor*

HIV: remember that despite HIV screening of donor blood, there is still a window period before HIV antibodies become apparent. Therefore transfuse only when you must. Other infections that can be transmitted through blood transfusion in this country include CMV, hepatitis, malaria and HTLV.

b) *By secondary contamination of blood*

This occurs rarely, but can be very serious if it does. For this reason, be clean and aseptic when transfusing, do not leave warm blood standing, and ideally, giving sets should be changed every 12 hours.

3. ***Circulatory overload***

Over-zealous blood transfusion can cause fluid overload and consequent problems such as pulmonary oedema. Remember, therefore, the need to give frusemide to those patients who are not hypovolaemic, and who have a compromised cardiovascular system.

4. ***Complications of massive blood transfusion***

Occasionally a patient will require a massive blood transfusion. This can be defined as a replacement of the full circulating blood volume or more. Some side effects of this include:

a) *Hypothermia*

Because blood is stored cold, a massive and quick transfusion can lead to hypothermia. This in turn can cause shivering, leading to increased oxygen demand and hypoxia, cardiac arrythmias and depressed clotting function.

When possible, therefore, always try and give warm

blood by placing the bags into a warm (*not hot*) bowl of water. If you work in a busy operating theatre, purchase an electric blood warmer which can be used to heat infusion fluids to body temperature level.

b) *Clotting deficiency*
There are effectively no platelets or clotting factors in transfused blood. Large transfusions can therefore produce a coagulation defect. If you transfuse a patient more than four units, give one unit of Freeze Dried Plasma (FDP) for every fourth unit. It is unlikely that platelets will be available for you to use, but these may be life saving when available.

c) *Micro-emboli to the lung*
Aggregates of platelets, blood cells, fibrin and protein can cause damage to the lung during massive blood transfusions. Special filters (with pore size around 40 microns) can reduce this complication, but may slow the flow of blood through the giving set.

d) *Hypocalcaemia*
Hypocalcaemia can occur secondary to calcium being bound by citrated packed blood cells. In order to counter this, give 10ml of 10% calcium gluconate by slow IV injection for every six units of blood transfused. If calcium gluconate is not available, use 5ml of calcium chloride instead.

## INDUSTRY NEWS

# GENERIC GIANT LAUNCHED IN SA

Apotex SA was recently launched at a special function in Pretoria at the Canadian High Commissioner's palatial home. Apotex Inc is the largest Canadian-owned pharmaceutical company and specialises in generic medications.

In his address, Mr Jack Kay, the president of Apotex Inc emphasised his company's commitment to bring down the costs of medicines in South Africa. Although most Apotex products are still being registered through the Medicines Control Council, those that have been registered will soon be available. The company's initial focus will be to introduce generics that are not currently available to South Africans.

A three-phase strategy has been developed. During the first phase, the products will be packaged in Canada and imported. During the second phase, the drugs will be brought to the country in bulk and packaged here. In the third phase, the drugs will be manufactured in South Africa.

*For further information contact Sheba on (011) 807-6607.*

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