THE DIAGNOSIS AND TREATMENT OF HAEMORRHAGIC SHOCK

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Anaesthetists frequently care for patients in haemorrhagic shock, and must be capable of judging its severity. This article will discuss the assessment and clinical signs associated with hypovolaemia, and the management of the shock state.

Pathophysiology

Shock produces a reduction in tissue perfusion resulting in hypoxic metabolism, acidosis and deterioration in organ function. The body responds to hypovolaemia through the sympathetic nervous system which causes tachycardia and vasoconstriction in an attempt to maintain cardiac output and blood pressure. To preserve blood flow to the vital organs (brain, heart, kidneys and liver), there is marked vasoconstriction of cutaneous and other peripheral blood vessels. Oliguria (defined as a urine output of less than 0.5ml/kg/ hour) occurs as the body actively retains fluid. The patient feels thirsty. As blood loss progresses there is increasing organ failure shown by dyspnoea (lungs), aggression or drowsiness (brain) and myocardial depression.

Classification of blood loss

Haemorrhage may be classified according to the actual amount of blood lost, or as a percentage of the circulating blood volume.

The circulating blood volume may be estimated using the formula in figure 1.

Figure 1. Calculating the circulating blood volume

Circulating blood volume @ 70mls/kg

e.g. A 70kg man has: 70 x 70 = 4,900mls

e.g. A 20kg child has: 70 x 20 = 1,400mls

The clinical signs of shock in adults are listed in table 1 according to the amount of blood lost.

After haemorrhage the diastolic blood pressure changes before the systolic, due to active arterial vasoconstriction. The capillary refill test indicates the condition of the peripheral circulation. It is assessed by squeezing the finger nailbed and observing how long it takes for the circulation to return. Normally it is less than 2 seconds. Note that patients who are drowsy or unconscious due to shock have lost at least 2000mls, or 40% of their blood volume.

Young fit adults can vasoconstrict intensely in response to blood loss maintaining a relatively normal systolic blood pressure even after 1500-2000mls. Therefore always assess the systolic blood pressure in conjunction with the other clinical signs of shock. Remember that during resuscitation with intravenous fluids, the restoration of systolic blood pressure does not mean that the blood volume has returned to normal-there may still be class 2 shock with severe volume depletion.

Not all clinical signs are present in every patient. For example elderly people may not develop a tachycardia, especially if they are taking a beta adrenergic blocker such as propranolol. Like patients with heart disease (ischaemic or valvular) they may become hypotensive after relatively little blood loss. In patients with pre-existing hypertension care must be taken when interpreting blood pressure. For example a systolic blood pressure of 110mmHg would be normal in a young person, but may reflect serious hypotension in the adult with hypertensive disease. Pain and cold may also produce some of the clinical signs of shock. Patients with extensive tissue damage lose a considerable amount of their circulating volume by oedema formation.

Management of haemorrhagic shock

Remember the ABC of resuscitation. Check and correct any problems with the airway and breathing. Give oxygen in a high inspired concentration by face mask. Intubate patients who are unconscious. Control external haemorrhage by elevating the limb and by direct firm pressure with a clean pad over the bleeding site.

Insert a large cannula (14 gauge) into a suitable vein, use two when shock is worse than class one. When it is difficult to find veins, cannulate the external jugular or femoral vein or perform a cutdown at the ankle or antecubital fossa. In small children the intra-osseus route has been used with success. Do not use leg veins when intra-abdominal haemorrhage is suspected, or cannulate veins in an injured arm or shoulder. Take a sample for blood crossmatching when the first cannula is inserted.

Choice of Intravenous Fluids

The choice of fluids will often be determined by what is available. There are 3 types of intravenous fluid: crystalloid, colloid and blood (table 2). Dextrose 5% is not effective in the treatment of shock as it leaves the circulation rapidly. It should only be used as a last resort.

Crystalloids are distributed rapidly between the circulation and the extracellular (interstitial) fluid. When

Figure 1: Types of Intravenous Fluids used in Shock

	Class 1	Class 2	Class 3	Class 4
Blood Loss Volume (mls) in adult	750mls	800 - 1500mls	1500 - 2000 mils	>2000mls
Blood loss % circ. blood volume	<15%	15-30%	30-40%	>40%
Systolic Blood Pressure	No change	Normal	Reduced	Very low
Diastolic Blood Pressure	No change	Raised	Reduced	Very low / unrecordable
Pulse (beats/ min)	Slight tachycardia	100 - 120	120 (thready)	>120 (very thready)
Capillary Refill	Normal	Slow (>2s)	Slow (>2s)	Undetectable
Respiratory Rate	Normal	Normal	Raised(>20/min)	Raised (>20/min)
Urine Flow (mls/hr)	>30	20-30	10-20	0-10
Extremities	Normal	Pale	Pale	Pale & cold
Complexion	Normal	Pale	Pale	Ashen
Mental State	Alert, thirsty	Anxious, or agressive, thirsty	Anxious or aggressive or drowsy	Drowsy, confused or unconscious

treating shock give three times the estimated blood loss to allow for this. i.e. when replacing 1000mls blood loss give 3000mls of crystalloid.

Colloids remain within the circulation for a longer time (typically 4-8 hours) and should be administered in an equal volume to the blood loss.

Blood transfusion is required in previously healthy patients when estimated blood loss is greater than 30% of the circulating blood volume (1500mls in an adult). In previously anaemic patients transfusion is required with less severe haemorrhage. In grade 4 haemorrhage early transfusion with uncrossmatched blood is often necessary. After blood transfusions of 8 units or more coagulation factors may become deficient requiring fresh frozen plasma (if available).

Intravenous fluid replacement should be given to replace the estimated losses rapidly. Suitable fluid regimes for differing degrees of blood loss are shown in table 3. Many readers will not have access to colloids; the correct response is to give more crystalloid in a volume of three times the estimated loss, plus blood transfusion as described above. If facilities allow, warm the fluids (especially blood) using a blood warmer.

Monitor the patient's response to treatment by careful observation and recording of the clinical signs in table 1. Pass a urinary catheter and measure urine output to assist in your assessment. Aim for a urine flow of 0.5-1ml/kg/hour. Clinical improvement will be sustained if you have replaced the correct amount of

blood and the rate of haemorrhage is lessening. When the patient fails to respond appropriately, consider whether there are other sources of haemorrhage that you have not identified, or that haemorrhage is continuing unabated into the chest or abdomen or pelvis. A tension pneumothorax, pericardial tamponade or cardiac contusion can compound the signs of shock. In these situations measuring central venous pressure (normal 4-10cmH20) is helpful as it will indicate if pump failure is present.

Investigations may be needed to assist the diagnosis of injuries eg chest or other X-rays. A haemoglobin or haematocrit estimation helps in the decision for blood transfusion, which should maintain the haemoglobin around 8-10g/dl. However, if the sample is taken before resuscitation, a misleadingly high result may be obtained as haemodilution will not have occurred. Occasionally the serum potassium levels may be altered.

Life saving surgery

When there is severe haemorrhage (eg ruptured spleen or ectopic pregnancy) the patient may require an immediate operation to save life. Delaying surgery for prolonged resuscitation wastes resources and may be fatal.

Resources. In many parts of the world resources such as intravenous fluids or blood are in short supply. The sooner shock is treated, and the underlying cause diagnosed and managed, the better the outcome (and less resources consumed).

Summary

The key to successful management of haemorrhagic shock is awareness, identification and careful assessment of the problem and treatment with adequate fluid replacement. Attention to the airway and ventilation with oxygen is vital. Early precise diagnosis and definitive surgery should follow rapid resuscitation.

Figure 2: Treating Shock

Airway clear?	Be careful of suspected cervical spine injury
Breathing adequate?	Give oxygen and support ventilation
Circulation	Stop external bleeding I.V. Cannulation Cross match sample Resuscitate with IV fluids
Diagnose problem	Undress and expose
Establish	Treatment priorities for definitive care

Table 2: Types of Intravenous Fluids Used in Shock

Crystalloid	Ringers lactate Saline
Colloid	Gelofusine Haemaccel Dextran 70* Hetastarch Plasma or albumen solutions
Blood	Whole blood Packed cells Plasma reduced blood

* Maximum of 1500mls/day is usually recommended for Dextran 70 as platelet function may be affected with larger amounts.

Table 3: Suitable Blood Replacement Regimes for Previously Healthy Adults

Estimated blood loss	Suitable fluid regime
1000 mls	3000 mils cyrstalooid or 1000mls colloid
1500 mils	1500mls crystalloid & 1000mls colloid or 4500mls crystalloid
2000mls	1000mls crystalloid, 1000mls colloid & 2 units blood or 3000mls crystalloid & 2 units blood