FLUID MANAGEMENT FOR EMERGENCY LAPAROTOMY IN RURAL HOSPITALS

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Introduction

Abdominal emergencies are a frequent cause of death in sub-Saharan Africa. Using experience gained in hospitals in several different African countries and analysing perioperative data I have developed a protocol, which I believe could be useful for colleagues in other African hospitals. This protocol does not involve any expensive monitoring and is based on structured clinical assessment, simple measurements and treatment options, which are available in any hospital.

Anaesthesia in many African hospitals is provided by experienced and competent non-physician anaesthetists. They are rarely involved in preoperative management and frequently only meet the critically ill patient in theatre. Preoperative management is usually prescribed by a surgeon or general physician.

In spite of the correct surgical diagnosis, the critical condition of these patients is frequently not recognised. Profound dehydration, hypovolaemia, hypoxia and acidosis are often overlooked and not corrected. As a result perioperative mortality in this group of patients is very high. These patients sometimes require more then 10 litres of intravenous fluids in first 24 hours (excluding intra-operative fluids) and medical and nursing staff may lack the confidence to infuse such volumes. However treating this group of patients with aggressive resuscitation reduces the mortality significantly.

The purpose of this article is to encourage the perioperative team (anaesthetists and non-anaesthetists) to provide effective pre-operative preparation of critically ill patients.

Patient presentation

Patients presenting with abdominal emergencies often come to hospitals in Africa very late, especially if payment for treatment is required. They have often been sick for some days with a perforated or obstructed bowel. It is extremely important to establish the duration of their disease, as this can give some idea of the degree of dehydration and electrolyte imbalance. Reasons for dehydration include:

- no oral intake especially in children
- vomiting/ diarrhoea
- fever
- high environmental temperature
- third space loss (fluid in the body which is not available to the circulation for example oedema, ascites or other collections).

When taking the history enquire specifically about the first three and also the colour and amount of urine over the last day as profound dehydration and hypovolaemia will result in oliguria or even anuria. Consider the possibility of drug or herb ingestion by asking about visits to the local healer or ingestion of local or traditional medications. A green, leafy gastric content on naso-gastric (NG) tube insertion is suggestive even if the patient is not toxic.

Keypoint: Every patient with an 'acute abdomen' is severely dehydrated unless proven otherwise

Physical examination

The ABCD framework should be used for both examination and initial management.

Airway is not usually a problem but should be checked in every patient.

Breathing - an increased respiratory rate (RR) is an early warning sign caused by acidosis or hypoxia and is often ignored. Tachypnoea can also be caused by pain, anxiety or pyrexia. Check the oxygen saturation and record respiratory rate regularly.

Tip: *make sure that nurses have a watch!*

Circulation - the cardiovascular system is usually significantly compromised due to hypovolaemia. Assess:

- heart rate (HR)
- blood pressure (BP)
- pulse - is it weak or well filled?
- capillary refill time; make sure it is done properly - press for 5s (count to 5) then release the pressure and count refill time. This sign is very accurate in children and young adults, less reliable in very anaemic or old patients. ***Tip***: *teach nurses how to do it - you do not even need a watch for this!*
- core - peripheral temperature gradient - check the difference between the temperature of the trunk, which is usually hot (pyrexia) and the extremities which are cold (vasoconstriction). This is a very good indicator of

the intravascular volume; especially useful to observe the trend - the difference should reduce during resuscitation.

- degree of dehydration - severe thirst, decreased skin turgor, dry tongue, sunken eyes, sunken fontanelle in a newborn. However, decreased skin turgor or sunken eyes may be masked by oedema resulting from hypoalbuminaemia.

Disability - assess the mental status; adult patients can be apathetic occasionally agitated; children can fluctuate between being apathetic and agitated.

Document all of your findings on an appropriate chart.

Key point - it is important to realise that these patients do not only have an abdominal problem, but multiple organ impairment.

Figure 1. Common problems in an emergency laparotomy

Cardiovascular	● Hypovolaemia ● Dehydration ● Sepsis and septic shock
Respiratory	● Hypoxia ● Tachypnoea ● Atelectasis
Blood	● Anaemia ● If septic - potential coagulopathy
Renal	● Oliguria or anuria due to acute renal failure
CNS	● Decreased level of consciousness, confusion ● Anxiety ● Pain ● Possibility of intoxication
Gastro-intestinal	● Full stomach ● Abdominal distension ● Bowel perforation or obstruction
Metabolic	● Pyrexia ● Hypothermia ● Acidosis ● Electrolyte disturbance ● Hypoglycaemia

Management

The main purpose of the preoperative treatment is to optimise the patient's condition and maximise their chance of survival.[1,2] Early effective resuscitation improves oxygen delivery to the tissues and reduces mortality in this group of patients.[3]

Preoperative resuscitation obviously takes time but long delays before surgery should be avoided as early surgical management improves the outcome in septic patients. The preoperative plan should be discussed between the surgical and anaesthetic teams to achieve the right balance between providing adequate resuscitation and the risk of delaying surgery. Most patients will benefit from 2 - 4 hours preoperative resuscitation. The best area to carry out resuscitation is ICU/HDU if available.

Make a management plan following the ABC framework.

Airway and Breathing

Provide oxygen with the face mask at 2-4 l/min

Circulation

- insert iv cannula, preferably 16G or 2x 18G
- take a sample for Hb, electrolytes and consider crossmatching (see below).
- Infuse first litre of normal saline or Hartmann's rapidly over 15 min. During the following hour give 2000mls, watching clinical signs.
- insert Foley catheter; measure and record the initial amount and colour (concentration) of urine in the bag and discard it.
- If the initial Hb is < 12g/dl and the patient is severely dehydrated and hypovolaemic, crossmatching is essential as the patient is most probably severely anaemic, and the "normal" Hb level is due to haemoconcentration

Further treatment

- request urgent surgical opinion.
- if abdominal X-ray requested by surgeon, and patient is very sick make sure that he/she is transported to X-ray department on a stretcher or wheel-chair and iv fluids are continued. If possible accompany the patient.
- antibiotics prescribed should be administered iv as soon as possible
- insert NG tube
- check temperature

Keypoint - make sure that patients are not operated on while still hypovolaemic, hypoxic, and oliguric.

Further management
Assess the patient after each 1 - 2 l of fluids. Whenever possible warm the fluids even if patient is pyrexial. Use either crystalloids and colloids, but avoid glucose 5 or 10%. Hartmann's solution seems slightly better then normal saline as it results in less hyperchloraemic acidosis - see page 15. The correct volume of fluid is more important then the type. When the initial resuscitation is completed, potassium containing fluids (20mmol KCl /litre) may be used providing there is an adequate urine output.

Tip: *No glucose 5% or 10% for preoperative fluid resuscitation!*

Assessment of progress of resuscitation involves assessment of:

- HR
- BP
- capillary refill time
- RR
- Improving peripheral temperature
- filling of neck veins
- urine output

After 4-5 l of IV crystalloid (or 1.5 - 2 l of colloid) it may be worth repeating the Hb level to assess whether a blood transfusion is likely to be required.

In case of severe anaemia (Hb < 4g/dl), which is frequently accompanied by hypoproteinaemia, there is a significant risk of pulmonary oedema. In such cases blood should be transfused in early stages of fluid resuscitation.

It is important to explain management to all staff involved or the IV infusion will be slowed down as soon as you leave the bedside. An anaesthetist needs to supervise the rapid resuscitation and not leave it to ward nurses.

What about measuring central venous pressure (CVP)?
CVP measurement provides valuable information in selected cases, especially if urine output is low despite infusing large amount of fluids. However it is frequently unavailable in rural African hospitals because of a lack of expertise with invasive monitoring. Even if it is available one has to weigh benefits against risks. Repeated assessment of capillary refill, cardiovascular observations and filling of the neck veins usually give reasonable indication of intravascular volume.

What about inotropes?
Adrenaline and noradrenaline are frequently used in developed countries to treat sick patients with abdominal emergencies. I believe however, that there is much less requirement for their use in sick patients treated in rural hospitals. These patients, who are predominantly young and previously fit, respond very well to simple, adequate fluid resuscitation, provided adequate volumes are given.

From my experience, patients who do not respond to fluid resuscitation and require an inotrope infusion have a very high mortality and are often in an irreversible clinical situation. Inotropes can also divert attention from providing adequate fluid resuscitation by increasing the blood pressure without adequate volume expansion.

In cases of septic shock, adrenaline or noradrenaline can be used provided adequate fluid administration has been achieved.

Electrolyte imbalance
Often it is not possible to measure electrolytes. K^+ levels are important as cardiac arrhythmias may result from hypo or hyperkalaemia. Sick patients are normally depleted due to K^+ loss from diarrhoea and third space losses. However, anuric patients are at risk of hyperkalaemia. After initial resuscitation, when the patient is passing good volumes of urine, it is justified to add 20 -40mmol of KCl to each litre of IV fluids.

Anaesthesia
The correct timing of anaesthesia and surgery depends on the underlying problem. Resuscitation should be as complete as possible, but delay dramatically increases the risk to the patient in cases of peritonitis or bleeding.

Ideally following resuscitation and before anaesthesia, the patient will be stable with a pulse less than 100/min, a blood pressure greater than 90 systolic, established urine output and good capillary return.

Patients require general anaesthesia with intubation and ventilation. Diligent preparation is extremely important. On top of the usual routine preparation and equipment check there is enough oxygen for a long case, adequate amounts of IV fluids (warmed) and high volume suction. Empty the urine bag and suction NG tube.

Very sick patients are frequently hypotensive immediately after induction. Make sure there is a large bore IV line through which you can infuse fluids fast.

Prepare "emergency" drugs:

- ephedrine or metarminol or other vasopressor, ready and diluted in the syringe
- atropine

In case of high risk patients I also prepare diluted adrenaline in two concentrations:

- 1 mg of adrenaline (1ml) diluted to 10 ml (concentration 1:10 000, 100mcg/ml)
- 1ml of the above solution diluted to 10 ml (concentration 1:100 000, 10mcg/ml)

Induction

Preoxygenation is followed by rapid sequence induction with cricoid pressure. Thiopentone or ketamine can be used. In hypotensive patients, ketamine is a better choice. This should be followed by suxamethonium, non-depolarising muscle relaxant and an opioid analgesic. The cricoid pressure is absolutely mandatory as regurgitation is almost guaranteed. It is worth teaching everybody in theatre how to do it.

Maintenance

In hypotensive patients maintenance with a ketamine infusion (500mg ketamine/500ml of fluid) has some advantages over halothane which can cause hypotension and arrhythmias, especially in patients with electrolyte imbalance.

It has been suggested that keeping inspired oxygen level around 80% intra-operatively and for 2 hours after surgery might reduce the incident of wound infection and post operative nausea and vomiting (PONV).[4,5]

If hypotension follows induction of anaesthesia, it should be treated with rapid infusion of fluids and ephedrine or adrenaline boluses. If hypotension does not respond to vasopressor, adrenaline is indicated. I usually give 1 - 2ml boluses of the more dilute adrenaline solution and change to more concentrated only if I use the whole 10 ml syringe within relatively short time (around 15 minutes).

During anaesthesia make sure that the patient receives an adequate amount of fluids and use ephedrine or adrenaline as your second line of treatment. In some patients an adrenaline infusion during anaesthesia is useful to prevent hypotension and can be continued postoperatively (5mg adrenaline/500ml). In septic patients who are unresponsive to inotropes, hydrocortisone 100 mg should be considered.[6]

Normothermia during and after surgery improves recovery, decreases oxygen consumption (increased by shivering), reduces wound infection and decreases blood loss. Intravenous fluids should be warmed, as patients always cool down during surgery, especially in air-conditioned operating theatres. This can be achieved by putting the fluids into a simple water bath. Using hot-water bottles (wrapped in cotton sheets) and applying them to armpit and groins can also help to warm up patients.

Appropriate antibiotics should be administered pre- or intra-operatively.

Post-operative period

Patients are best managed in a recovery area, and then in an Intensive Care Unit (ICU) or High Dependency Unit (HDU) if possible. In many hospitals in rural Africa this is an area where good nursing care is available, but there are often no ventilators or infusion pumps. Supplementary oxygen (3-4 litres/minute) should be continued for the first 24 hours if available.

Careful monitoring of basic physiological parameters (RR, HR, BP, oxygen saturation, urine output, temperature) is essential over next 24 hours. Signs such as tachypnoea, tachycardia, hypotension, hypoxia, oliguria, changed mental state or hypothermia should trigger immediate review by the medical staff.

Adequate pain control should be established. This is usually achieved by intravenous opioid in recovery followed by intramuscular injections when required. Paracetamol suppositories can be a valuable addition. NSAID suppositories should be used only in patients with good renal function.

Intravenous fluid requirements will remain high in the immediate post-operative period. Patients will continue to have third space loss and residual fluid deficit from the preoperative period. Therefore fluid requirements will be above the maintenance amount of 3 litres per day. Often 4 - 6 litres are required in the first 24 hours and should be given as Hartmanns or Normal Saline. Although the calculated fluid balance will be positive, increased insensible losses (fever, tropical environment), fluid loss from drains and continuing third space losses due to the underlying pathology result in continued fluid deficit in the circulation. Adding 20mmol of potassium to each 1000ml bag of fluid is recommended, providing the urine output is adequate. The daily requirement of potassium is 70 - 100mmol.

Summary

Finding the right balance between appropriate pre-operative resuscitation but not delaying surgery unnecessarily seems to be the key to successful treatment of sick patients with abdominal emergencies.

Appropriate assessment and management by medical and nursing staff is based on interpretation of simple parameters which do not require any sophisticated monitoring equipment, and can be achieved in any rural hospital in Africa.

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