

Fluid Therapy

Prescribing the wrong type or amount of fluid can do serious harm. Assessing fluid needs requires care and attention, with adjustment for the individual patient. This is as important as safe drug prescribing.

The evidence base for fluid prescribing continues to change. Recent analyses have highlighted risks of over-replacement as well as under-treatment, and questioned our choice of replacement fluids.

This is the agreed policy for NHS Fife, Lothian and Borders. It guides fluid and electrolyte management in ADULT medical and surgical patients. For others:

- Children - consult paediatrician or paediatric resuscitation guidelines
- Diabetes - use diabetic protocol for maintenance
- Head injury
- Renal and hepatic failure - seek senior advice
- Pregnancy, pre-eclampsia - consult specific guidelines

In sick patients it is easy to give excess salt and water but very difficult to remove them. Fluid retention in sick patients with leaky capillaries contributes to complications such as ileus, nausea and vomiting, pressure sores, poor mobility, pulmonary oedema, and wound and anastomotic breakdown. A low serum sodium is commonly caused by excess water, not by too little sodium.

Urine output is an unreliable guide to fluid requirements in sick patients. It is usually less during illness or after trauma such as surgery because the kidney conserves both salt and water. Too much intravenous fluid makes this worse. Cellular dysfunction and potassium loss result. Excess chloride leads to renal vasoconstriction and increased sodium and water retention.

Questions to ask before prescribing

- Is my patient euvolaemic, hypovolaemic or hypervolaemic?
- Does my patient need IV fluid? Why?
- How much?
- What type(s) of fluid does my patient need?

Assess the patient:

- **Euvolaemic:** veins are well filled, extremities are warm, blood pressure and heart rate are normal (depending on other pathology)
- **Hypovolaemic:** The patient may have cold hands and feet, absent veins, hypotension, tachycardia, oliguria and confusion. History of fluid loss or low intake.
- **Hypervolaemic:** Patient is oedematous, may have inspiratory crackles; history of poor urine output or fluid overload.

1. Does my patient need IV fluid?

- **NO:** he may be drinking adequately, may be receiving adequate fluid via NG feed or TPN, or may be receiving large volumes with drugs or drug infusions (or a combination of these). Allow patients to drink if at all possible.
- **YES:** not drinking, has lost or is losing fluid.

2. Why do they need fluid?

- **MAINTENANCE FLUID ONLY** - patient does not have excess losses above insensible loss. If no other intake this is approximately **30ml/kg/24hrs**. He/she may only need **part** of this if receiving other fluid. Patients fasting for over 6 hours for any reason should be started on IV maintenance fluid.
- **REPLACEMENT OF LOSSES**, either previous or current. If losses are likely it is best to replace these later rather than give extra fluid in anticipation of losses which may not occur. This fluid is *in addition to Maintenance fluid*.
- **RESUSCITATION** - they are hypovolaemic as a result of dehydration, blood loss or sepsis and require urgent correction of intravascular depletion.

3. How much fluid does my patient need?

- Obtain or estimate weight: Maintenance fluid requirement is approximately 30ml/kg/24h (Table 1).
- Review recent U+E, other electrolytes, and Hb
- Recent events, e.g. fasting, losses, sepsis, operations - and check patient's fluid balance chart for losses.

Calculate how much loss has to be replaced and work out which type of fluid has been lost: e.g. GI secretions, blood, inflammatory losses.

Note that urine does not need to be replaced unless excessive (diabetes insipidus, recovering renal failure). If replacement is necessary, note that urine is usually low in sodium - do not use resuscitation fluids.

Post-op: high urine output may be due to excess fluid; low urine output is common and may be normal due to anti-diuretic hormone release.

4. What type of fluid does my patient need?

Maintenance - Replacement - Resuscitation

Maintenance fluid

IV fluid should be given via volumetric pump if a patient is on fluids for over 6 hours. Always prescribe as ml/hr not as 'x hourly bags'.

Do not give maintenance fluids at more than 100ml/hour (2.4 litres/day). Volume and electrolyte requirements are shown below:

Weight kg	Fluid, ml/day	Fluid, ml/h
35-44	1200	50
45-54	1500	65
55-64	1800	75
65-74	2100	85
>75	2400	100 (max)

Table 1a - Maintenance fluid VOLUME requirements. Excess volumes may cause hyponatraemia.

Sodium	1 mmol/kg/24hrs (approx 1 x 500ml 0.9% NaCl)
Potassium	1 mmol/kg/24hrs (give 20mmol in each litre)
Glucose	1 g/kg/24hrs to minimize starvation ketosis (1L 4% glucose contains 40g; 50g in 5%)

Table 1b - Maintenance ELECTROLYTE requirements

Suggested maintenance fluids:

- **0.18% NaCl/4% glucose** with potassium (10, 20 or 40 mmol) added as required. Provides water, Na⁺, and K⁺ requirements until the patient can eat or drink.
- **OR**
- **5% glucose 500ml and 0.9% NaCl** may be used in a ratio of 2:1 (2 x glucose: 1 x NaCl. Prescribe each bag with added potassium as above.

Patients with established renal failure: consult a senior doctor. Greatly reduced maintenance fluid needed if not producing normal volumes of urine. Potassium supplementation usually inappropriate.

Magnesium, calcium and phosphate may fall in sick patients: monitor and replace as required.

Replacement fluid

Fluid losses are often caused by diarrhoea, vomiting, fistulae, drain output, bile leaks, high stoma output, ileus, blood loss or excessive sweating. Inflammatory losses in the tissues are hard to quantify and are common in pancreatitis, sepsis, burns and abdominal emergencies.

It is vital to replace large gastro-intestinal (GI) losses. Patients may otherwise develop severe metabolic derangement with acidosis or alkalosis and hypokalaemia. Hypochloraemia occurs with upper GI losses.

Urinary and insensible losses are met by the maintenance part of the prescription. In the recovery phase of acute kidney injury patients may start to pass more urine as they mobilise excess fluid.

Hyponatraemia is common: in the absence of large GI losses the causes are almost always too much fluid, SIADH, or chronic diuretic use.

Potassium replacement: A potassium value in the normal range does not mean that there is no total body potassium deficit. 20 mmol may be given in 500ml 0.9%NaCl at 125ml/hr. In critical care only up to 40mmol in 100ml bags via a central line at 25ml/hr. Ensure IV cannulae are working; extravastation of potassium is harmful. Potassium-containing fluids must be given via a volumetric pump. Supplementation may be given orally.

Calculate replacement fluid requirements by adding up all the losses over the previous 24 hours and give this volume as Hartmann's (Compound Sodium Lactate) * solution, PlasmaLyte 148 (PL148) or 0.9% NaCl with KCl in addition to the calculated maintenance requirement.

Fluid	Na	K	Cl	Normal vol/24h
Gastric fluid	50	15	140	2-3 litres
Bile	145	5	100	0.5-1 litres
Small bowel	140	11	70-130	varies
Ileostomy	50	4	25	0.5 litres
Colostomy	60	15	40	0.1-0.2 litres
Diarrhoea	30-140	30-70	-	0

Table 2 - Electrolyte content and volume of body fluids (mmol/l)

Fluid	Na	K	Cl	Mg	Ca	Osm	Other
0.9% sodium chloride	154	-	154	-	-	308	
0.18% sodium chloride/ 4% glucose	30	-	30	-	-	284	224 gluc (40g)
0.45% sodium chloride/ 5% glucose	77	-	77	-	-	406	278 gluc (50g)

Hartmann's *	131	5	111	-	2	278	29 Lactate
Plasmalyte 148	140	5	98	1.5	-	297	27 gluconate
5% glucose	-	-	-	-	-	278	278 gluc (50g)

Table 3 - electrolyte content of common IV fluids (mmol/l unless otherwise specified)

Resuscitation fluid

For severe dehydration, sepsis, or haemorrhage leading to hypovolaemia and hypotension. **Controlling bleeding and treating sepsis are priorities.**

Recommendation: use balanced electrolyte solutions. Avoid colloids.

- For severe **blood loss**, use Plasmalyte 148 or Hartmann's*. These balanced electrolyte solutions are probably better handled by the body than 0.9% NaCl.
- Severely **septic** patients with circulatory collapse may need inotropic support in a critical care area. Their blood pressure may not respond to large volumes of fluid; excess volumes may be detrimental.

*Hartmann's Solution (official name is Compound Sodium Lactate (Hartmann's) solution) is not routinely stocked in South East Scotland. We have kept it in this guide as it may be read more widely.

In summary

- Remember the 4 questions
- Take time and consult seniors if you are unsure
- Patients on IV fluids need regular blood tests
- Patients should be allowed food and drink as soon as possible

Fluid challenge algorithm

Fluid Challenge Algorithm

