



## GUIDANCE FOR INTRAVENOUS FLUID AND ELECTROLYTE PRESCRIPTION IN ADULTS

*Fluid prescriptions are very important. Prescribing the wrong type or amount of fluid can do serious harm. Assessment of fluid requirements needs care and attention, with adjustment for the individual patient. This is as important as safe drug prescribing – fluids are drugs.*

*Try to prescribe fluids during daytime ward rounds for patients you know rather than leaving it to the night teams. However, complex patients need review of fluid requirements more than once a day.*

**Exclusion:** Children under 16: consult paediatrician.

**Special Circumstances: Principles remain the same**

**Burns:** use established protocols for burns.

**Diabetes:** use Diabetic Ketoacidosis/Hyperosmolar Hyperglycaemic State protocols as appropriate.

Use 0.18%NaCl/4%glucose/KCl with IV insulin.

**Obstetrics:** consult senior for complex patients.

**Head injury:** avoid fluids containing glucose.

**Renal/liver failure patients:** consult senior doctor.

*Produced by the Fluid Prescription Working Group.  
3rd Edition January 2014*

Endorsed by The Scottish Intensive Care Society

## Basic physiology of sick patients

It is easy to give an excess of salt and water but very difficult to remove them. Serum sodium may fall due to excess water load. Inadequate filling may lead to poor organ perfusion.

In sick patients with leaky capillaries fluid retention contributes to complications such as ileus, poor mobility peripheral oedema, pressure sores, pulmonary oedema, poor wound healing and anastomotic breakdown.

Urine output naturally decreases during illness or after trauma such as surgery due to increased sodium retention by the kidney. 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. **Urine output is a poor guide to fluid requirements in sick patients and oliguria does not always require fluid therapy (full assessment is required).**

**Maintenance requirement: 30ml/kg/24hrs of 'water'**

**It is vital that sick patients receive THE RIGHT AMOUNT OF THE RIGHT FLUID AT THE RIGHT TIME.**

### Questions to ask before prescribing fluid:

1. Is my patient euvolaemic, hypovolaemic or hypervolaemic?
2. Does my patient need IV fluid? Why?
3. How much?
4. What type(s) of fluid does my patient need?

## 1. Assess the patient

**Euvolaemic:** veins are well filled, extremities are warm, blood pressure and heart rate are normal.

**Hypovolaemic:** Patient may have cool peripheries, respiratory rate >20, systolic BP <100mmHg, FEWs >=5, HR >90bpm, postural hypotension, oliguria and confusion. History of fluid loss or low intake. May respond to 45° passive leg raise. Consider urinary catheter in sick patients. However signs of hypovolaemia may be unreliable in elderly patients.

**Hypervolaemic:** Patient is oedematous, may have inspiratory crackles, high JVP and history/charts showing fluid overload.

## 2. 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.

**Hypervolaemic:** may need fluid restriction or gentle diuresis.

**YES:** not drinking, has lost, or is losing fluid.

**ALLOW PATIENTS TO EAT AND DRINK IF POSSIBLE.**

### So WHY does the patient need IV fluid?

**Maintenance** fluid only – patient does not have excess losses above insensible loss/urine. If no other intake he needs approximately **30ml/kg/24hrs**. He may only need part of this if receiving other fluid. Patients having to fast for over 8 hours should be started on IV maintenance fluid.

**Replacement** of losses, either previous or current. If losses are predicted 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. Check blood gases.

**Resuscitation:** The patient is hypovolaemic as a result of dehydration, blood loss or sepsis and requires urgent correction of intravascular depletion to correct the deficit.

### 3. How much fluid does my patient need?

- Obtain weight (estimate if required). **Maintenance fluid requirement approximately 30ml/kg/24hours.** (Table 1).
- Review recent U&Es, other electrolytes and Hb.
- Recent history – e.g. fasting, input/output, sepsis, operations, fluid overload. Check fluid balance charts. Calculate how much loss has to be replaced and work out which type of fluid has been lost: e.g. gastro-intestinal (GI) secretions, blood, inflammatory losses.

Note **urine** does not need to be replaced unless excessive (diabetes insipidus, recovering renal failure). 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.

Assess fully before giving extra fluid.

### 4. What type of fluid does my patient need?

#### **MAINTENANCE FLUID**

IV fluid should be given via volumetric pump if a patient is on fluids for over 6 hours or if the fluid contains potassium.

**Always prescribe as ml/hr not 'x hourly' bags.**

**Never give maintenance fluids at more than 100ml/hour.**

**Do not 'speed up' bags; rather give replacement for losses.**

| Weight kg | Fluid Requirement mls/24hrs | Rate ml/hr |
|-----------|-----------------------------|------------|
| 35-44     | 1200 (500ml '10 hrly')      | 50         |
| 45-54     | 1500 ('8 hrly')             | 65         |
| 55-64     | 1800 ('7 hrly')             | 75         |
| 65-74     | 2100 ('6 hrly')             | 85         |
| ≥75       | 2400 ('5 hrly')             | 100 (max)  |

Table 1

**Preferred maintenance fluids:** 0.18%NaCl/4%glucose with or without added potassium (20 mmol) in 500ml. 1 litre bags are available. This fluid **if given at the correct rate (Table 1)** provides all water and  $\text{Na}^+/\text{K}^+$  requirements until the patient can eat and drink or be fed. Excess volumes of this fluid (or any fluid) may cause hyponatraemia.

**IF SERUM SODIUM IS  $\leq 132\text{mmol/l}$   
USE PL148 FOR MAINTENANCE.**

For the frail elderly, patients with renal impairment or cardiac failure and patients who are malnourished or at risk of refeeding syndrome consider giving less fluid: 20-25ml/kg/day (NICE guidelines). Consult a senior doctor for fluid advice. If the serum potassium is above 5mmol/l or rising quickly do not give extra potassium. Give Pabrinex IV if refeeding risk.

**Diabetes:** use 0.18%NaCl/4%glucose/KCl at maintenance rates with intravenous insulin.

### Electrolyte requirements

Sodium **1 mmol/kg/24hrs (approx. 1x500ml 0.9%NaCl)**

Potassium **1 mmol/kg/24hrs (give 20mmol/500ml bag)**

Calories: 50-100g glucose in 24 hours to prevent starvation ketosis. Consult dietitian if patient is malnourished.

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

### REPLACEMENT FLUID

**Fluid losses** may be due to diarrhoea, vomiting, fistulae, drain output, bile leaks, high stoma output, ileus, blood loss, excess sweating or excess urine. Inflammatory losses ('redistribution') in the tissues are hard to quantify and are common in pancreatitis, sepsis, burns and abdominal emergencies. It is vital to replace high GI losses. Patients may otherwise develop severe metabolic derangement with acidosis or alkalosis and hypokalaemia. Hypochloraemia

may occur with upper GI losses. Check blood gases in these patients and request chloride with U&Es.

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

Treatment of hyponatraemia is complex and requires senior input. A sodium of < 125mmol/l is dangerous. 0.9%NaCl or fluid restriction are first line treatments and frequent U&Es are required. See Hyponatraemia Guideline on Intranet.

### Potassium maintenance and replacement:

A normal potassium level does not mean that there is no total body potassium deficit. Give potassium in maintenance fluid. Only in critical care areas give up to 40mmol in 100ml bags via a central line at 25-50ml/hr. Ensure IV cannulae are patent and clean.

Potassium-containing fluids **must** be given via a pump.

Give Kay-Cee-L/ Sando-K orally if possible.

Estimate replacement fluid/electrolyte requirements by adding up all the losses over the previous 24 hours and give this volume as PlasmaLyte 148 (PL148). Use 0.9% NaCl with KCl for upper GI or bile loss (high NaCl content). **Otherwise avoid it as it causes fluid retention.** Diarrhoea may lead to potassium loss.

| Fluid/Content/l            | Na  | K | Cl  | Mg  | Ca | mmol/l                   | Osm. |
|----------------------------|-----|---|-----|-----|----|--------------------------|------|
| 0.9%NaCl                   | 154 | 0 | 154 | 0   | 0  | 0                        | 308  |
| 0.18%NaCl<br>4%glucose+/-K | 30  | 0 | 30  | 0   | 0  | Gluc 40g/l               | 284  |
| 0.45%NaCl<br>5% glucose    | 77  | 0 | 77  | 0   | 0  | Gluc 50g/l               | 406  |
| Gelaspan                   | 151 | 4 | 103 | 1   | 1  | Acetate 24               | 284  |
| Hartmann's                 | 131 | 5 | 111 | 0   | 2  | Lactate 29               | 274  |
| PlasmaLyte<br>148 (PL148)  | 140 | 5 | 98  | 1.5 | 0  | Acetate27<br>Gluconate23 | 297  |
| 5% glucose                 | 0   | 0 | 0   | 0   | 0  | Gluc 50 g/l              | 278  |

Osm = osmolality

Plasma osmolality is approximately 285-295mosm/l

## RESUSCITATION FLUID

For severe dehydration, sepsis or haemorrhage leading to hypovolaemia and hypotension. For urgent resuscitation use PlasmaLyte 148 (PL148) or colloid (Gelaspan/Albumin). PL148 is a balanced electrolyte solution and is better handled by the body than 0.9%NaCl. Give Albumin only in severe sepsis.

See Fluid Challenge Algorithm

Priorities: Stop the bleeding: consider surgery/endoscopy.

Use Major Haemorrhage Protocol. Treat sepsis.

CALL FOR HELP!

For severe **blood loss** initially use colloid or PL148 until blood/clotting factors arrive. Use O Negative blood for torrential bleeding. 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; excessive volumes (many litres) may be detrimental.

**IN SUMMARY:** assess, why, how much, which fluid?

- Take time and consult senior if you are unsure.
- Patients on IV fluids need regular blood tests.
- Patients should be allowed food and drink ASAP

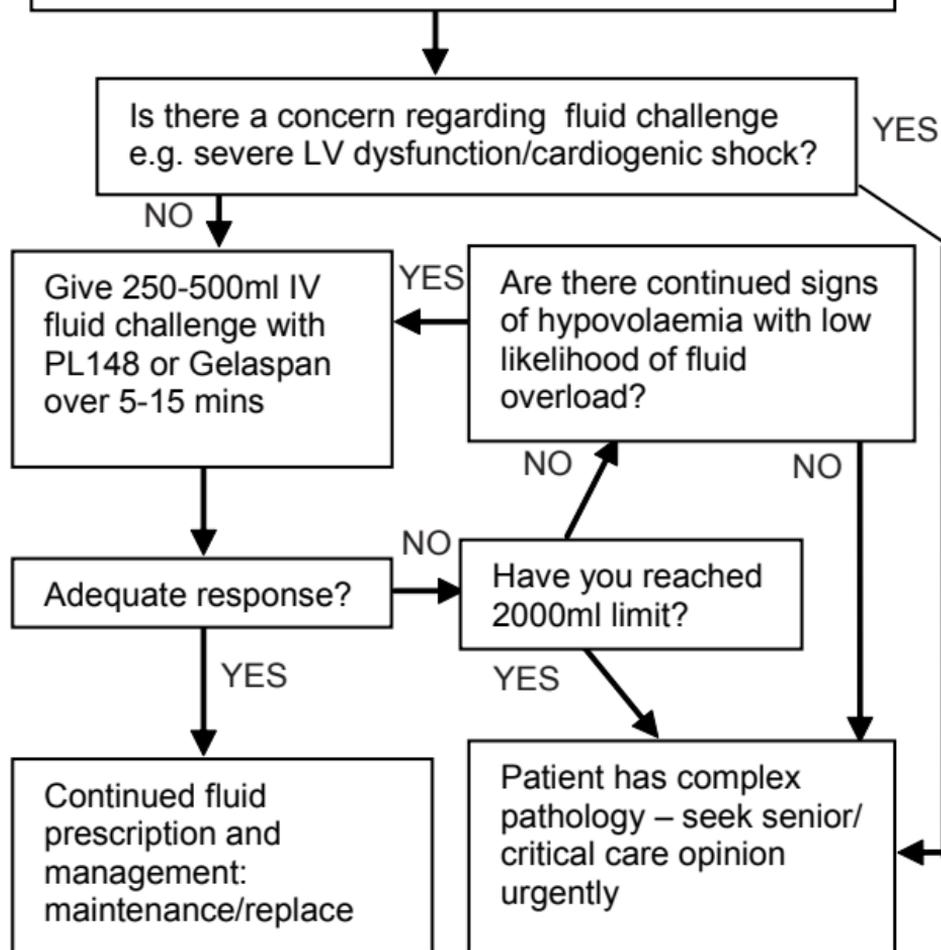
### Consider Critical Care Referral if:

- GCS  $\leq 8$  or falling from higher levels
- O<sub>2</sub> saturation  $< 90\%$  on 60% O<sub>2</sub> or higher
- PaCO<sub>2</sub>  $> 7\text{kPa}$  unresponsive to NIV
- Persistent hypotension and/or oliguria unresponsive to 2000ml fluid/or concern over cardiac function
- Metabolic acidosis: base deficit  $-8$  or worse, bicarbonate  $< 18\text{mmol/l}$ , lactate  $> 3\text{mmol/l}$  and not improving in 2 hours
- Aggressive/agitated patients whose treatment (e.g. oxygen/IV therapy) is compromised due to agitation.

Referral is not always appropriate –consult senior doctor.

# Fluid Challenge Algorithm

**Hypovolaemia:** low BP, tachycardia, low CVP/JVP, oliguria, reduced skin turgor, poor tissue perfusion, capillary refill time >4sec. **Note** patients with epidurals may need vasoconstriction rather than fluid but must be assessed for other causes of hypotension.



References: Southampton Fluid Guidance 2009,  
NICE Intravenous Therapy in Adults in Hospital , Guideline 174 Dec 2013,  
GIFTASUP guidelines 2009: [www.bapen.org.uk/pdfs/bapen\\_pubs/giftasup.pdf](http://www.bapen.org.uk/pdfs/bapen_pubs/giftasup.pdf)