

Trust Operational Policy
Clinical Biochemistry Department
Guidelines for IV Fluid Management in RLBUHT

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Please note that the Intranet version of this document is the only version that is maintained.

Any printed copies must therefore be viewed as “uncontrolled” and as such, may not necessarily contain the latest updates and amendments.

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1.0 Introduction

Inappropriate intravenous fluid prescription can lead to serious complications. There is a risk of hypovolaemia and acute kidney injury if insufficient fluids are given. Excessive hypotonic fluids eg 5% dextrose can lead to dangerous hyponatraemia. Excessive fluid infusion leading to sodium, chloride and water overload is a major cause of postoperative morbidity. Prior to prescribing IV fluids, it is essential to know why they are being prescribed. It is also essential that patients receiving IV fluids are monitored closely both clinically and biochemically. This policy provides a basis for good practice and a resource for education.

1.1 Equality and Diversity

The Trust is committed to an environment that promotes equality and embraces diversity in its performance as an employer and service provider. It will adhere to legal and performance requirements and will mainstream equality and diversity principles through its policies, procedures and processes. This policy should be implemented with due regard to this commitment.

To ensure that the implementation of this policy does not have an adverse impact in response to the requirements of the Race Relations (Amendment Act), the Disability Discrimination Act 2005, and the Equality Act 2006 this policy has been screened for relevance during the policy development process and a full impact assessment conducted where necessary prior to consultation. The Trust will take remedial action when necessary to address any unexpected or unwarranted disparities and monitor practice to ensure that this policy is fairly implemented.

This policy and procedure can be made available in alternative formats on request including large print, Braille, moon, audio, and different languages. To arrange this please refer to the Trust translation and interpretation policy in the first instance.

The Trust will endeavour to make reasonable adjustments to accommodate any employee/patient with particular equality and diversity requirements in implementing this policy and procedure. This may include accessibility of meeting/appointment venues, providing translation, arranging an interpreter to attend appointments/meetings, extending policy timeframes to enable translation to be undertaken, or assistance with formulating any written statements.

2.0 Objective

The objective of this policy is to ensure that all relevant staff understand the Trust's guidelines for managing IV Fluids in adult patients.

3.0 Scope of the Policy

These are guidelines for typical patient's in general medical and surgical wards of the Trust. Patients requiring more intensive management, such as in ITU, CCU, POCCU or the Renal Unit will be subject to local care plans and immediate access to specialists who will determine appropriate therapy.

4.0 Policy

4.1 General Principles of IV fluid prescribing

- IV fluids should aim to maintain the effective circulatory volume while attempting to minimize interstitial fluid overload.
- Excessive amounts of 5% dextrose or 4%/0.18% dextrose/saline may cause **dangerous hyponatraemia**, especially in the elderly, in children and in young women of low body weight.
- Excessive infusion of 0.9 % saline or Hartmann's solution leading to sodium, chloride and water overload is a major cause of postoperative morbidity and there is evidence that more accurate fluid therapy improves outcome.
- In acutely unwell patients, and those in the first 1-3 days post-operative period (longer after complex surgery), there is retention of water and sodium, under the influence of antidiuretic hormone and aldosterone as a part of the normal stress response. In the absence of complications, a reduction in urine output occurring soon after surgery is a normal physiological response. A low urine volume should lead to IV fluid challenge **only** if it likely to be due to hypovolaemia. Assess this clinically:
 - is the patient thirsty?
 - check pulse, assess peripheral circulation, arterial blood pressure, venous pressure (Jugular Venous Pressure/ Central Venous Pressure JVP/CVP), Glasgow Coma Scale, acid-base and lactate measurements.
- The oedematous patient should be managed with particular care in order to achieve successful negative sodium and water balance.

4.2 Monitoring patients receiving IV fluid

Patients receiving IV fluids should be monitored carefully using:

- clinical examination
- fluid balance charts - ensure all sources of loss, and all intakes (e.g. IV antibiotics) are included on charts.
- regular weighing (ideally daily)
- at least daily U&Es, and in patients with gastrointestinal (GI) losses, serum magnesium

4.3 Essential information required before IV fluid prescription

Prescription of IV fluids should not be made without knowledge of the following:

- Composition of commonly used IV solutions (Table 1)
- The expected composition of intestinal or other losses (Table 2)

- Does the patient have a deficit or excess of Na, Cl, K or water?

The aim of the fluid therapy:

- maintenance?
- replacement?
- resuscitation?

4.4 Normal Saline vs Hartmann's Solution

The concentration of sodium in normal saline is slightly higher, and the concentration of chloride is considerably higher, than the concentrations in plasma. The concentrations of sodium and chloride in Hartmann's solution are nearer to plasma concentrations.

The osmolality of normal saline is higher than that of plasma which may cause greater release of ADH. Urinary excretion of Hartmann's is more rapid than that of an identical volume of normal saline.

Excess normal saline may cause:

- water retention and oedema and may contribute to gastric paresis due to reduced gastric mucosal perfusion.
- hyperchloraemic acidosis which may cause reduced glomerular filtration rate.

Hartmann's solution should be used rather than normal saline when the patient's plasma chloride is >108 mmol/l

If plasma chloride is <98 mmol/L e.g.; vomiting or gastric drainage, normal saline may be more appropriate than Hartmann's.

Hartmann's solution contains 29 mmol/l lactate as a buffer. The normal liver and kidney can metabolise up to 100 mmol lactate per hour so lactate clearance should not be a problem except in end-stage liver failure and in diabetic ketoacidosis.

The lactate in Hartmann's is metabolised to glucose and rises of about 2 mmol/l in plasma glucose may be observed. For this reason, normal saline may be preferable to Hartmann's in patients with unstable diabetes.

In summary,

- Avoid normal saline if plasma chloride is > 108 mmol/l.
- Hartmann's is preferable to normal saline except in
 - hyperkalaemia
 - end-stage liver disease
 - patients with unstable diabetes and
 - when the plasma lactate is elevated.

4.5 Maintenance fluid therapy

The normal maintenance requirement for an adult patient with no deficit or excess of electrolytes or fluid is

- Sodium 60 – 150 mmol / day
- Potassium 40- 80 mmol / day
- Water 1.5 to 3 Litres (approx. 30 - 35 ml/Kg/day)

e.g. ~ 1.5L in a 50 kg medical patient, ~ 2L following an uncomplicated appendectomy or laparoscopic cholecystectomy, ~ 3L following more major surgery e.g. Whipple's.

For a 70 kg patient, **this may be prescribed as one litre of Hartmann's OR 0.9% saline PLUS 1 – 2 litres of 5% dextrose with 20 or 40 mmol K (depending on the plasma K) per day.**

A 40 kg patient will have lower requirements as follows: 1.5 L in total – 500 mls of Hartmann's OR 0.9% saline PLUS one litre of 5% dextrose with appropriate K.

4.6 Replacement fluid therapy

In addition to the normal maintenance requirements, patients with ongoing losses need like-for-like replacement of the losses (Table 2) by prescribing Hartmann's or 0.9% saline in addition to the maintenance fluids. Patients with high output ileostomy / jejunostomy or diarrhoea / vomiting may have very high potassium and magnesium requirements.

e.g. For a ~70 Kg patient with 1L of GI losses daily, prescribe over 24 hours:
Maintenance requirement: One litre of Hartmann's solution **or** normal saline **PLUS** 1 – 2 litres of 5% dextrose with added potassium depending on plasma potassium
PLUS
one litre of Hartmann's solution.

If the patient is pyrexial or hyperventilating, then additional water (as 5% dextrose) may be required, but additional saline will not normally be required since the stress response will cause sodium retention.

4.7 Resuscitation

After major surgery, fluid redistribution to third spaces may occur, necessitating additional fluid and electrolytes. In some patients, this may be substantial, but the fluid infused and the amount to be given should be decided only by those with sufficient experience.

4.7.1 Post operative oliguria when the diagnosis of hypovolaemia is in doubt

If a post-operative patient develops oliguria (urine output less than 20ml/hour for more than 2 consecutive hours) without hypotension, give an initial fluid challenge of **250ml of Hartmann's solution over 30 – 60 minutes**. The clinical response should be monitored by measurement of the pulse, assessment of peripheral circulation, CVP and blood pressure before and 15 minutes after the infusion. **If there is no improvement, do not repeat- refer to a senior**

colleague. If there is a clinical response, the procedure should be repeated until there is no further improvement in clinical parameters.

4.7.2 Post operative acute hypotension

If a patient who is receiving IV fluids develops acute hypotension, follow the **ALERT guidelines:** -

Possible causes:

- a. Reduced preload (volume loss) e.g. haemorrhage/sepsis
- b. Reduced cardiac contractility (pump failure) e.g. MI, heart failure
- c. Reduced afterload (vasodilatation) e.g. sepsis/overdose

In deciding which of the above is the likeliest pathophysiology in a particular case, note should be taken of the following:-

- i. If there are signs of sepsis (pyrexia, obvious pus, infected wound, raised WCC, positive cultures etc) then assume mechanisms a) and c) are important and give a full fluid challenge.
- ii. If significant haemorrhage has been observed (e.g. haematemesis, melaena) or recorded (e.g. during major surgery) assume mechanism a) is important and give a full fluid challenge.
- iii. In elderly patients (>70y) an element of myocardial dysfunction is possible even in the absence of known heart disease. Any fluid challenge should therefore take this into account since fluid overload resulting in heart failure, pulmonary oedema or arrhythmia can be very easily induced especially post operatively
- iv. If the patient is known to have a past history of heart problems associated with left ventricular dysfunction e.g. MI, angina, CCF or there are current indications suggestive of acute cardiac disease e.g. chest pain, arrhythmias especially AF, clinical heart failure, abnormal ECG then assume mechanism b) is important and beware the adverse effects of fluid challenge and overload. Urgent senior advice or the opinion of the on call physician should be sought before giving any fluid.

4.7.3 Immediate treatment:

- Check airway and breathing, heart rate and rhythm
- Give a fluid challenge- a full fluid challenge is **500ml Hartmann's solution over 30 – 60 minutes** (if possibility of pump-failure e.g. MI, give 250ml initially) **It is essential to bear in mind the points i-iv above** -Check effect - capillary refill, limb temperature, peripheral pulses, central pulses, heart rate and rhythm, blood pressure, urine output, oxygen saturation.
- This will only be effective if there is reduced preload or afterload. It is potentially dangerous if there is pump failure when this may cause fluid overload (colloids such as Gelofusin can cause intractable pulmonary oedema in patients with LV impairment).

Therefore, **if this does not lead to an improvement, do not repeat, refer to a senior colleague.**

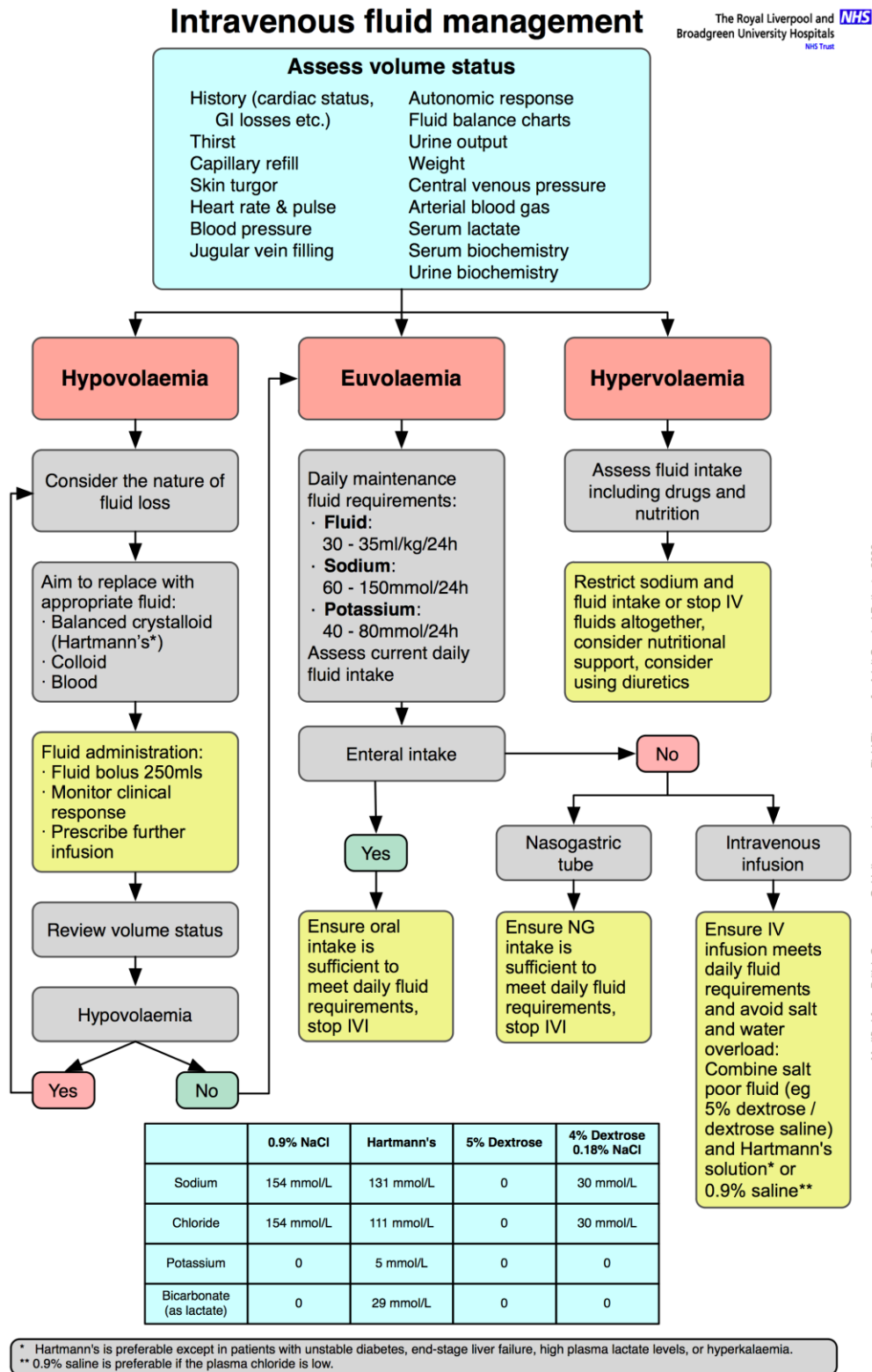
Severe Sepsis

These patients may have very high fluid requirements and require immediate senior review

4.7.4 Prescribing IV fluids in oedematous patients

Postoperative oedema reflects accumulation of salt and water in the interstitial space. The excretion of excess sodium is a slow process. Potassium depletion and hyperchloraemia make mobilization of oedema more difficult. In the absence of signs of intravascular volume depletion, the aim is to achieve a negative overall fluid and sodium balance. Sodium excretion can be assessed by measuring urine sodium concentration and urine volume: excretion should exceed intake.

4.8 Fluid management flowchart



4.9

Table 1 Composition of common IV solutions

	0.9% saline	Hartmann's	5% dextrose	4% dextrose 0.18% saline
Sodium	154 mmol/L	131 mmol/L	0	30 mmol/L
Chloride	154 mmol/L	111 mmol/L	0	30 mmol/L
Potassium	0	5 mmol/L	0	0
Bicarbonate (as lactate)		29 mmol/L	0	0

4.10

Table 2. Composition of some body secretions

Fluid	Na mmol/L	K mmol/L	Cl mmol/L	Bicarb mmol/L
Gastric	20 -60	14	140	14
Pancreatic	125-138	8	56	85
Bile	145	5	105	30
Jejunal	140	5	135	8
Ileal	140	5	125	30
Ileostomy (adapted)	50	4	25	-
Diarrhoea	30 - 140	30 - 70		20- 80
Sweat	60	10	45	-

5.0 Roles & Responsibilities

5.1 Author

It is the responsibility of the person writing the policy, protocol or guideline to ensure that there is a justified need for the policy, and that the Trust format as set out within this policy are adhered to.

The author must also ensure that the policy has been impact assessed. The Equality and Diversity Team can be contacted for advice and support in completing this.

5.2 Directorate Managers/Heads of Department, Clinical Directors

It is the responsibility of all Directorate Managers/Heads of Departments and Clinical Directors to ensure that staff are made aware of all new or updated

policies, protocols and guidelines when issued. All new and temporary staff must be made familiar with the policy website and policy files as part of their local induction.

5.3. Directorate

Each Directorate Manager/Head of Department will compile a list of areas, which need to access policies, protocols and guidelines via folders; this list must be agreed with the Clinical & Cost Effectiveness Sub Committee. These areas will be issued with new or updated policies through the Policy Co-ordinator. No policy folders other than those agreed with the Clinical & Cost Effectiveness Sub Committee should be kept.

Directorates will be responsible for ensuring that policies within their areas that are due for review are up-dated within the agreed timescales as per 4.4 of this policy.

5.4 Executive Lead

The relevant Executive Lead will report on new and reviewed policies to the Trust Board via the Clinical Governance 'Overview Reports'.

6.0 Training & Resources

This policy will form the basis for the teaching of medical students and postgraduate doctors on the topic of IV fluid prescription. The policy will be discussed at the induction of junior doctors in July / August each year and a hyperlink to the document will be included on the Education Centre intranet page.

7.0 Monitoring and Audit

Adherence to the policy will be audited on a 6-monthly basis by the medical staff in the Department of Clinical Biochemistry. This will be included in the Division of Diagnostics and Therapeutics Clinical Governance rolling audit programme. The audit results will be forwarded to the relevant Clinical Governance Sub Committees no later than 2 months after the completion date.

7.1 Recording and Monitoring of Equality & Diversity

The Trust understands the business case for equality and diversity and will make sure that this is translated into practice. Accordingly, all policies and procedures will be monitored to ensure their effectiveness.

Monitoring information will be collated, analysed and published on an annual basis as part of our Single Equality and Human Rights scheme. The monitoring will cover all strands of equality legislation and will meet statutory employment

duties under race, gender and disability. Where adverse impact is identified through the monitoring process the Trust will investigate and take corrective action to mitigate and prevent any negative impact.

The information collected for monitoring and reporting purposes will be treated as confidential and it will not be used for any other purpose.

If you have any queries or comments please bleep the duty clinical biochemist on bleep 4313 or e mail Dr Marks on Eileen.Marks@rlbuht.nhs.uk