1. Introduction

Many patients require IV fluids to maintain or improve hydration. It is recognised that harm comes to patients from inappropriate fluid prescriptions and poor fluid stewardship. This guideline will build upon NICE guidance CG 174 – Intravenous fluids therapy for adults in hospital.

2. Scope

Applies to all adult inpatients

3. Recommendations, Standards and Procedural Statements

Fluid management should be considered to fall into one of the following 4 phases;

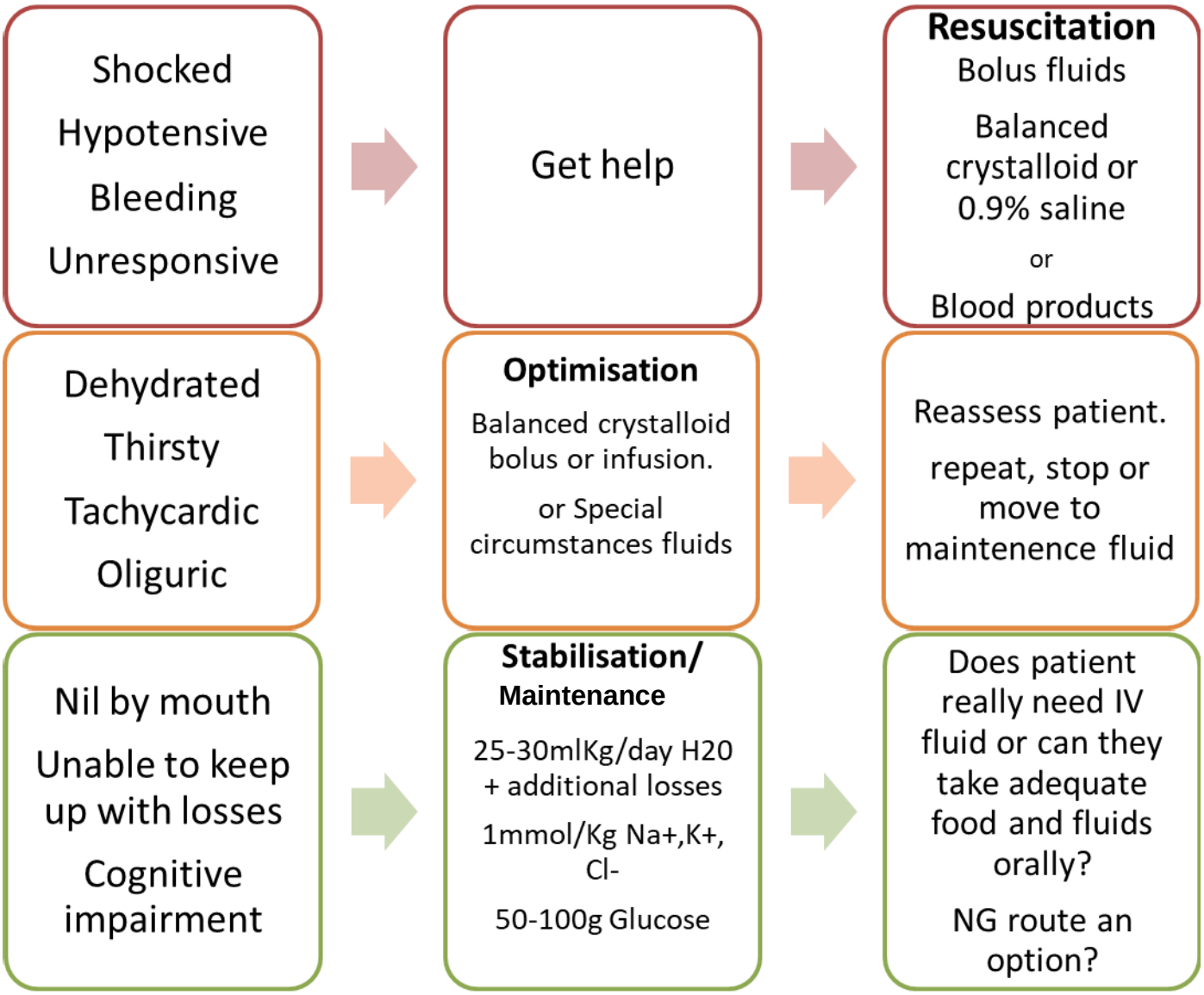
Resuscitation – The rapid administration of fluid boluses for immediate management of life-threatening conditions associated with impaired tissue perfusion. NICE guidance recommends 500ml over 15 minutes followed by reassessment of need for further fluid. This should typically be balanced crystalloid such as Plasmalyte or Hartmanns, or 0.9% saline (although this is associated with hyperchloraemic metabolic acidosis), or in the form of blood products if there is active bleeding. Of note some shocked patients will benefit from vasoactive medications such as noradrenaline or adrenaline to improve their cardiac output rather than fluids and should be discussed with Intensive Care rather than receive excessive fluid administration.

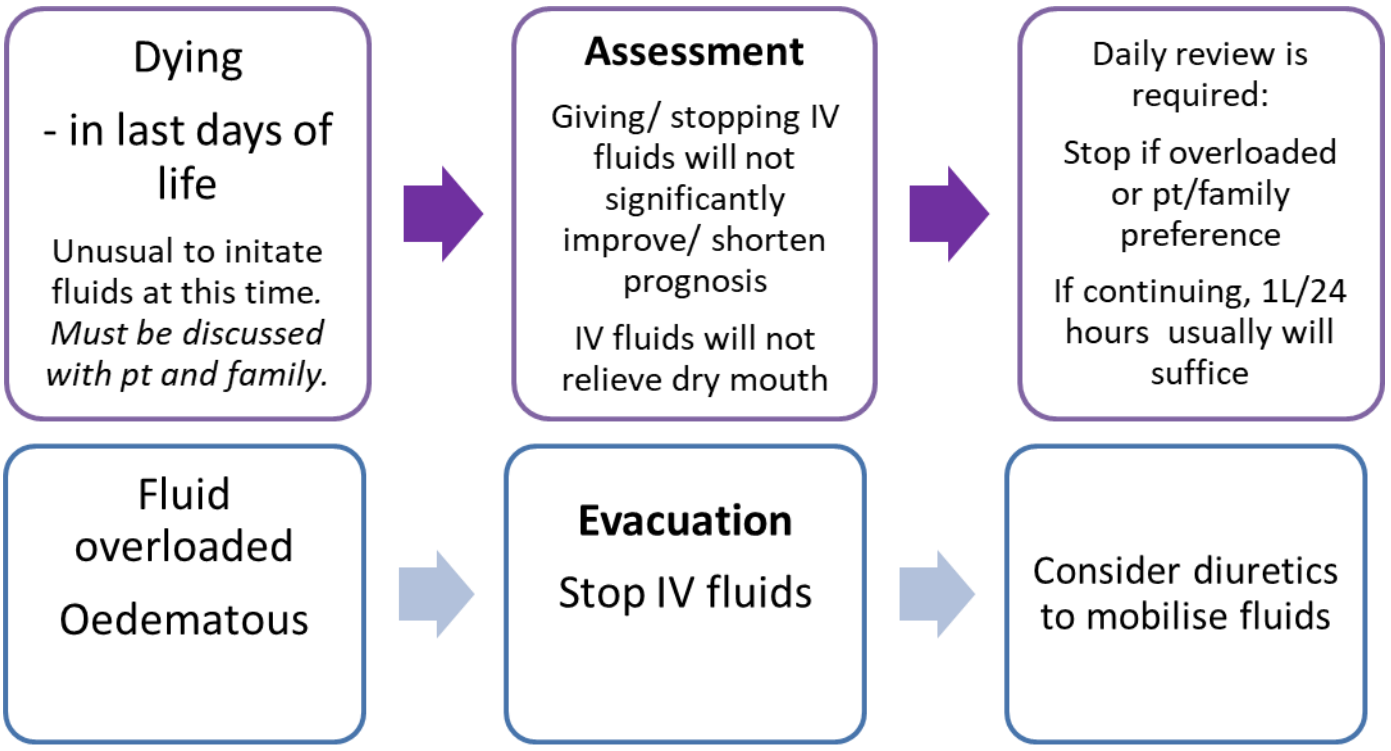
Optimisation – Is the fine tuning of fluid administration to optimise cardiac function to improve tissue and organ perfusion. An example would be the haemodynamically stable patient with dehydration. Typically these patients require smaller boluses or above maintenance rate infusions of crystalloids such as Plasmalyte, Hartmanns or 0.9% saline, with regular reassessment of fluid requirements.

Stabilisation/Maintenance – This reflects the point at which a patient is in a steady, euvolaemic state so that fluid therapy is now only used to replace ongoing losses that the patient is not able to take enterally. An example of this would be a nil by mouth patient for elective surgery, or a patient unable to swallow who is awaiting a nasogastric tube. A typical regime for a 80kg patient for 24 hours would be 2 litres of fluid in the form of 1L 0.45% Sodium Chloride + 1L 4% Glucose, +1L 5% Glucose + 40mmol/l Potassium Chloride. This avoids sodium and chloride excess and provides much of the requirements for daily potassium, water and glucose.
For patients in their last days of life, the focus is on making an individualised assessment regarding the benefits and burdens of continuing IV fluids whilst the patient is dying.

Evacuation – As soon as a patient is not dehydrated and able to take fluid enterally, additional IV fluids should usually cease, as there is no benefit and significant risk of harm from fluid excess. Fluid overload should be managed with diuresis to remove excess fluid that has accumulated during illness.

My patient is…




Dying
- in last days of life
Unusual to initate fluids at this time. *Must be discussed with pt and family.*
Assessment
Giving/ stopping IV fluids will not significantly improve/ shorten prognosis
IV fluids will not relieve dry mouth
Daily review is required:
Stop if overloaded or pt/family preference
If continuing, 1L/24 hours usually will suffice
Fluid overloaded
Oedematous
Evacuation
Stop IV fluids
Consider diuretics to mobilise fluids

Maintenance Fluid management
IV fluids should not be given to patients as a routine if the patient can manage their intake enterally. Excessive and poorly prescribed fluids cause harm to patients. Excess sodium chloride containing fluids have been associated with acidosis, decreased urine output, oedema, acute kidney injury, and requirement for renal replacement.

If a patient is unable to maintain their own enteral fluid intake to account for daily losses fluid replacement should be prescribed based on the following recommendations from NICE:

Water – 25-30ml/kg/day
1mmol/kg/day of Sodium, Potassium and Chloride
50-100g/day of glucose to limit starvation ketosis
The goal is to prescribe as close to their requirements as possible but this is difficult in practice

Examples
80kg Patient daily requirements =
2000-2400ml H20/day
80 mmol Na+, K+. Cl-
50-100g Glucose

Suggested regime/ 24hours for 80Kg patient who is nil by mouth
1 Litre 0.45% Sodium Chloride/4% Glucose
1L 5% Glucose +40mmol Potassium Chloride
500ml of 5% Glucose +20mmol Potassium Chloride

Fluid		Water	Na+	Cl-	K+	Glucose
Goal	=	**2-2.4Litres**	**80mmol**	**80mmol**	**80mmol**	**50-100g**
1 Litre of 0.45% NaCl/4% Glucose		1L	77mmol	77mmol	Nil	40g
1Litre of 5% Glucose +40mmol KCl		1L	Nil	40mmol	40mmol	50g
500ml of 5% Glucose +20mmol KCl		500	Nil	20mmol	20mmol	25g
Sum	=	**2.5Litres**	**77mmol**	**137mmol**	**60mmol**	**115g**

Additional losses will require additional fluid replacement – See Fluid balance and hydration policy;
e.g. 50kg patient with ongoing vomiting 2000ml additional loss per day
24 hour requirements = 50kg x25ml = 1250ml/day, + will need additional 2000ml H20 to account for vomiting losses = 3250ml/day
50 mmol Na+, 50mmol K+, 50mmol Cl- . Gastric losses are rich in Na+, K+, Cl- and H+ and will require additional replacement in fluids above routine maintenance tailored to electrolytes
50-100g Glucose

Suggested regime/24 hours

Fluid		Water	Na+	Cl-	K+	Glucose
Goal		**3.25-3.5L**	**50+mmol**	**50+mmol**	**50+mmol**	**50-100g**
1 Litre of 0.45% NaCl/4% Glucose		1L	77mmol	77mmol	Nil	40g
1Litre of 5% Glucose +40mmol KCl		1L	Nil	40mmol	40mmol	50g
1 Litre of 5% Glucose +20mmol KCl		1L	Nil	20mmol	20mmol	50g
250ml additional fluid tailored to electrolytes		250ml				
Sum	=	**3.25 litres**	**77mmol**	**137mmol**	**60mmol**	**140g**

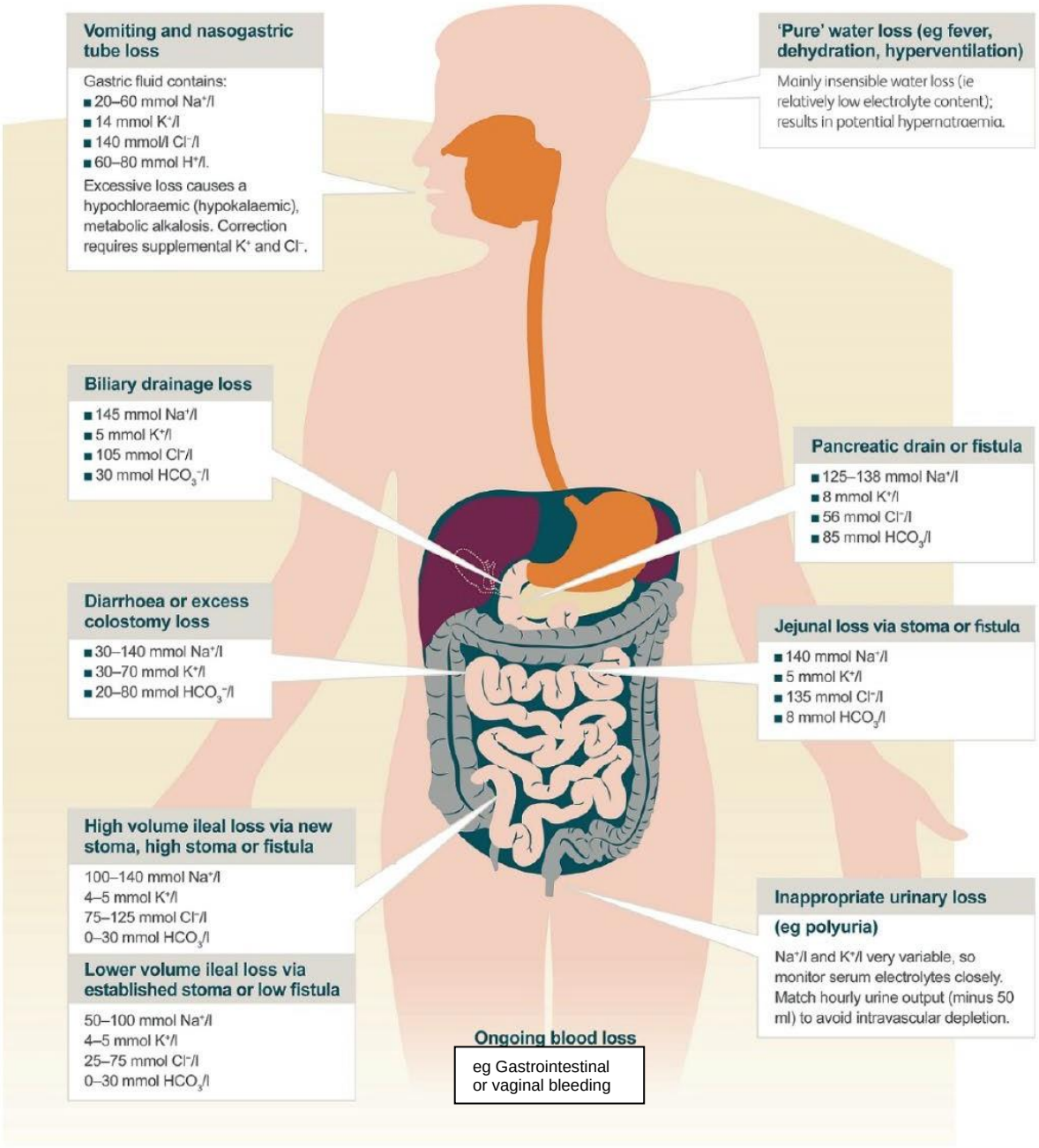
Composition of commonly used crystalloids

Content	Plasma	Sodium chloride 0.9%*	Sodium chloride 0.18%/ 4% glucose[a]	0.45% NaCl/ 4% glucose[a]	5% glucose[a]	Hartmann's	Lactated Ringer's (USP)	Ringer's acetate	Alternative balanced solutions for resuscitation**	Alternative balanced solutions for maintenance**
Na^+ (mmol/l)	135–145	154	31	77	0	131	130	130	140	40
Cl^- (mmol/l)	95–105	154	31	77	0	111	109	112	98	40
$[Na^+]:[Cl^-]$ ratio	1.28–1.45:1	1:1	1:1	1:1	-	1.18:1	1.19:1	1.16:1	1.43:1	1:1
K^+ (mmol/l)	3.5–5.3	*	*	*	*	5	4	5	5	13
HCO_3^- / Bicarbonate	24–32	0	0	0	0	29 (lactate)	28 (lactate)	27 (acetate)	27 (acetate) 23 (gluconate)	16 (acetate)
Ca^{2+} (mmol/l)	2.2–2.6	0	0	0	0	2	1.4	1	0	0
Mg^{2+} (mmol/l)	0.8–1.2	0		0		0	0	1	1.5	1.5
Glucose (mmol/ l)	3.5–5.5	0	222 (40 g)	222 (40 g)	278 (50 g)	0	0	0	0	222 (40 g)
pH	7.35–7.45	4.5–7.0	4.5		3.5–5.5	5.0–7.0	6–7.5	6–8	4.0–8.0	4.5–7.0
Osmolarity (mOsm/l)	275–295	308	284		278	278	273	276	295	389

* These solutions are available with differing quantities of potassium already added, and the potassium-containing versions are usually more appropriate for meeting maintenance needs.
** Alternative balanced solutions are available commercially under different brand names and composition may vary by preparation.
[a] The term dextrose refers to the dextro-rotatory isomer of glucose that can be metabolised and is the only form used in IV fluids. However IV fluid bags are often labelled as glucose so only this term should be used. Traditionally hospitals bought a small range of fluids combining saline (0.18-0.9%) with glucose but several recent NICE/NPSA documents have recommended specific combinations, which are now purchased to enable guidelines to be followed. Glucose–saline combinations now come in 5 different concentrations, and the addition of variable potassium content expands the pre-mixed range to 13 different products. Prescribers must therefore specify the concentration of each component; the term dextrose-saline (or abbreviation D/S) is meaningless without these details. What is specified also impacts significantly on the cost of the product.
Note: Weight-based potassium prescriptions should be rounded to the nearest common fluids available (for example, a 67 kg person should have fluids containing 20 mmol and 40 mmol of potassium in a 24-hour period). Potassium should not be added to intravenous fluid bags as this is dangerous.

Source: This table was drafted based on the consensus decision of the members of the Guideline Development Group.

'Intravenous fluid therapy in adults in hospital', NICE clinical guideline 174 (December 2013. Last update December 2016)



Source: Copyright – National Clinical Guideline Centre

Ongoing fluid losses will require additional maintenance replacement with fluids with a similar composition based on the diagram above.

Last days of life. - When a patient is felt to have only a short number of days to live, fluid management must be reviewed on a daily basis. There is lack of evidence to support or refute the routine use of clinically assisted hydration in the last days of life. A focus on good mouth care and careful, sensitive discussion with the patient and family can often address concerns regarding hydration. Mouth care should routinely be offered to all dying patients.[1]

If IV fluids are not in place, it is unusual to initiate them at this time. If IV fluids are already in place, consideration must be given to the benefits vs burdens of continuing. If a decision is made to continue then usually 1L/24 hours will suffice. Where fluids cause harm such as overload, they should be discontinued but when the balance of benefit and burden is finely balanced, the patient's wishes will usually be the deciding factor. Daily review and an individualised approach is critical. Decision will need to be made in advance how to proceed should IV access be lost as replacing a cannula can be difficult and distressing at this time.

If reaching agreement around fluid management is difficult or the patient/ family or ward staff are requiring additional support with this, the specialist palliative care team should be contacted for advice.

Additional information

Gelatin- based solutions (Gelofusin, Volplex) are associated with anaphylaxis[2], coagulopathy, make no difference to mortality[3], and are expensive. They are therefore not recommended.

0.9% saline should be the resuscitation fluid of choice in brain injury patients.[4]

0.9% saline is associated with hyperchloreamic metabolic acidosis.

The estimated effect of using balanced crystalloids versus saline in critically ill adults ranges from a 9% relative reduction to a 1% relative increase in the risk of death, with a high probability that the average effect of using balanced crystalloids is to reduce mortality[5].

Hyperkalaemia is not a contraindication to balanced crystalloid solution containing 5mmol/Litre or less of potassium [6],[7], and has been shown to decrease serum potassium levels compared to administration of 0.9% saline, due to the acidosis effects of 0.9% saline causing intracellular release of potassium.

Lactate in Hartmanns is supplied as sodium lactate rather than lactic acid, and should not be seen as a contraindication in its use in conditions with raised lactate.[8]

Healthy adults should consume <5g of NaCl/Day[9]. One litre of 0.9% saline contains 9g NaCl which is equivalent to the amount of salt in 19.5 packets of crisps.

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[1] https://www.nice.org.uk/guidance/ng31

[2] https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/pdf/10.1111/anae.14497

[3] https://pubmed.ncbi.nlm.nih.gov/30073665/

[4] https://www.nejm.org/doi/10.1056/NEJMoa2114464

[5] https://evidence.nejm.org/doi/full/10.1056/EVIDoa2100010

[6] https://pubmed.ncbi.nlm.nih.gov/29121282/

[7] https://pubmed.ncbi.nlm.nih.gov/18569935/

[8] https://link.springer.com/article/10.1186/cc13793

[9] https://www.who.int/elena/titles/guidance_summaries/sodium_intake/en/
Accessed 2.6.21

This guideline pertains to adult patients and separate guidance should be sought for fluid management in children.

Patients with end stage renal failure typically do not require maintenance fluids.

Caution should be taken with administering additional potassium in patients with advanced chronic kidney disease (eGFR<30)

Special circumstances such as hyponatraemia, metabolic alkalosis, ongoing fluid losses, or hyperosmotic states will require specialist opinion on appropriate fluids and this is a generic guideline for the most typical fluid scenarios only.

In the setting of a normal anion gap metabolic acidosis 1.26% or 1.4% Sodium bicarbonate fluid can be used instead of an alternative crystalloid if the patient still requires fluid administration and optimisation. It should be given no faster than 250ml/hr. Typically 500ml-1000ml should be given and serum bicarbonate rechecked. It is of no benefit in raised anion gap acidosis and its use is not advised.

Administration of albumin has not been shown to improve outcomes[10], and has not been shown to improve oedematous states[11] and is expensive. Its use should be reserved for specialist scenarios such as cirrhosis.

4. Education and Training

Education of IV fluids is embedded within multiple education streams in the Trust for both medical and nursing staff.

5. Monitoring and Audit Criteria

All guidelines should include key performance indicators or audit criteria for auditing compliance,

if this template is being used for associated documents (such as procedures or processes) that support a Policy then this section is not required as all audit and monitoring arrangements will be documented in section 8 of the Policy.

Key Performance Indicator	Method of Assessment	Frequency	Lead
Number of patients developing Acute Kidney Injury within UHL	QlikQ dashboard	Quarterly	DPB Trust AKI lead
Number of hyper and hyponatraemia episodes at UHL	QlikQ dashboard	Quarterly	DPB Trust AKI lead

6. Supporting Documents and Key References

https://www.nice.org.uk/guidance/cg174

See footnotes in the additional information section

7. Key Words

List of words, phrases that may be used by staff searching for the Policy on SharePoint: fluid, hydration, fluid management, IV fluids, resuscitation, optimisation, maintenance, fluid hydration

[10] https://www.nejm.org/doi/full/10.1056/NEJMoa1305727

[11] https://pubmed.ncbi.nlm.nih.gov/30037660/

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This table is used to track the development and approval and dissemination of the document and any changes made on revised / reviewed versions

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