NICE National Institute for Health and Care Excellence

NICE guideline

# Intravenous fluid therapy in adults in hospital

Clinical guideline
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# Your responsibility

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals and practitioners are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or the people using their service. It is not mandatory to apply the recommendations, and the guideline does not override the responsibility to make decisions appropriate to the circumstances of the individual, in consultation with them and their families and carers or guardian.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Local commissioners and providers of healthcare have a responsibility to enable the guideline to be applied when individual professionals and people using services wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with complying with those duties.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

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# Contents



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This guideline is the basis of QS66.

# Overview

This guideline covers the general principles for managing intravenous (IV) fluid therapy in hospital inpatients aged 16 and over with a range of conditions. It aims to help prescribers understand the optimal amount and composition of IV fluids to be administered and the best rate at which to give them, to improve fluid prescribing and outcomes among people in hospital. It does not cover pregnant women, and those with severe liver or renal disease, diabetes or burns.

## Who is it for?

- Healthcare professionals
- People who receive IV fluid therapy in hospital and their families and carers

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# Introduction

Many adult hospital inpatients need intravenous (IV) fluid therapy to prevent or correct problems with their fluid and/or electrolyte status. Deciding on the optimal amount and composition of IV fluids to be administered and the best rate at which to give them can be a difficult and complex task, and decisions must be based on careful assessment of the patient's individual needs.

Errors in prescribing IV fluids and electrolytes are particularly likely in emergency departments, acute admission units, and general medical and surgical wards rather than in operating theatres and critical care units. Surveys have shown that many staff who prescribe IV fluids know neither the likely fluid and electrolyte needs of individual patients, nor the specific composition of the many choices of IV fluids available to them. Standards of recording and monitoring IV fluid and electrolyte therapy may also be poor in these settings. IV fluid management in hospital is often delegated to the most junior medical staff who frequently lack the relevant experience and may have received little or no specific training on the subject.

The National Confidential Enquiry into Perioperative Deaths report Extremes of age in 1999 highlighted that a significant number of hospitalised patients were dying as a result of infusion of too much or too little fluid. The report recommended that fluid prescribing should be given the same status as drug prescribing. Although mismanagement of fluid therapy is rarely reported as being responsible for patient harm, it is likely that as many as 1 in 5 patients on IV fluids and electrolytes suffer complications or morbidity due to their inappropriate administration.

There is also considerable debate about the best IV fluids to use (particularly for more seriously ill or injured patients), resulting in wide variation in clinical practice. Many reasons underlie the ongoing debate, but most revolve around difficulties in interpretation of both trial evidence and clinical experience, including the following factors:

- Many accepted practices of IV fluid prescribing were developed for historical reasons rather than through clinical trials.
- Trials cannot easily be included in meta-analyses because they examine varied outcome measures in heterogeneous groups, comparing not only different types of fluid with different electrolyte content, but also different volumes and rates of

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administration and, in some cases, the additional use of inotropes or vasopressors.

- Most trials have been undertaken in operating theatres and critical care units rather than admission units or general and elderly care settings.
- Trials claiming to examine best early therapy for fluid resuscitation have actually evaluated therapy choices made after initial fluid resuscitation, with patients already in critical care or operating theatres.
- Many trials inferring best therapy for fluid resuscitation after acute fluid loss have actually examined situations of hypovolaemia induced by anaesthesia.

There is a clear need for guidance on IV fluid therapy for general areas of hospital practice, covering both the prescription and monitoring of IV fluid and electrolyte therapy, and the training and educational needs of all hospital staff involved in IV fluid management.

The aim of this NICE guideline is to help prescribers understand the:

- physiological principles that underpin fluid prescribing
- pathophysiological changes that affect fluid balance in disease states
- indications for IV fluid therapy
- reasons for the choice of the various fluids available **and**
- principles of assessing fluid balance.

In developing the guideline, it was necessary to limit the scope by excluding patient groups with more specialised fluid prescribing needs. It is important to emphasise that the recommendations do not apply to patients under 16 years, pregnant women, and those with severe liver or renal disease, diabetes or burns. They also do not apply to patients needing inotropes and those on intensive monitoring, and so they have less relevance to intensive care settings and patients during surgical anaesthesia. Patients with traumatic brain injury (including patients needing neurosurgery) are also excluded. The scope of the guideline does not cover the practical aspects of administration (as opposed to the prescription) of IV fluids.

It is hoped that this guideline will lead to better fluid prescribing in hospitalised patients, reduce morbidity and mortality, and lead to better patient outcomes.

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Strategies for further research into the subject have also been proposed.

The guideline will assume that prescribers will use a drug's summary of product characteristics to inform decisions made with individual patients.

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# Key priorities for implementation

The following recommendations have been identified as priorities for implementation.

## Principles and protocols for intravenous fluid therapy

- When prescribing intravenous (IV) fluids, remember the 5 Rs: Resuscitation, Routine maintenance, Replacement, Redistribution and Reassessment.
- Offer IV fluid therapy as part of a protocol (see the algorithms for IV fluid therapy):
  - Assess patients' fluid and electrolyte needs following algorithm 1: assessment.
  - If patients need IV fluids for fluid resuscitation, follow algorithm 2: fluid resuscitation.
  - If patients need IV fluids for routine maintenance, follow algorithm 3: routine maintenance.
  - If patients need IV fluids to address existing deficits or excesses, ongoing abnormal losses or abnormal fluid distribution, follow algorithm 4: replacement and redistribution.
- Patients should have an IV fluid management plan, which should include details of:
  - the fluid and electrolyte prescription over the next 24 hours
  - the assessment and monitoring plan.

    Initially, the IV fluid management plan should be reviewed by an expert daily. IV fluid management plans for patients on longer-term IV fluid therapy whose condition is stable may be reviewed less frequently.

## Assessment and monitoring

- Assess the patient's likely fluid and electrolyte needs from their history, clinical examination, current medications, clinical monitoring and laboratory investigations:

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  - History should include any previous limited intake, thirst, the quantity and composition of abnormal losses (see the diagram of ongoing losses), and any comorbidities, including patients who are malnourished and at risk of refeeding syndrome (see the NICE guideline on nutrition support for adults).
  - Clinical examination should include an assessment of the patient's fluid status, including:
    - pulse, blood pressure, capillary refill and jugular venous pressure
    - presence of pulmonary or peripheral oedema
    - presence of postural hypotension.
  - Clinical monitoring should include current status and trends in:
    - National Early Warning Score (NEWS)
    - fluid balance charts
    - weight.
  - Laboratory investigations should include current status and trends in:
    - full blood count
    - urea, creatinine and electrolytes.
- All patients continuing to receive IV fluids need regular monitoring. This should initially include at least daily reassessments of clinical fluid status, laboratory values (urea, creatinine and electrolytes) and fluid balance charts, along with weight measurement twice weekly. Be aware that:
  - Patients receiving IV fluid therapy to address replacement or redistribution problems may need more frequent monitoring.
  - Additional monitoring of urinary sodium may be helpful in patients with high-volume gastrointestinal losses. (Reduced urinary sodium excretion [less than 30 mmol/l] may indicate total body sodium depletion even if plasma sodium levels are normal. Urinary sodium may also indicate the cause of hyponatraemia, and guide the achievement of a negative sodium balance in patients with oedema. However, urinary sodium values may be misleading in the presence of renal impairment or diuretic therapy.)

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  - Patients on longer-term IV fluid therapy whose condition is stable may be monitored less frequently, although decisions to reduce monitoring frequency should be detailed in their IV fluid management plan.

- Clear incidents of fluid mismanagement (for example, unnecessarily prolonged dehydration or inadvertent fluid overload due to IV fluid therapy) should be reported through standard critical incident reporting to encourage improved training and practice (see the table on consequences of fluid mismanagement to be reported as critical incidents).

# Resuscitation

- If patients need IV fluid resuscitation, use crystalloids that contain sodium in the range 130 to 154 mmol/l, with a bolus of 500 ml over less than 15 minutes. (For more information, see the table on composition of commonly used crystalloids on the guideline's tools and resources page.)

# Routine maintenance

- If patients need IV fluids for routine maintenance alone, restrict the initial prescription to:

  - 25 to 30 ml/kg/day of water **and**

  - approximately 1 mmol/kg/day of potassium, sodium and chloride **and**

  - approximately 50 to 100 g/day of glucose to limit starvation ketosis. (This quantity will not address patients' nutritional needs; see the NICE guideline on nutrition support in adults.)

    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 IV fluid bags as this is dangerous. For more information, see the table on IV fluid prescription for routine maintenance over a 24-hour period.

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# Training and education

- Hospitals should establish systems to ensure that all healthcare professionals involved in prescribing and delivering IV fluid therapy are trained on the principles covered in this guideline, and are then formally assessed and reassessed at regular intervals to demonstrate competence in:
  - understanding the physiology of fluid and electrolyte balance in patients with normal physiology and during illness
  - assessing patients' fluid and electrolyte needs (the 5 Rs: Resuscitation, Routine maintenance, Replacement, Redistribution and Reassessment)
  - assessing the risks, benefits and harms of IV fluids
  - prescribing and administering IV fluids
  - monitoring the patient response
  - evaluating and documenting changes **and**
  - taking appropriate action as required.
- Hospitals should have an IV fluids lead, responsible for training, clinical governance, audit and review of IV fluid prescribing and patient outcomes.

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# Recommendations

People have the right to be involved in discussions and make informed decisions about their care, as described in NICE's information on making decisions about your care.

Making decisions using NICE guidelines explains how we use words to show the strength (or certainty) of our recommendations, and has information about prescribing medicines (including off-label use), professional guidelines, standards and laws (including on consent and mental capacity), and safeguarding.

## 1.1 Principles and protocols for intravenous fluid therapy

The assessment and management of patients' fluid and electrolyte needs is fundamental to good patient care.

1.1.1 Assess and manage patients' fluid and electrolyte needs as part of every ward review. Provide intravenous (IV) fluid therapy only for patients whose needs cannot be met by oral or enteral routes, and stop as soon as possible.

1.1.2 Skilled and competent healthcare professionals should prescribe and administer IV fluids, and assess and monitor patients receiving IV fluids (see the recommendations in the section on training and education).

1.1.3 When prescribing IV fluids, remember the 5 Rs: Resuscitation, Routine maintenance, Replacement, Redistribution and Reassessment.

1.1.4 Offer IV fluid therapy as part of a protocol (see the algorithms for IV fluid therapy):

- Assess patients' fluid and electrolyte needs following algorithm 1: assessment.

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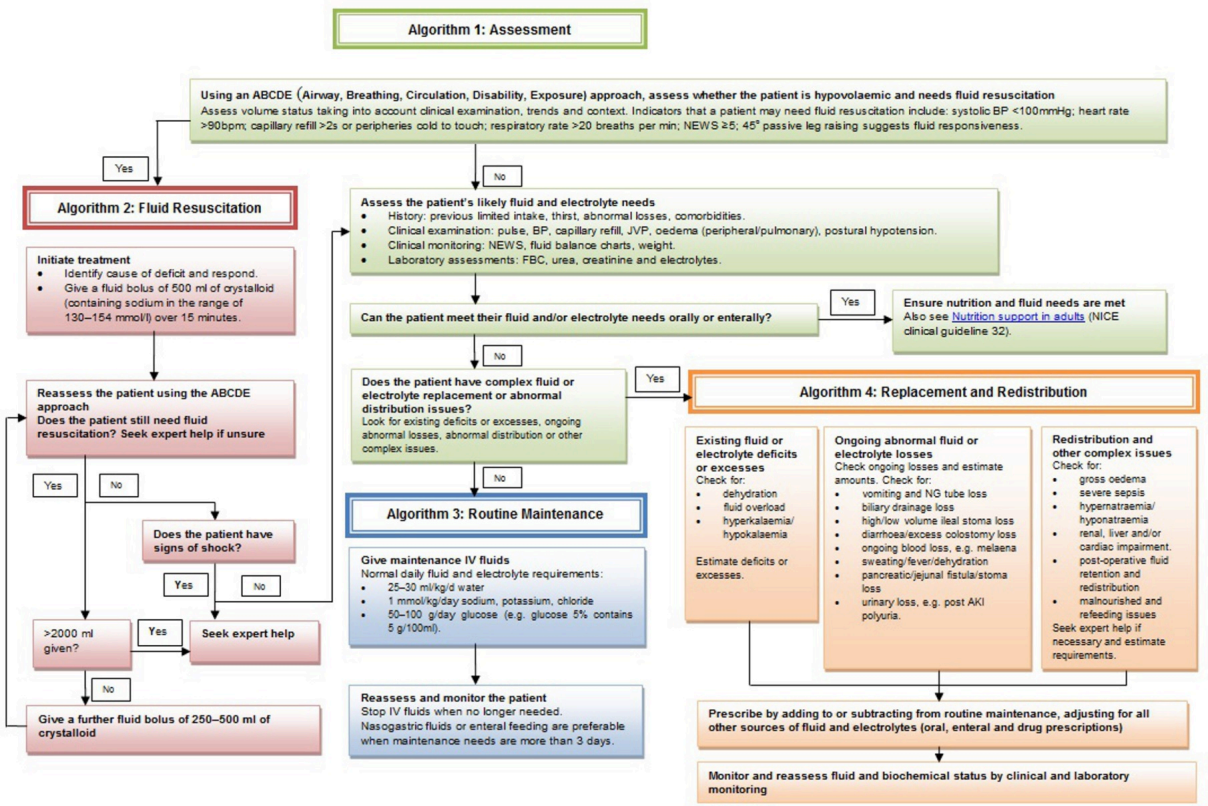
- If patients need IV fluids for fluid resuscitation, follow algorithm 2: fluid resuscitation.
- If patients need IV fluids for routine maintenance, follow algorithm 3: routine maintenance.
- If patients need IV fluids to address existing deficits or excesses, ongoing abnormal losses or abnormal fluid distribution, follow algorithm 4: replacement and redistribution.

## Algorithms for IV fluid therapy

See the downloadable PDF version of the algorithm poster set.




1.1.5 Include the following information in IV fluid prescriptions:

- the type of fluid to be administered
- the rate and volume of fluid to be administered.

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1.1.6 Patients should have an IV fluid management plan, which should include details of:

- the fluid and electrolyte prescription over the next 24 hours
- the assessment and monitoring plan.

Initially, the IV fluid management plan should be reviewed by an expert daily. IV fluid management plans for patients on longer-term IV fluid therapy whose condition is stable may be reviewed less frequently.

1.1.7 When prescribing IV fluids and electrolytes, take into account all other sources of fluid and electrolyte intake, including any oral or enteral intake, and intake from drugs, IV nutrition, blood and blood products.

1.1.8 Patients have a valuable contribution to make to their fluid balance. If a patient needs IV fluids, explain the decision, and discuss the signs and symptoms they need to look out for if their fluid balance needs adjusting. If possible or when asked, provide written information (for example, NICE's information for the public), and involve the patient's family members or carers (as appropriate).

# 1.2 Assessment and monitoring

## Initial assessment

1.2.1 Assess whether the patient is hypovolaemic. Indicators that a patient may need urgent fluid resuscitation include:

- systolic blood pressure is less than 100 mmHg
- heart rate is more than 90 beats per minute
- capillary refill time is more than 2 seconds, or peripheries are cold to touch
- respiratory rate is more than 20 breaths per minute
- National Early Warning Score (NEWS) is 5 or more

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- passive leg raising suggests fluid responsiveness.

  Passive leg raising is a bedside method to assess fluid responsiveness in a patient. It is best undertaken with the patient initially semi-recumbent and then tilting the entire bed through 45°. Alternatively, it can be done by lying the patient flat and passively raising their legs to greater than 45°. If, at 30 to 90 seconds, the patient shows signs of haemodynamic improvement, it indicates that volume replacement may be required. If the condition of the patient deteriorates, in particular breathlessness, it indicates that the patient may be fluid overloaded.

1.2.2 Assess the patient's likely fluid and electrolyte needs from their history, clinical examination, current medications, clinical monitoring and laboratory investigations:

- History should include any previous limited intake, thirst, the quantity and composition of abnormal losses (see the diagram of ongoing losses), and any comorbidities, including patients who are malnourished and at risk of refeeding syndrome (see the NICE guideline on nutrition support in adults).
- Clinical examination should include an assessment of the patient's fluid status, including:
  - pulse, blood pressure, capillary refill and jugular venous pressure
  - presence of pulmonary or peripheral oedema
  - presence of postural hypotension.
- Clinical monitoring should include current status and trends in:
  - NEWS
  - fluid balance charts
  - weight.
- Laboratory investigations should include current status and trends in:
  - full blood count

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— urea, creatinine and electrolytes.

## Reassessment

1.2.3 If patients are receiving IV fluids for resuscitation, reassess the patient using the ABCDE approach (Airway, Breathing, Circulation, Disability, Exposure), monitor their respiratory rate, pulse, blood pressure and perfusion continuously, and measure their venous lactate levels and/or arterial pH and base excess according to guidance on advanced life support (Resuscitation Council UK, 2011).

1.2.4 All patients continuing to receive IV fluids need regular monitoring. This should initially include at least daily reassessments of clinical fluid status, laboratory values (urea, creatinine and electrolytes) and fluid balance charts, along with weight measurement twice weekly. Be aware that:

- Patients receiving IV fluid therapy to address replacement or redistribution problems may need more frequent monitoring.
- Additional monitoring of urinary sodium may be helpful in patients with high-volume gastrointestinal losses. (Reduced urinary sodium excretion [less than 30 mmol/l] may indicate total body sodium depletion even if plasma sodium levels are normal. Urinary sodium may also indicate the cause of hyponatraemia, and guide the achievement of a negative sodium balance in patients with oedema. However, urinary sodium values may be misleading in the presence of renal impairment or diuretic therapy.)
- Patients on longer-term IV fluid therapy whose condition is stable may be monitored less frequently, although decisions to reduce monitoring frequency should be detailed in their IV fluid management plan.

1.2.5 If patients have received IV fluids containing chloride concentrations greater than 120 mmol/l (for example, sodium chloride 0.9%), monitor their serum chloride concentration daily. If patients develop hyperchloraemia or acidaemia, reassess their IV fluid prescription and assess their acid–base status. Consider less frequent monitoring for patients who are stable.

1.2.6 Clear incidents of fluid mismanagement (for example, unnecessarily prolonged

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dehydration or inadvertent fluid overload due to IV fluid therapy) should be reported through standard critical incident reporting to encourage improved training and practice (see the table on consequences of fluid mismanagement to be reported as critical incidents).

1.2.7 If patients are transferred to a different location, reassess their fluid status and IV fluid management plan on arrival in the new setting.

# 1.3 Resuscitation

1.3.1 If patients need IV fluid resuscitation, use crystalloids that contain sodium in the range 130 to 154 mmol/l, with a bolus of 500 ml over less than 15 minutes. (For more information, see the table on composition of commonly used crystalloids on the guideline's tools and resources page.)

1.3.2 Do not use tetrastarch for fluid resuscitation.

1.3.3 Consider human albumin solution 4% to 5% for fluid resuscitation only in patients with severe sepsis.

# 1.4 Routine maintenance

1.4.1 If patients need IV fluids for routine maintenance alone, restrict the initial prescription to:

- 25 to 30 ml/kg/day of water **and**
- approximately 1 mmol/kg/day of potassium, sodium and chloride **and**
- approximately 50 to 100 g/day of glucose to limit starvation ketosis. (This quantity will not address patients' nutritional needs; see the NICE guideline on nutrition support in adults.)

  Weight-based potassium prescriptions should be rounded to the nearest common fluids available (for example, a 67 kg person should have fluids

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containing 20 mmol and 40 mmol of potassium in a 24-hour period). Potassium should not be added to IV fluid bags as this is dangerous. For more information, see the table on IV fluid prescription for routine maintenance over a 24-hour period.

1.4.2 For patients who are obese, adjust the IV fluid prescription to their ideal body weight. Use lower range volumes per kg (patients rarely need more than a total of 3 litres of fluid per day) and seek expert help if their body mass index (BMI) is more than 40 kg/m$^2$.

1.4.3 Consider prescribing less fluid (for example, 20 to 25 ml/kg/day fluid) for patients who:

- are older or frail
- have renal impairment or cardiac failure
- are malnourished and at risk of refeeding syndrome (see the NICE guideline on nutrition support in adults).

1.4.4 When prescribing for routine maintenance alone, consider using 25 to 30 ml/kg/day sodium chloride 0.18% in 4% glucose with 27 mmol/l potassium on day 1 (there are other regimens to achieve this). Prescribing more than 2.5 litres per day increases the risk of hyponatraemia. These are initial prescriptions and further prescriptions should be guided by monitoring.

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 IV fluid bags as this is dangerous.

1.4.5 Consider delivering IV fluids for routine maintenance during daytime hours to promote sleep and wellbeing.

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# 1.5 Replacement and redistribution

1.5.1 Adjust the IV prescription (add to or subtract from maintenance needs) to account for existing fluid and/or electrolyte deficits or excesses, ongoing losses (see the diagram of ongoing losses) or abnormal distribution.

1.5.2 Seek expert help if patients have a complex fluid and/or electrolyte redistribution issue or imbalance, or significant comorbidity, for example:

- gross oedema
- severe sepsis
- hyponatraemia or hypernatraemia
- renal, liver and/or cardiac impairment
- post-operative fluid retention and redistribution
- malnourished and refeeding issues (see the NICE guideline on nutrition support in adults).

# 1.6 Training and education

1.6.1 Hospitals should establish systems to ensure that all healthcare professionals involved in prescribing and delivering IV fluid therapy are trained on the principles covered in this guideline, and are then formally assessed and reassessed at regular intervals to demonstrate competence in:

- understanding the physiology of fluid and electrolyte balance in patients with normal physiology and during illness
- assessing patients' fluid and electrolyte needs (the 5 Rs: Resuscitation, Routine maintenance, Replacement, Redistribution and Reassessment)
- assessing the risks, benefits and harms of IV fluids
- prescribing and administering IV fluids

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- monitoring the patient response
- evaluating and documenting changes **and**
- taking appropriate action as required.

1.6.2 Healthcare professionals should receive training and education about, and be competent in, recognising, assessing and preventing consequences of mismanaged IV fluid therapy, including:

- pulmonary oedema
- peripheral oedema
- volume depletion and shock.

1.6.3 Hospitals should have an IV fluids lead, responsible for training, clinical governance, audit and review of IV fluid prescribing and patient outcomes.

## Diagram of ongoing losses

See the downloadable PDF version of the diagram of ongoing losses.

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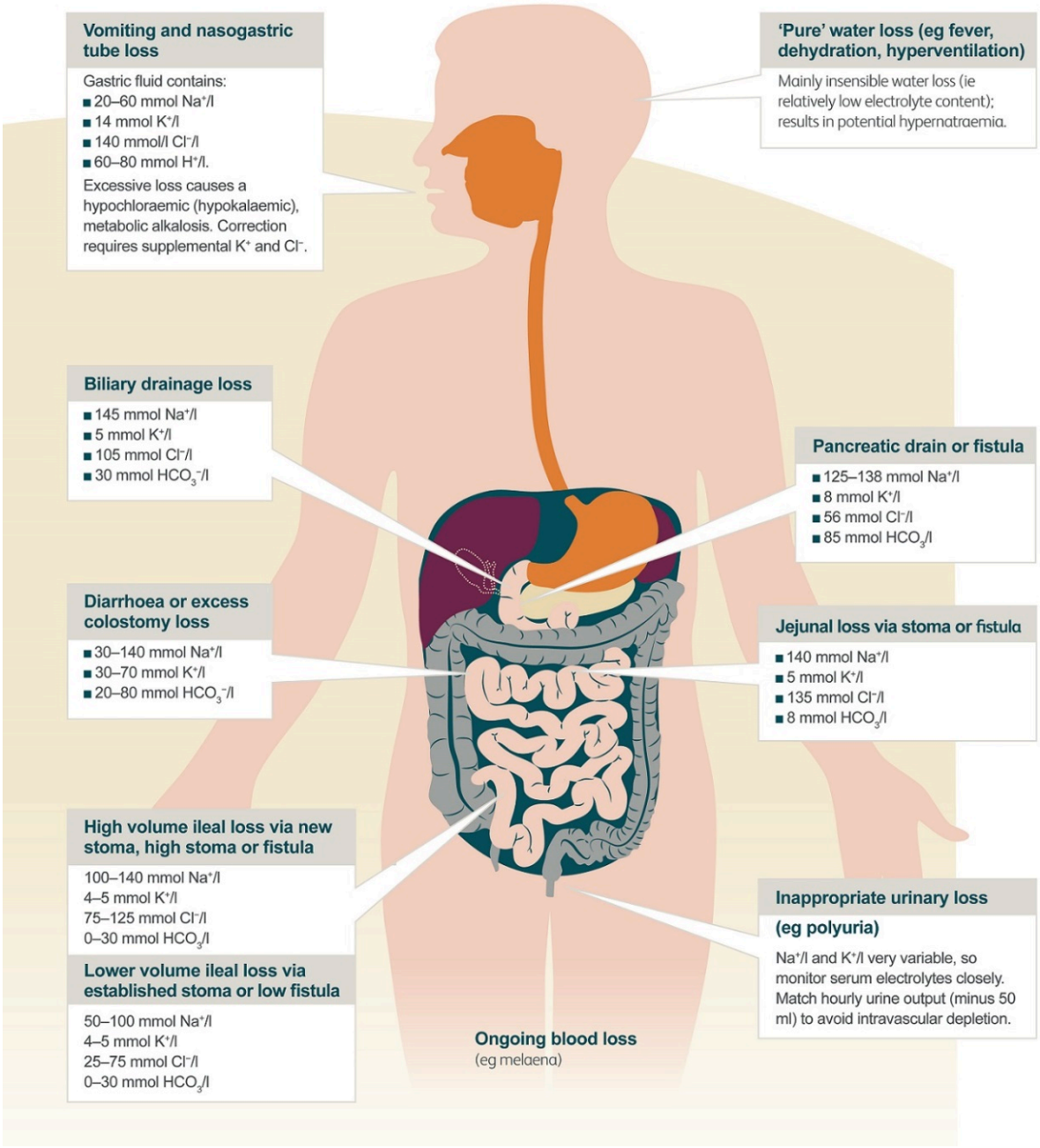


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**Table 1 Consequences of fluid mismanagement to be reported as critical incidents**

| Consequence of fluid mismanagement | Identifying features | Time frame of identification |
|---|---|---|
| Hypovolaemia | Patient's fluid needs not met by oral, enteral or intravenous (IV) intake and:<br>• Features of dehydration on clinical examination<br>• Low urine output or concentrated urine<br>• Biochemical indicators, such as more than 50% increase in urea or creatinine with no other identifiable cause | Before and during IV fluid therapy |
| Pulmonary oedema (breathlessness during infusion) | • No other obvious cause identified (for example, pneumonia, pulmonary embolus or asthma)<br>• Features of pulmonary oedema on clinical examination<br>• Features of pulmonary oedema on X ray | During IV fluid therapy or within 6 hours of stopping IV fluids |
| Hyponatraemia | • Serum sodium less than 130 mmol/l<br>• No other likely cause of hyponatraemia identified | During IV fluid therapy or within 24 hours of stopping IV fluids |
| Hypernatraemia | • Serum sodium 155 mmol/l or more<br>• Baseline sodium normal or low<br>• IV fluid regimen included 0.9% sodium chloride<br>• No other likely cause of hypernatraemia identified | During IV fluid therapy or within 24 hours of stopping IV fluids |

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| Consequence of fluid mismanagement | Identifying features | Time frame of identification |
|---|---|---|
| Peripheral oedema | • Pitting oedema in extremities and/or lumbar sacral area<br>• No other obvious cause identified (for example, nephrotic syndrome or known cardiac failure) | During IV fluid therapy or within 24 hours of stopping IV fluids |
| Hyperkalaemia | • Serum potassium more than 5.5 mmol/l<br>• No other obvious cause identified | During IV fluid therapy or within 24 hours of stopping IV fluids |
| Hypokalaemia | • Serum potassium less than 3.0 mmol/l likely to be due to infusion of fluids without adequate potassium provision<br>• No other obvious cause (for example, potassium-wasting diuretics, refeeding syndrome) | During IV fluid therapy or within 24 hours of stopping IV fluids |

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 IV fluid bags as this is dangerous.

Source: Table 1 was drafted based on the consensus decision of the members of the guideline development group.

**Table 2 IV fluid prescription (by body weight) for routine maintenance over a 24-hour period**

| Body weight (in kg) | Water (25 to 30 ml/kg/day) | Sodium, chloride, potassium (approximately 1 mmol/kg/day of each) |
|---|---|---|
| 40 | 1000 to 1200 | 40 |
| 41 | 1025 to 1230 | 41 |
| 42 | 1050 to 1260 | 42 |

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| | | |
|---|---|---|
| 43 | 1075 to 1290 | 43 |
| 44 | 1100 to 1320 | 44 |
| 45 | 1125 to 1350 | 45 |
| 46 | 1150 to 1380 | 46 |
| 47 | 1175 to 1410 | 47 |
| 48 | 1200 to 1440 | 48 |
| 49 | 1225 to 1470 | 49 |
| 50 | 1250 to 1500 | 50 |
| 51 | 1275 to 1530 | 51 |
| 52 | 1300 to 1560 | 52 |
| 53 | 1325 to 1590 | 53 |
| 54 | 1350 to 1620 | 54 |
| 55 | 1375 to 1650 | 55 |
| 56 | 1400 to 1680 | 56 |
| 57 | 1425 to 1710 | 57 |
| 58 | 1450 to 1740 | 58 |
| 59 | 1475 to 1770 | 59 |
| 60 | 1500 to 1800 | 60 |
| 61 | 1525 to 1830 | 61 |
| 62 | 1550 to 1860 | 62 |
| 63 | 1575 to 1890 | 63 |
| 64 | 1600 to 1920 | 64 |
| 65 | 1625 to 1950 | 65 |
| 66 | 1650 to 1980 | 66 |
| 67 | 1675 to 2010 | 67 |
| 68 | 1700 to 2040 | 68 |

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| | | |
|---|---|---|
| 69 | 1725 to 2070 | 69 |
| 70 | 1750–2100 | 70 |
| 71 | 1775 to 2130 | 71 |
| 72 | 1800 to 2160 | 72 |
| 73 | 1825 to 2190 | 73 |
| 74 | 1850 to 2220 | 74 |
| 75 | 1875 to 2250 | 75 |
| 76 | 1900 to 2280 | 76 |
| 77 | 1925 to 2310 | 77 |
| 78 | 1950 to 2340 | 78 |
| 79 | 1975 to 2370 | 79 |
| 80 | 2000 to 2400 | 80 |
| 81 | 2025 to 2430 | 81 |
| 82 | 2050 to 2460 | 82 |
| 83 | 2075 to 2490 | 83 |
| 84 | 2100 to 2520 | 84 |
| 85 | 2125 to 2550 | 85 |
| 86 | 2150 to 2580 | 86 |
| 87 | 2175 to 2610 | 87 |
| 88 | 2200 to 2640 | 88 |
| 89 | 2225 to 2670 | 89 |
| 90 | 2250 to 2700 | 90 |
| 91 | 2275 to 2730 | 91 |
| 92 | 2300 to 2760 | 92 |
| 93 | 2325 to 2790 | 93 |
| 94 | 2350 to 2820 | 94 |

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| | | |
|---|---|---|
| 95 | 2375 to 2850 | 95 |
| 96 | 2400 to 2880 | 96 |
| 97 | 2425 to 2910 | 97 |
| 98 | 2450 to 2940 | 98 |
| 99 | 2475 to 2970 | 99 |
| 100 | 2500 to 3000 | 100 |
| >100 | 2500 to 3000 | 100 |

Add 50 to 100 grams/day glucose (for example, glucose 5% contains 5 g/100 ml).

For special considerations, refer to the recommendations for routine maintenance.

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 IV fluid bags as this is dangerous.

Source: Table 2 was drafted based on the consensus decision of the members of the guideline development group.

# Terms used in this guideline

## Expert

In this guideline, the term 'expert' refers to a healthcare professional who has core competencies to diagnose and manage acute illness. These competencies can be delivered by a variety of models at a local level, such as a critical care outreach team, a hospital-at-night team or a specialist trainee in an acute medical or surgical specialty. For more information, see the NICE guideline on acutely ill patients in hospital.

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# Recommendations for research

The guideline development group has made this recommendation for research.

## 1 Assessment and monitoring

What is the incidence of complications during, and as a consequence of, intravenous fluid therapy?

### Why this is important

This is almost certainly under-reported in the ward setting with significant implications for patients, predominantly morbidity through to mortality. It is probable that complications of fluid therapy are frequent and may be associated with increased clinical needs, such as critical care and, on occasion, may necessitate fluid resuscitation. Lack of a set of clearly defined features of the complications of fluid mismanagement compounds the problem. It is important to define these features and then undertake an observational study in a hospital setting to determine the epidemiology of these complications. Such a study would highlight the prevalence of fluid related complications and inform the development of preventive measures.

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# Finding more information and committee details

To find NICE guidance on related topics, including guidance in development, see the NICE topic page on medicines management.

For full details of the evidence and the guideline committee's discussion, see the full guideline. You can also find information about how the guideline was developed, including details of the committee.

NICE has produced tools and resources to help you put this guideline into practice. For general help and advice on putting our guidelines into practice, see resources to help you put NICE guidance into practice.

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# Update information

**May 2017:** Some research recommendations that have become outdated since original publication have been stood down and deleted.

**December 2016:** We added information about weight-based potassium prescriptions and clarified that potassium should not be added directly to intravenous fluid bags (as this is dangerous) in recommendations 1.4.1 and 1.4.4, tables 1 and 2 and the accompanying algorithms giving more information on weight-based potassium prescriptions.

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# Accreditation


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