Intravenous fluid therapy for adults in hospital: summary of NICE guidance

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Many hospital staff who prescribe intravenous (IV) fluids have not received adequate training on the subject despite the fact that fluid management is one of the commonest tasks in hospital involving complex decisions on optimal volume, rate, and type of fluid to be given. Although inappropriate fluid therapy is rarely reported as being responsible for patient harm, a 1999 report from the National Confidential Enquiry into Perioperative Deaths (NCEPOD) suggested that as many as 1 in 5 patients receiving IV fluids in hospital suffered complications or morbidity due to their inappropriate administration.1 A more recent NCEPOD report in 2011 highlighted that patients were at an increased risk of death within thirty days of having an operation if they had received inadequate or excessive IV fluids in the preoperative period.2 This article summarises recent recommendations from the National Institute for Health and Care Excellence (NICE).3

Recommendations

NICE recommendations are based on systematic reviews of the best available evidence and explicit consideration of cost effectiveness. When minimal evidence is available, recommendations are based on the Guideline Development Group’s experience and opinion of what constitutes good practice. Evidence levels for the recommendations are in the full version of this article on bmj.com.

Principles and protocols for intravenous fluid therapy

The assessment and management of patients’ fluid and electrolyte needs are fundamental to good patient care.

- 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.
- Skilled and competent healthcare professionals should prescribe and administer IV fluids and assess and monitor patients receiving IV fluids.
- When prescribing IV fluids, remember the five Rs: resuscitation, routine maintenance, replacement, redistribution, and reassessment.
- Offer IV fluid therapy as part of a protocol (see figure):
  - Assess patients’ fluid and electrolyte needs following algorithm 1 (assessment)
  - If patients need IV fluids for 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).

- Include the following information in IV fluid prescriptions:
  - The type of fluid to be administered
  - The rate and volume of fluid to be administered.
- 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 receiving longer term IV fluid therapy whose condition is stable may be reviewed less frequently.

- 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.
- 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).

Assessment and monitoring

Initial assessment

- Assess whether the patient is hypovolaemic. Algorithm 1 (see figure) outlines the indicators that a patient may need urgent fluid resuscitation.
- Assess the patient’s likely fluid and electrolyte needs from their history, clinical examination, current medications, clinical monitoring, and laboratory investigations—see Algorithm 1.

Reassessment

- If the patient is receiving IV fluids for resuscitation, reassess the patient using the ABCDE approach (airway, breathing, circulation, disability, exposure); monitor respiratory rate, pulse, blood pressure, and perfusion continuously; and measure venous lactate level or arterial pH and base excess according to the Resuscitation Council’s guidance on advanced life support.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.
Algorithms for IV fluid therapy

- Additional monitoring of urinary sodium may be helpful in patients with high volume gastrointestinal losses; reduced urinary sodium excretion (<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; but urinary sodium values may be misleading in the presence of renal impairment or diuretic therapy
- Patients receiving 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.

- If patients have received IV fluids containing chloride concentrations >120 mmol/L (such as 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.

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

Fluid resuscitation
• If patients need IV fluid resuscitation, use crystalloids that contain sodium in the range 130-154 mmol/L, with a bolus of 500 mL over less than 15 minutes (see Algorithm 2 in the figure for details).
• Do not use tetrastarch for fluid resuscitation.
• Consider human albumin solution 4-5% for fluid resuscitation only in patients with severe sepsis.

Routine maintenance
• If patients need IV fluids for routine maintenance alone, restrict the initial prescription to:
  – 25-30 mL/kg/day of water and
  – Approximately 1 mmol/kg/day of potassium, sodium, and chloride and
  – Approximately 50-100 g/day of glucose to limit starvation ketosis. (This quantity will not address patients’ nutritional needs; see NICE clinical guideline on nutrition support in adults (CG32).)

See Algorithm 3 in figure for detail.
• 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 is >40.
• Consider prescribing less fluid (for example, 20-25 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 NICE clinical guideline on nutrition support in adults (CG32)).

• When prescribing for routine maintenance alone, consider using 25-30 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 >2.5 L/day increases the risk of hyponatraemia. These are initial prescriptions, and further prescriptions should be guided by monitoring.
• Consider delivering IV fluids for routine maintenance during daytime hours to promote sleep and wellbeing.

Replacement and redistribution
• Adjust the IV prescription (add to or subtract from maintenance needs) to account for existing fluid or electrolyte deficits or excesses, ongoing losses, or abnormal distribution (see Algorithm 4 in figure).
• Seek expert help if patients have a complex fluid or electrolyte redistribution issue or imbalance, or substantial comorbidity (Algorithm 4 outlines examples, including gross oedema and severe sepsis).

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 five 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
  – Taking appropriate action as required.
• 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.
• Hospitals should have an IV fluids lead, responsible for training, clinical governance, audit, and review of IV fluid prescribing and patient outcomes.

Overcoming barriers
Implementing this guideline will require all clinicians to acknowledge and understand that intravenous fluid therapy is a key area of patient care, and to make consistent efforts to ensure compliance with the recommendations. Challenges to the identification of adverse events in hospitals as consequences of mismanagement of intravenous fluid therapy will include difficulties in establishing causal relationships between the two. However, careful monitoring of patients in line with the recommendations and recording of relevant observations will establish safe and effective care, removing the current variations in both practice and outcome. Perceptions among clinicians with regard to the use of tetrastarch for fluid resuscitation will also need re-evaluation in light of the evidence presented.

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Dental pain

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A 40 year old woman presents complaining of severe dental pain and swelling, and is unable to contact her dentist. She reports that the pain started three days ago and has increased in intensity since, with her face becoming swollen in the last 24 hours.

What you should cover

Nature and severity of the pain

Dental pain occurs as a result of inflammation of the pulp (pulpitis) (see figure). This is generally caused by bacteria from decayed teeth or defective dental fillings. Dental pain can be practically grouped into five progressive pain categories. A short pain history and examination is required to categorise this pain.

1. A short, sharp pain lasting only a few seconds and occurring in response to a cold or “sweet” stimulus is likely to be reversible pulpitis. This is generally not a severe problem, and the pulp of the tooth can be saved. Antibiotics and analgesics are not required, but the patient should be advised to attend a dentist.
2. A dull, aching, “pulsing” pain that occurs spontaneously and in response to thermal stimuli is likely to be irreversible pulpitis. There is no swelling, but pain is debilitating, often disturbs sleep, and may last for hours. Irreversible pulpitis requires expedient dental intervention. Antibiotics and analgesics are ineffective.
3. Untreated pulpitis leads to pulp necrosis and death, and the pain may temporarily decrease. However, inflammation and infection of the surrounding tissues, known as apical periodontitis, will ensue as bacterial and pulp breakdown products escape from the tooth. The offending tooth will be tender to touch or pressure. The tooth may respond to antibiotics, but they are not essential. Dental intervention is still required.
4. An acute apical abscess is a common manifestation of untreated apical periodontitis and is associated with a swelling, tooth mobility, and severe tenderness to touch. Conversely, a chronic apical abscess may be present without pain or obvious swelling if the infection is draining.1 Chronic abscesses usually drain intra- or extra-orally but occasionally can appear as a skin “pimple” extra-orally. Acute apical abscesses will require drainage by a dentist but will be relieved in the short term by antibiotics.
5. Acute abscesses may spread as a cellulitis within soft tissue spaces to the floor of the mouth (Ludwig’s angina), leading to neck and mediastinal abscesses; this can compromise the patient’s airway. The patient’s general health affects the spread of infection. Spreading infection, pyrexia, and affected breathing will require referral and hospital admission.

History

Take a pain history—This is necessary to identify the stage and severity of the infection (see above).
Ascertain pattern of swelling—How long has the swelling been present and is it worsening? If the swelling is rapidly progressing and affecting swallowing, breathing, speech, or ability to open the eye, hospital referral is required. If there are signs and symptoms of systemic infection, including nausea, malaise, pyrexia, or rigors,2 prescribe antibiotics and consider hospital referral.
Ask about recent or planned dental treatment—A history of recent dental treatment is more likely to indicate a dental aetiology, which has resulted in an inflammatory or infective complication. Returning to the dentist should be priority for the patient.
Check medication—Ask the patient if he or she is already taking medication for the problem, such as antibiotics or analgesics, as this will affect your assessment of how the condition is responding, as well as your treatment.

Dental anatomy, decay, and pain. The crown of a tooth is made up of three basic layers; enamel (A), dentine (B), and pulp (C). The dental pulp is essentially a connective tissue containing nerves, blood vessels, and lymphatics. It is continuous with the supporting tissues around the tooth. Pain results when the pulp is inflamed, which is generally caused by bacteria from decay (D), or a leaking dental restoration or “filling”.

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- Flashes, floaters, and a field defect (BMJ 2013;347:f6496)
- An adult with a neck lump (BMJ 2013;347:f5473)
- Abnormal vaginal discharge (BMJ 2013;347:f4975)
- Umbilical hernia (BMJ 2013;347:f4252)
- A pain in the bottom (BMJ 2013;347:f4192)
Red flags (warranting hospital referral and assessment)

Symptoms
- Difficulty swallowing, breathing, or speaking
- Difficulty opening the eye
- Mouth opening of less than 2 finger breadths

Signs
- Infection spreading to the neck
- Swelling in the floor of the mouth, leading to a raised tongue
- Rapid progression of infection despite adequate oral antibiotics
- Signs and symptoms of systemic infection—such as pyrexia, tachycardia, and altered blood pressure—may also be recorded

Remember the relevance of medical history—Patients who are immunosuppressed or have unstable diabetes are more susceptible to infection. Ask about allergies to antibiotics and latex, which is present in the gloves used for examination.

What you should do

Examination

Extra-orally

Check for swelling—Is swelling evident around the mandible, submandibularly (usually associated with a lower tooth), or in the infraorbital region (usually associated with an upper tooth)? Is the eye opening limited? These indicate spreading infection, which will require referral to a hospital.

Assess trismus—Normal mouth opening is 40-60 mm (between two and three finger breadths). If mouth opening is less than two finger breadths, hospital referral is advised, as this implies that the infection is spreading to the tissue planes around the muscles of mastication.

Check vital signs—Check temperature, pulse, blood pressure, and oxygen saturation if the airway is compromised. These are signs of systemic infection, which warrants antibiotic treatment and hospital referral if the airway is compromised.

Palpate the lymph nodes—If there is regional lymphadenopathy, antibiotic treatment is required.

Look for extra-oral drainage—Draining dental infection can present as a large red spot on the skin.

Intra-orally

Examine intra-orally—Look inside the mouth with good light and a tongue spatula if no dental mirror is available.

Check for swelling—If a swelling is present, is it raising the tongue? A raised tongue should flag concern as it indicates infection that has spread to the floor of the mouth. If this is not treated, the airway may become compromised; therefore, it warrants hospital referral.

Look at the teeth—Is gross decay or a badly broken down tooth evident? These may indicate likely sources of infection. Remember, a denture can conceal an offending tooth and needs to be removed. A chronic abscess may present as a sinus tract (appearing as a “bubble” on the gum).

Examine the back of the mouth—Lower wisdom teeth often give rise to dental pain because of caries or inflammation of the surrounding gum tissue (pericoronitis).

Consider referral

After examination, decide if any treatment, prescription, or immediate hospital referral is required. If red flags (see box) are not present, the patient should be reassured.

In general, the importance of attending a dentist should be emphasised to the patient. It should be stressed that the prescription of medication will not eliminate the source of infection.

Medication

Often, the prescription of analgesia and advice that the patient should see his or her dentist are all that is required. Appropriate pain relief would ideally be a non-steroidal anti-inflammatory drug such as ibuprofen, which can be taken with paracetamol. Codeine phosphate can also be prescribed for adult patients. Prolonged use of opiates can lead to dependence. The prescriber should regularly evaluate the risks and benefits of taking these drugs. It is of utmost importance that patients are advised to see their dentist even if symptoms are subsiding.

Antibiotics should be prescribed if there are systemic symptoms (as described above). When bacteria from acute dental abscesses have been cultured, there are many combinations, including strict anaerobic infections (20%), mixed aerobic infections (6%), and both facultative and strict anaerobic infections (59-75%). The common bacteria from acute dental abscesses include streptococci species and Fusobacterium. The appropriate antibiotics are a combination of amoxicillin and metronidazole. There is little evidence to support a specific antibiotic regimen for the treatment of dental abscesses. Patients should be reviewed by their dentist within three days to ensure systemic signs of infection are resolving and to allow necessary dental treatment to be carried out.

Subsequent dental treatment may include a filling or restoration, root canal treatment, tooth extraction, incision and drainage of a swelling, or a combination of these.

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