In critical care, one of the main aims of treatment is to optimise vital organ function. A key component of this is to evaluate the patient’s circulating volume and fluid requirements through accurate assessment of fluid balance.

Healthcare bodies have highlighted problems in monitoring fluid balance, leading to unplanned critical care admissions (National Institute for Health and Care Excellence (NICE) 2013; Stewart et al, 2009; NICE, 2007). One study found that, in critical care units, up to 35% of fluid balance charting was inaccurate; workload, along with lack of skills and training, were cited as key factors for this (Asfour, 2016).

What is fluid balance?

Fluid balance is a term used to describe the balance of the input and output of fluids in the body to allow metabolic processes to function correctly (Welch, 2010). It involves the measurement of overall body input and output, including ongoing losses, which are sometimes missed. Understanding the body’s distribution of fluid compartments helps explain why it is so important to measure fluid balance in critical care.

Body fluid compartments consist of intracellular fluid (40% of body weight) and extracellular fluid (20% of body weight) (Fig 1). The extracellular fluid compartment can be divided into interstitial fluid and plasma volume. In critical illness, the volumes of fluid can shift considerably, particularly between the interstitial fluid and plasma volume. This often leads to a need for plasma volume supplementation with intravenous (IV) fluids, or diuresis to help with fluid offloading.

The balance of plasma electrolytes – particularly sodium, potassium and magnesium – is key to maintaining metabolic and cardiac stability, as imbalances can lead to cardiac arrhythmias. When plasma sodium is increased above normal levels (>145mmol/L – known as hypernatraemia), it can be because of large-volume fluid resuscitation with sodium-rich formulations, such as 0.9% saline solution (usually accompanied with hyperchloraemic acidosis). However, it can also be an indicator of dehydration when plasma sodium has increased.

Key points

- Acute kidney injury will develop in around half of all critical care patients
- Fluid resuscitation and management is a key intervention in the care of patients who are critically ill
- Accurate fluid balance charting has a significant impact on patient safety
- Small fluctuations can have a significant impact on patient outcomes

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Abstract

Fluid balance is a key area of critical care clinical practice of which all staff who care for patients need to be aware. Small fluctuations can have a significant impact on patient outcomes and progress, so careful charting and review is needed from the multidisciplinary team. This article, which is part five of the essential critical care skills series, discusses the importance of fluid balance in adults who are critically ill, common considerations for the inputs and outputs of such patients, and potential effects on patient status. It also provides a framework for when and how concerns around fluid balance should be escalated to the multidisciplinary team.

Citation

been concentrated. Sodium levels will influence decision making about fluid balance targets.

**Fluid input in critical care**

There are varying sources of fluid inputs in patients in critical care. Some, such as IV fluids, are obvious, but there are more covert input methods that are sometimes overlooked when calculating fluid balance. These are outlined below.

**IV fluid resuscitation**

IV fluids administered as boluses to test fluid responsiveness or background infusions are sometimes referred to as IV maintenance. These need to be charted accurately, in terms of fluid type and volume.

**Nasogastric/orogastric/total parenteral nutrition feeding**

Patients in intensive care units (ICUs) are usually fed via the nasogastric/orogastric (NG/OG) route. Some who cannot tolerate feed are administered total parenteral nutrition. Both feeding routes involve infusing a volume of feed that needs to be charted, often each hour. To ensure accuracy of charting, it is prudent to not just assume the rate of administration is the exact volume administered – for example, an NG feeding pump may have been on pause for a procedure, so the actual volume administered that hour is documented as exact volume administered – for example, 3ml/hr, you should also consider the flush fluid of IV transducers.

**Oral intake**

As critical care has progressed, many more patients are awake, alert and may be taking food or fluids administered continuously by syringe driver or volumetric pump to maintain blood-plasma concentrations and drug effect. These should be documented each hour, and the volume administered recorded. Although a small volume overall (usually 3ml/hr), you should also consider the flush fluid of IV transducers.

**Fluid output in critical care**

Patients in critical care have a variety of fluid outputs. Some of these would be the same for a patient in any clinical area, but there are some nuances specific to patients in critical care that need to be considered.

**Drain output**

Many patients are admitted to ICU postoperatively and, as part of the operative course, drains are often placed in body cavities such as the thorax or abdomen. These are monitored regularly for bleeding and fluid output. In the first few hours of postoperative recovery, a patient’s drains may be monitored multiple times an hour to check for signs of blood loss. The activation of major blood loss pathways in hospitals are usually based on the charted output from drains and surgical sites.

**Ongoing losses in critical care**

Ongoing losses are defined as fluid outputs that are not easily measured, but are ongoing and need to be considered in the...
management of fluid balance (NICE, 2013). The sources of these are depicted in Fig 2.

Some specific considerations need to be made for patients in critical care. Diarrhoea is common in such adults and its cause is often multifactorial (Tirlapur et al, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). It can be extreme and, where stool is liquid type 7 on the Bristol stool chart (Alf, 2016). Patients who are intubated and on mechanical ventilation will experience ongoing losses from the respiratory system via the breaking of natural defences by bypassing the upper airway (Intensive Care Foundation, 2015). The impact of this is reduced through passive and active humidification techniques.

Due to low colloid oncotic pressure and fluid shift into the interstitial space, serous fluid can leak out of drain sites, IV-line sites and other areas of skin puncture (Cordemans et al, 2012).

**Documentation and care escalation**

During ward rounds, patients’ daily fluid balance goals are usually set. Multidisciplinary teams should consider flexible fluid balance targets that are clearly communicated to bedside ICU staff in unambiguous language; using closed-loop communication and standardised language can reduce the risk of error (Hickey et al, 2012).

When fluid balance targets are not being met (more than +/-500ml), or the patient is showing signs of fluid overload, a review from an appropriate member of the medical team should be sought. This may include a senior registrar or advanced critical care practitioner. Table 1 gives an example of a fluid balance chart used in intensive care.

**Conclusion**

The measurement of fluid balance is a core skill for nursing staff working in the critical care unit. Accurate measurement of input and output, considering the factors affecting adults who are critically ill, will enhance care delivery, improve safety and make sure care is evidence based. NT