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What's new in volume therapy in the intensive care unit?

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The administration of intravenous fluid to critically ill patients is one of the most common but also one of the most fiercely debated interventions in intensive care medicine. During the past decade, a number of important studies have been published which provide clinicians with improved knowledge regarding the timing, the type and the amount of fluid they should give to their critically ill patients. However, despite the fact that many thousands of patients have been enrolled in these trials of alternative fluid strategies, consensus remains elusive and practice is widely variable.

Early adequate resuscitation of patients in shock followed by a restrictive strategy may be associated with better outcomes. Colloids such as modern hydroxyethyl starch are more effective than crystalloids in early resuscitation of patients in shock, and are safe when administered during surgery. However, these colloids may not be beneficial later in the course of intensive care treatment and should best be avoided in intensive care patients who have a high risk of developing acute kidney injury. Albumin has no clear benefit over saline and is associated with increased mortality in neurotrauma patients. Balanced fluids reduce the risk of hyperchloraemic acidosis and possibly kidney injury. The use of hypertonic fluids in patients with sepsis and acute lung injury warrants further investigation and should be considered experimental at this stage.

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Fluid therapy impacts relevant patient-related outcomes. Clinicians should adopt an individualized strategy based on the clinical scenario and best available evidence. One size does not fit all.

Introduction

The administration of intravenous fluids is one of the most common interventions in the intensive care environment. There is ongoing discussion regarding the benefits and disadvantages of infusion therapy. While the application of fluid during shock leads to circulatory stabilization and can therefore be life-saving, fluid overload is associated with oedema development and worse outcomes. This single measure, which may be vital in the early phase of shock, also has the potential to harm the patient. Interestingly, despite the worldwide use of various infusion solutions, no concrete evidence has been provided that infusion therapy per se leads to a lower mortality among seriously ill patients. This may be related to the complexity of treatment in an intrinsically heterogeneous group of critically ill patients, as well as to considerable differences that exist in the clinical use of infusion therapy.

In the past 10 years, an impressive amount of new research has been conducted and published in the field of fluid resuscitation in critically ill patients. To put this statement into context, combining the search terms fluid resuscitation and intensive care in PubMed, and limiting the search to papers published between 2003 and 2013, an impressive number of 1238 publications can be identified. The results of some of the largest and most rigorously conducted studies in the history of intensive care medicine have provided clinicians with useful answers but also with many more questions and, as a result, a significant level of debate and controversy still remains. In the following review, an attempt will be made to put some of these new data into clinical context. Some of the more specific topics (e.g., balanced solutions, fluids in trauma and fluids in anaesthesia) will be discussed elsewhere in this edition of Best Practice and Research, Clinical Anaesthesiology, and readers will be referred to other sections where appropriate.

Timing of fluid administration

It is important to differentiate between fluid substitution and volume substitution in intensive care patients [1]. Different indications warrant different strategies and fluid choices, a distinction that has not always been appreciated sufficiently in the design of fluid studies.

The now generally accepted concept based on some interventional but mostly on observational studies and expert opinion is that resuscitation of patients in shock needs to be timely and adequate. Often, this part of the resuscitation will have occurred in the pre-intensive care unit (ICU) setting, for example, in the emergency department.

Early goal-directed treatment (EGDT) of septic shock has been incorporated into the surviving sepsis guidelines [2,3]. However, the findings of the original Rivers et al. study were not replicated in the recently published randomized trial of Protocol-based Care for Early Septic Shock (ProCESS) [4]. In this study, 1341 patients with septic shock were randomly assigned to protocol-based EGDT, protocol-based standard therapy or to usual care. Resuscitation strategies differed significantly with respect to the monitoring of central venous pressure and oxygen and the use of intravenous fluids, vasopressors, inotropes and blood transfusions. No differences in 90 day mortality, 1-year mortality or the need for organ support were observed.

Other large studies including the Australasian Resuscitation in Sepsis Evaluation randomized controlled trial (ARISE) and the Protocolised Management in Sepsis trial (ProMISe) are currently under way and should provide us with more definitive data in this specific area of fluid resuscitation [5]. An important challenge the investigators of these three important trials face is the likelihood that the