Principles of Fluid Management

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KEYWORDS

• Crystalloid • Colloid • Resuscitation • Intravenous • Fluid balance • Toxicity

KEY POINTS

- Intravenous (IV) fluids should be recognized and prescribed as drugs.
- Fluid therapy is a dynamic intervention. Its prescription can be viewed as occurring across distinct but interrelated phases of resuscitation (rescue, optimization, stabilization, and de-escalation) whereby the goals of fluid therapy naturally vary.
- Natural colloids, such as albumin, have similar effectiveness as resuscitation fluid in critical illness and have a role in prevention of hepatorenal syndrome; however, their use in traumatic brain injury is associated with higher mortality.
- The issue of fluid toxicity is important and associated with increased mortality. Accumulated fluid should be mobilized and removed aggressively as patients recover from their critical illness.

INTRODUCTION

IV fluid therapy remains the most ubiquitous intervention administered in acutely ill hospitalized patients.[1] Fluid therapy is routinely prescribed across a broad range of clinical settings, including in the management of critically ill patients with infections, hypovolemia, and in those with hemodynamic deterioration deemed to be volume responsive, and for the perioperative replacement of significant fluid deficits and losses. In these contexts, fluid therapy is generally perceived to have benefit for patients. However, there is wide variation in practice.[2,3] Fluid therapy prescription varies considerably depending on where care is provided (ie, country, region, hospital, care unit) and by provider specialty (ie, surgical, medical, anesthesia, emergency).[4] This variation stems from several factors such as the physiologic complexity of bedside determination of

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the optimal type, volume and rate of fluid administration, the mechanisms for assessing the response to fluid loading, and due to many prescribing clinicians having limited expertise and underappreciation for the potential for harm.[5–7] This variation has also historically stemmed from a general lack of clarity in the literature on the principles of optimal fluid prescription (ie, efficacy and safety), the idea of prescribing fluid therapy for "the right patient, at the right time, and in the right context."[1]

In the last few years, several large high-quality randomized trials have reported on the efficacy and safety of IV fluid therapy for acute resuscitation in the critically ill.[8–12] These data provide greater clarity to long-standing debates regarding fluid type and dose, during and after acute resuscitation, and better inform best clinical practice to improve patient outcomes. In addition, several organizations have published consensus statements, performed quality assurance audits, and implemented evidenced-based recommendations regarding fluid therapy for acutely ill patients.[5,7,13] More commonly, there has been a recommendation for clinicians to give the same attention to prescribing IV fluid therapy as they would any other drug (**Table 1**). IV fluids should be prescribed for specific indications; should have the type, dose, and rate specified; and should have recognized contraindications. Fluid therapy should be prescribed with an appreciation for the potential for adverse effects; this is particularly relevant when considering that the vast majority of acutely ill hospitalized patients, including children, receive IV fluid therapy in some form or another, usually as some combination of crystalloids, colloids, and blood products. This review provides an overview of recent relevant evidence related to the management of fluid therapy used in acutely ill and hospitalized patients.

HISTORICAL CONTEXT

We owe the origins of the salt solution for IV resuscitation to the Scottish physician William O'Shaughnessy, who in 1831 recommended the use of a dilute salt solution as a novel therapy to counteract the profound hypovolemia associated with cholera.[13]

Table 1
Overview of the analogy of prescribing fluid therapy and prescribing a drug

Steps for Prescribing a Drug	Prescribing an Oral Hypoglycemic Medication	Prescribing Fluid Therapy
Define the clinical problem	Diabetes mellitus	Hypovolemia or other fluid responsive state
Specify the therapeutic objective	Lower blood glucose	Restore absolute/relative fluid deficit
Verify the suitability of the drug	Class of oral hypoglycemic agent	Crystalloid, colloid, or blood product
Write a prescription to start the use of drug	Order written by MD, verified and dispensed by pharmacy	Order written by MD; verified by pharmacy, blood bank, or RN; administered by RN
Monitor therapeutic response of the drug	Blood glucose or hemoglobin A1C, evidence of adverse effect/toxicity	Monitor hemodynamic profile and end-organ perfusion, evidence of dose-response toxicity
Write an order to discontinue	Order written by MD, verified by pharmacy	Order written by MD, administered by RN

Adapted from Raghunathan K, Shaw AD, Bagshaw SM. Fluids are drugs. Curr Opin Crit Care 2013;19(4):290–8; with permission.