then the comprehensive review, analysis, and reflection provided by the ADQI group should be welcome as an important educational process for clinicians to improve their knowledge base and make rational, if not evidence-based, therapeutic choices.

Supplementary material

Supplementary material is available at *British Journal of Anaesthesia* online.

Declaration of interest

None declared.

References

1 Bihari S, Peake SL, Seppelt I. Sodium administration in critically ill patients in Australia and New Zealand: a multicentre point prevalence study. *Crit Care Resusc* 2013; **15**: 294–300

2 Bihari S, Baldwin CE, Bersten AD. Fluid balance does not predict estimated sodium balance in critically ill mechanically ventilated patients. *Crit Care Resusc* 2013; **15**: 126–33

3 Gattas DJ, Saxena MK. Is maintenance fluid therapy in need of maintenance? *Crit Care Resusc* 2013; **15**: 255–6

4 Saxena MK. Should sodium be the real target of fluid restriction. *Crit Care Resusc* 2013; **15**: 75–7

5 Myburgh J, Finfer S, Bellomo R, *et al.* Hydroxyethyl starch or saline for fluid resuscitation in intensive care. *N Engl J Med* 2012; **367**: 1901–11

6 Maitland K, Kiguli S, Opoka RO, *et al.* Mortality after fluid bolus is African children with severe infection. *N Engl J Med* 2011; **364**: 2483–95

7 Goldstein S, Bagshaw S, Cecconi M, *et al.* Pharmacological management of fluid overload. *Br J Anaesth* 2014; **113**: 756–63

8 Rosner MH, Ostermann M, Murugan R, *et al.* Indications and management of mechanical fluid removal in critical illness. *Br J Anaesth* 2014; **113**: 764–71

9 Wiedemann HP, Wheeler AP, Bernard GR, *et al.* Comparison of two fluid-management strategies in acute lung injury. *N Engl J Med* 2006; **354**: 2564–7

10 Brandstrup B, Tonnesen H, Beier-Holgersen R, *et al.* Effects of intravenous fluid restriction on postoperative complications: comparison of two perioperative fluid regimens: a randomized assessor-blinded multicenter trial. *Ann Surg* 2003; **238**: 641–8

11 Glassford N, Myles P, Bellomo R. The Australian approach to perioperative fluid balance. *Curr Opin Anesthesiol* 2012; **25**: 102–10

12 Arikan AA, Zappitelli M, Goldstein SL, Naipaul A, Jefferson LS, Loftis LL. Fluid overload is associated with impaired oxygenation and morbidity in critically ill children. *Pediatr Crit Care Med* 2012; **13**: 253–8

13 Sutherland SM, Zappitelli M, Alexander SR, *et al.* Fluid overload and mortality in children receiving continuous renal replacement therapy: the prospective pediatric continuous renal replacement therapy registry. *Am J Kidney Dis* 2010; **55**: 316–25

14 Bouchard J, Soroko SB, Chertow GM, *et al.* Fluid accumulation, survival and recovery of kidney function in critically ill patients with acute kidney injury. *Kidney Int* 2009; **76**: 422–7

British Journal of Anaesthesia **113** (5): 735–7 (2014)
Advance Access publication 3 June 2014 · doi:10.1093/bja/aeu141

Expert consensus: a flawed process for producing guidelines for the management of fluid therapy in the critically ill†

S. Finfer

The George Institute for Global Health and Royal North Shore Hospital, The University of Sydney, St Leonards, NSW 2065, Australia

E-mail: sfinfer@georgeinstitute.org.au

The 12th Consensus Conference of the Acute Dialysis Quality Initiative (ADQI XII) addresses the highly topical and controversial issues of fluid administration and removal in the context of perioperative and critical care medicine. The stated goal of the initiative is to develop consensus and evidence-based recommendations for patient care using a methodology that departs from current accepted best practice. In describing their methodology, the lead authors argue that the evidence used to develop the guidelines should not be limited to published randomized clinical trials (RCTs) but should include data from observational studies and 'even expert opinion'.[1] This view ignores the inherent biases of observational data and the even greater risk that 'expert' opinion may be influenced by academic and financial competing interests.[2–5] It is inconceivable that a new pharmaceutical would be given marketing authorization based on observational studies and expert opinion; yet, fluid guidelines have the potential to do as much good and potentially more harm than any single drug. In addition to influencing clinical practice, guidelines are used as marketing tools, to support malpractice lawsuits, and as performance measures.[2] Given these uses, the scientific rigour used to develop guidelines must match that required of a company seeking to market a drug. In recent years, independent research groups have demonstrated that it is possible to conduct high-quality large-scale randomized trials in perioperative and critical care medicine, including

†This editorial is accompanied by Editorial aeu143.

trials comparing types of fluids and fluid administration strategies.[6–11] Thus, while I would agree that not all interventions can be evaluated in RCTs, they do provide the most robust evidence available and should be the bedrock on which any guideline is based.[12–14]

Leaving aside the methodological concerns, does the consensus conference document addressing when and how to administer fluids for resuscitation[15] provide objective, evidence-based, and unbiased recommendations? Are they likely to result in improvements in patient care?

The question of when and how to administer i.v. fluids could easily be the subject of a series of review articles or a fairly large book; to attempt to cover this in one article means that the coverage is patchy and superficial. The authors have first addressed the question of terminology and the different stages of resuscitation as recently proposed by Vincent and De Backer.[16] The stages of Salvage, Optimization, Stabilization, and De-escalation will be recognized by any clinician working in critical care; those working in emergency or perioperative medicine may not treat patients during the stabilization and de-escalation phases. Somewhat controversial is the characterization of patients in the 'stabilization phase' as being unstable and the recommendation that the conservative use of fluid challenges is appropriate for unstable patients. This approach might well result in under-resuscitation. This recommendation is allied to an effort to introduce a distinction between a fluid bolus defined as at least 500 ml of fluid given in 15 min or less to correct *hypotensive* shock and a fluid challenge being a smaller volume (100–200 ml) given to test the effect of fluid administration. More traditionally, a fluid bolus (not restricted to the volumes or timing suggested by the authors) has been viewed as a treatment in a patient deemed to need fluid therapy, whereas a fluid challenge is given to test whether a patient exhibits a beneficial physiological response to fluid. Succinctly one is a treatment, the other is a diagnostic test. In common with many of their statements, the authors provide no primary evidence to convince the reader that the approach they advocate will benefit patients.

The authors also propose appropriate monitoring and reassessment strategies without proposing particular targets for therapy. Again, far more space, detail, and considered discussion are needed to offer practical guidance and do the topic justice. The most important statement is that patients require constant observation and frequent reassessment. Improved outcomes through particular monitoring strategies are difficult to prove as it is the clinical actions in response to the measurements and observations that determines outcome rather than the use of the monitor itself.

Perioperative fluid resuscitation and therapy has been studied extensively, but this body of evidence is dismissed as possibly obsolete due a single recent trial that examined a lung protective ventilation strategy.[17] While adopting this approach to ventilation might alter the effects of different fluid strategies, this is pure speculation which does little to educate the reader regarding appropriate fluid management of perioperative patients.

Ultimately, the authors of this section were faced with an impossible task; fluid administration is a complex and difficult task that is influenced by the clinical setting, the disease process, the patient's other comorbid conditions, and the use of other treatments, particularly vasoactive drugs and mechanical ventilation.

The take-home message they offer is that different strategies are needed at different stages of acute illness, in different disease states, and that treatment should be 'individualized' to suit a particular patient. This is a very important area of acute medical practice and these are appropriate motherhood statements; however, a much more rigorous methodological approach is needed to properly assess the evidence and far greater detail is needed to provide practical guidance at the bedside.

Supplementary material

Supplementary material is available at *British Journal of Anaesthesia* online.

Declaration of interest

None declared.

References

1 Kellum J, Mythen MG, Shaw AD. The 12th consensus conference of the Acute Dialysis Quality Initiative (ADQI XII). *Br J Anaesth* 2014; **113**: 729–31

2 Hirsh J, Guyatt G. Clinical experts or methodologists to write clinical guidelines? *Lancet* 2009; **374**: 273–5

3 Collins R, MacMahon S. Reliable assessment of the effects of treatment on mortality and major morbidity, I: clinical trials. *Lancet* 2001; **357**: 373–80

4 MacMahon S, Collins R. Reliable assessment of the effects of treatment on mortality and major morbidity, II: observational studies. *Lancet* 2001; **357**: 455–62

5 Cook D, Guyatt G. Colloid use for fluid resuscitation: evidence and spin. *Ann Intern Med* 2001; **135**: 205–8

6 Devereaux PJ, Yang H, Yusuf S, *et al.* Effects of extended-release metoprolol succinate in patients undergoing non-cardiac surgery (POISE trial): a randomised controlled trial. *Lancet* 2008; **371**: 1839–47

7 The SAFE Study Investigators. A comparison of albumin and saline for fluid resuscitation in the intensive care unit. *N Engl J Med* 2004; **350**: 2247–56

8 Roberts I, Yates D, Sandercock P, *et al.* Effect of intravenous corticosteroids on death within 14 days in 10008 adults with clinically significant head injury (MRC CRASH trial): randomised placebo-controlled trial. *Lancet* 2004; **364**: 1321–8

9 NICE-SUGAR Study Investigators. Intensive versus conventional glucose control in critically ill patients. *N Engl J Med* 2009; **360**: 1346–9

10 Myburgh JA, Finfer S, Bellomo R, *et al.* Hydroxyethyl starch or saline for fluid resuscitation in intensive care. *N Engl J Med* 2012; **367**: 1901–11

11 The National Heart, Lung, and Blood Institute Acute Respiratory Distress Syndrome (ARDS) Clinical Trials Network. Comparison of two fluid-management strategies in acute lung injury. *N Engl J Med* 2006; **354**: 2564–75

12 Jeanne L. Why we can't trust clinical guidelines. *BMJ* 2013; **346**: f3830

13 Shaneyfelt T. In guidelines we cannot trust. *Arch Intern Med* 2012; **172**: 1633–4
14 Shaneyfelt TM, Centor RM. Reassessment of clinical practice guidelines: go gently into that good night. *J Am Med Assoc* 2009; **301**: 868–9
15 Hoste EA, Maitland K, Brudney CS, *et al.* Four phases of intravenous fluid therapy: a conceptual model. *Br J Anaesth* 2014; **113**: 740–7
16 Vincent JL, De Baker D. Circulatory shock. *N Engl J Med* 2013; **369**: 1726–34
17 Futier E, Constantin JM, Paugam-Burtz C, *et al.* A trial of intraoperative low-tidal-volume ventilation in abdominal surgery. *N Engl J Med* 2013; **369**: 428–37

British Journal of Anaesthesia **113** (5): 737–9 (2014)
Advance Access publication 31 May 2014 · doi:10.1093/bja/aeu143

Clinical Trials without conceptual foundation may produce flawed results for the management of fluid therapy in the critically ill

M. R. Pinsky

Department of Critical Care Medicine, University of Pittsburgh, 606 Scaife Hall, 3550 Terrace Street, Pittsburgh, PA 15261, USA

E-mail: pinskymr@upmc.edu

The 12th Consensus Conference of the Acute Dialysis Quality Initiative (ADQI XII) focused on i.v. fluid administration and removal in perioperative and critical care medicine.[1] It used a process of structured literature review, Delphi approach to consensus of a group of experts. These experts have a documented history of academic leadership and bedside medicine in fluid resuscitation and removal strategies. Fluid management is a central aspect of management of perioperative and critically ill patients. Critical illness, anaesthesia, surgery, and related therapies all may alter generalized macrovascular and regional tissue blood flow requiring prompt specific therapies, most of which are centred around specific fluid resuscitation. Furthermore, resuscitation physiology research shows clear discrepancies and divergent findings between the treatments that target macrocirculatory variables (e.g. cardiac output, arterial pressure, and oxygen delivery/consumption) or regional/cellular variables (e.g. organ function, tissue oxygen saturation, microcirculatory flow, and local energy metabolism).[2] Therefore, creating a broad summary of consensus will be useful to the clinician attempting to define rational approaches to assess fluid status, and need for fluids or their removal.

In an accompanying commentary, Dr Finfer[3] criticized the ADQI XII approach of using expert opinion based on physiological principles, personal heuristics, and clinical experience coupled to results from published literature and randomized clinical trials (RCTs). His criticisms underscore much of the present-day clinical focus of trying to define best practice clinical decision-making by tightly linking it to the results of published RCTs of groups so similar though not identical patients. Although the use of appropriately powered outcome-based RCTs is the backbone of much of clinical practice advancement, especially in the fields of cardiology and oncology, their juxtaposition onto critical care medicine rapidly degrades. Unlike acute coronary syndromes, heart failure, or cancer, critical illness creates a much more heterogeneous and dynamic interaction of the determinants of outcome than seen in single organ system processes. Furthermore, titration of care common to the management of the acutely ill and perioperative patient is much more difficult to be protocolized. The malignant academic pressure to reduce all critical care medicine practice to RCT-based positive trials and not use treatments from RCT-based negative trials deserves to be questioned.

While consensus without evidence can lead to adoption of practices that ultimately prove incorrect,[4] trials without proper grounding in conceptual frameworks can lead to erroneous conclusions. Two simple examples underscore this truth. A trial of penicillin for bacteraemia would likely only show harm without understanding the susceptibility of the infecting organisms. Similarly, a trial of norepinephrine for hypotensive shock would very likely show harm without understanding of the intravascular volume status, vasomotor tone, and cardiac contractility of the patient and an associated volume and inotrope support protocol linked to that trial. The ADQI XII view was that consensus of experts guided by evidence, and evidence acquisition guided by experts, is the best way forward.

The RCT example suggested by Dr Finfer of the ARDSNet liberal *vs* restrictive fluid trail in patients with acute lung injury (ARDS) illustrates this point nicely.[5] Though Dr Finfer gave this trial an example of how an RCT can define practice, this RCT actually gave a different outcome when studied