

Perioperative fluid management – what are the issues?*

H. Kehlet

Abteilung für Chirurgische Pathophysiologie, Rigshospitalet, Universität von Kopenhagen, Kopenhagen, Dänemark

Much attention has been directed to the role of perioperative fluid management with the aim of improving postoperative outcome, as described in recent reviews [1,2]. Thus, among the many factors to be considered in order to enhance recovery and reduce postoperative morbidity and hospitalisation, avoidance of fluid excess and hypovolaemia is one of the key factors (table 1).

Table 1: Why is the patient in hospital today [1,3,4]
organ dysfunction ("surgical stress")
hypothermia
pain
PONV
fluid excess/ hypovolaemia
hypoxaemia – sleep disturbances
immobilisation
semi-starvation
fatigue
traditions (tubes, drains, restrictions)

However, the issue of perioperative fluid management is complicated, including such factors as the composition (colloid / crystalloid) of the fluid administered, the amount of fluid and the concept of goal-directed therapy, which must be considered on a procedure-specific basis since fluid-dynamics may vary between procedures (fig. 1). Finally, in addition to these four factors, overall perioperative care must be taken into account and adjusted to current evidence regarding analgesia, mobilisation, oral feeding, use of tubes, drains, catheters, etc. (the fast-track methodology) [3,4].

In the present issue, other contributions deal with the role of fluid composition and the choice of colloid, as

well as the detailed mechanisms of perioperative fluid dynamics.

Discussions as to the role of the amount of crystalloid administered in minor procedures in which the administration of less than about 1 litre leads to impaired early functional recovery (dizziness, nausea, etc) have been resolved on the basis of more than 18 randomised studies in ambulatory or semi-ambulatory procedures [1]. These results are probably explained by functional hypovolaemia even in these minor procedures due to inappropriate fasting or minor trauma-induced fluid disturbances. However, the debate has mostly been focused on "high" vs. "low" fluid administration, predominantly in abdominal procedures [1,2,5,6] where the results from the 7 randomised studies are relatively inconclusive [6] due to different definitions of "high" fluid volume, as the studies show an overlap of "high" and "low" volumes. In addition, discharge criteria have not been described in detail, and there is a lack of information on different perioperative care principles [3,4], shortcomings that preclude adequate interpretation. Nevertheless, the general pattern of these comparative studies suggests that a fluid excess (with significant weight gain) may increase postoperative morbidity [1,2,5,6]. Only 3 randomised blinded studies comparing different, well-defined crystalloid volumes in combination with implemented evidence-based fast-track methodology have been reported [7-9]. These studies involving laparoscopic cholecystectomy, knee replacement and colonic surgery demonstrated a shorter length of hospitalisation than other randomised studies, indicating that the results and signals from single-modality interventions involving fluid management may not be clearly documented unless all aspects of perioperative care are adjusted to current evidence (table 1). However, in these three blinded studies with assessment of a detailed battery of functional outcomes it was shown that the amount of crystalloid is important, both for early recovery and morbidity. Thus, the administration of about 3 vs. 1 litre of Ringer lactate in ambulatory laparoscopic cholecystectomy improved early functional recovery, and reduced hospital stay, while the same study design showed no differences in functional outcomes in fast-track knee replacement (hospital stay about 4 days) or fast-track open colonic surgery (hospital stay about 2.5 days) [7-9]. However, the

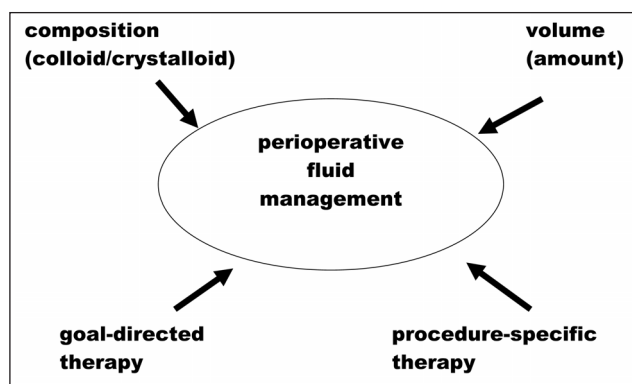


Fig. 1: Current issues in perioperative fluid management in fast-track surgery [1,6,10].

* Rechte vorbehalten

► colonic study comparing 1.6 litres with 5 litres of Ringer lactate showed an almost significantly higher morbidity with the “low” volume [7], underscoring the potential risk of “restrictive” fluid management.

In summary, studies of the role of the amount of crystalloid on postoperative recovery need to be redefined on a procedure-specific basis, and should include the latest evidence-based care principles, before final recommendations can be made. So far, it may be concluded only that inappropriate fluid “restriction” or fluid “excess” will lead to increased morbidity – but where the exact “cut-off points” remains to be clarified. A rational approach, however, would be to provide sufficient fluid to replace external losses and to avoid a weight gain of more than 1-2 kilograms.

Another aspect that must be further evaluated in perioperative fluid management is the goal-directed fluid therapy concept (GDT) [5,10], where small amounts of colloid are administered to optimise cardiac stroke volume. So far, the 11 randomised clinical GDT outcome studies are mostly positive [10] across a variety of procedures. However, here again, none of these studies have included the fast-track methodology, thereby necessitating a new series of studies to define the patients and procedures in which the GDT approach is indicated. Furthermore, we need studies on the optimal non-invasive technique for goal-directed fluid therapy with the aim of increasing implementation in clinical practice. It should be emphasized that the modern concept of GDT is different from the previous Shoemaker concept, according to which fixed goals for cardiovascular optimisation were applied in place of individualised optimisation [10]. Finally, we need goal-directed fluid therapy studies in the subsequent postoperative period, for which no studies are available, but which may be relevant in major procedures where significant visible and invisible losses take place.

In conclusion, despite the increased attention it has received in recent years, perioperative fluid management has still not been finally evaluated, given the many factors in perioperative care (table 1) and the techniques for fluid administration (fig. 1). Hopefully,

increased attention and international collaboration will improve such evaluation, which is so important for general recommendations and implementation in clinical practice.

References

1. Holte K, Kehlet H. Fluid therapy and surgical outcomes in elective surgery: a need for reassessment in fast-track surgery. *J Am Coll Surg* 2006;202:971-989.
2. Chappell D, Jacob M, Hofmann-Kiefer K, Conzen P, Rehm M. A rational approach to perioperative fluid management. *Anesthesiology* 2008;109:723-740.
3. Kehlet H, Wilmore DW. Evidence-based surgical care and the evolution of fast-track surgery. *Ann Surg* 2008;248:189-198.
4. Kehlet H, Dahl JB. Anaesthesia, surgery, and challenges in postoperative recovery. *Lancet* 2003;362:1921-1928.
5. Bundgaard-Nielsen M, Holte K, Secher NH, Kehlet H. Monitoring of perioperative fluid administration by individualized goal-directed therapy. *Acta Anaesthesiol Scand* 2007;51:331-340.
6. Bundgaard-Nielsen M, Secher N. H., Kehlet H. "Liberal" vs. "restrictive" perioperative fluid therapy - a critical assessment of the evidence. *Acta Anaesthesiol Scand* 2009 (in press).
7. Holte K, Foss NB, Andersen J, Valentiner L, Lund C, Bie P, Kehlet H. Liberal or re-strictive fluid administration in fast-track colonic surgery: a randomized, double-blind study. *Br J Anaesth* 2007;99:500-508.
8. Holte K, Kristensen BB, Valentiner L, Foss NB, Husted H, Kehlet H. Liberal versus restrictive fluid management in knee arthroplasty: a randomized, double-blind study. *Anesth Analg* 2007;105:465-474.
9. Holte K, Klarskov B, Christensen DS, Lund C, Nielsen KG, Bie P, Kehlet H. Liberal versus restrictive fluid administration to improve recovery after laparoscopic cholecystectomy: a randomized, double-blind study. *Ann Surg* 2004;240:892-899.
10. Kehlet H, Bundgaard-Nielsen M. Goal-directed perioperative volume therapy - why, when and how? *Anesthesiology* 2009; 110:453-455.

Korrespondenzadresse:

Prof. Henrik Kehlet, M.D. Ph.D.
 Section of Surgical Pathophysiology 4074
 Copenhagen University Hospital
 Rigshospitalet
 Blegdamsvej 9
 2100 Copenhagen
 Denmark
 Tel.: +45 3545 4074
 Fax: +45 3545 6543
 E-Mail: henrik.kehlet@rh.regionh.dk