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Review

Liberal or restrictive fluid management during elective surgery: a systematic review and meta-analysis☆,☆☆

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Abstract This article reviews if a restrictive fluid management policy reduces the complication rate if compared to liberal fluid management policy during elective surgery. The PubMed database was explored by 2 independent researchers. We used the following search terms: "Blood transfusion (MESH); transfusion need; fluid therapy (MESH); permissive hypotension; fluid management; resuscitation; restrictive fluid management; liberal fluid management; elective surgery; damage control resuscitation; surgical procedures, operative (MESH); wounds (MESH); injuries (MESH); surgery; trauma patients." A secondary search in the Medline, EMBASE, Web of Science, and Cochrane library revealed no additional results. We selected randomized controlled trials performed during elective surgeries. Patients were randomly assigned to a restrictive fluid management policy or to a liberal fluid management policy during elective surgery. The patient characteristics and the type of surgery varied. All but 3 studies reported American Society of Anaesthesiologists groups 1 to 3 as the inclusion criterion. The primary outcome of interest is total number of patients with a complication and the complication rate. Secondary outcome measures are infection rate, transfusion need, postoperative rebleeding, hospital stay, and renal function. In total, 1397 patients were analyzed (693 restrictive protocol, 704 liberal protocol). Meta-analysis showed that in the restrictive group as compared with the liberal group, fewer patients experienced a complication (relative risk [RR], 0.65; 95% confidence interval [CI], 0.55-0.78). The total complication rate (RR, 0.57; 95% CI, 0.52-0.64), risk of infection (RR, 0.62; 95% CI, 0.48-0.79), and transfusion rate (RR, 0.81; 95% CI, 0.66-0.99) were also lower.

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The postoperative rebleeding did not differ in both groups: RR, 0.76 (95% CI, 0.28-2.06). We conclude that compared with a liberal fluid policy, a restrictive fluid policy in elective surgery results in a 35% reduction in patients with a complication and should be advised as the preferred fluid management policy.

1. Introduction

Although fluid therapy is a cornerstone in current surgical practice, no consensus on the optimal perioperative fluid management exists, and the existing trials are contradictory.

Since Shires in 1961, a liberal transfusion practice is advocated [1]. Today's textbook management is approximately 20 mL/kg per hour fluid transfusion (crystalloids and colloids) to account for fasting, third space, and urine losses [2]. On top of the standard management, blood loss will be compensated 3 to 4 times the actual loss [2]. Although a more liberal fluid management is practiced widely, it has never been properly evaluated [3]. Excessive fluid therapy is associated with negative outcomes, even in healthy patients (American Society of Anesthesiologists [ASA] 1) [2,4-7]. One important side effect of the liberal approach is volume overload which may cause reduced pulmonary function, postoperative reduced gut motility, and reduced subcutaneous oxygen tension [5,7]. More fluid puts a greater demand on the cardiac and urinary systems predisposing for cardiac morbidity and urinary retention [5]. In addition, the crystalloids and colloids transfused interfere with coagulation due to dilution, acidosis, or faster clot disintegration [5,8-10].

Recently, more restrictive perioperative fluid management policies have been studied in randomized controlled trials challenging the liberal practice. Despite avoiding an overloading effect, restrictive fluid management and its potential hypovolemic state are associated with impaired cardiac output. This results in inadequate oxygenation putting the organs at risk for ischemia, infarction, and organ failure [2]. With all strategies having their own risks, the most important goal is to achieve an optimized state with a normovolemic patient.

In this systematic review, we will evaluate a liberal vs a restrictive policy intraoperatively in general elective surgery. The primary outcome of interest is total number of patients with a complication and the complication rate (defined as the total number of complications given in the trials per group). The secondary outcome measures are hospital stay, infection rate (the total of peritonitis, sepsis, wound infection, pneumonia, urinary tract infection, and wound abscess), postoperative bleedings (defined as the total number of postoperative bleedings that occurred requiring transfusion and surgical treatment), transfusion need, and renal function.

2. Methods

In this systematic review, the PRISMA statement for reporting reviews was applied [11]. The PubMed database was explored by 2 independent researchers to identify appropriate articles. We used the following search terms: "Blood transfusion (MESH); transfusion need; fluid therapy (MESH); permissive hypotension; fluid management; resuscitation; restrictive fluid management; liberal fluid management; elective surgery; damage control resuscitation; surgical procedures, operative (MESH); wounds (MESH); injuries (MESH); surgery; trauma patients." A secondary search in the Medline, EMBASE, Web of Science, and Cochrane library revealed no additional results.

Studies had to meet the following criteria to be included: (1) a randomized controlled trial, (2) a population that was admitted for any kind of elective surgery, and (3) a comparison of restrictive and liberal fluid management with complication rate and/or hospital stay as outcome measurements. No restrictions were set with regard to age, ethnicity, or sex. Articles were excluded if a goal-directed approach of fluid management or if an additional anesthesia was used in either of the groups (eg, restrictive policy with epidural compared to standard care without an epidural anesthesia) was used. Screening was done on title and abstract; if this provided insufficient information, the full text was read. Inclusion and exclusion were done independently by 2 researchers. Disagreement about inclusion or exclusion was resolved through discussion, and a third researcher was decisive if needed. The reference lists of included articles were screened for additional articles.

The following data were extracted and summarized: (1) number of participants and type of surgery, (2) intervention protocol, (3) outcome measures, and (4) results. The required data were available in all selected articles.

One researcher (IMT) performed the quality assessment (Appendix 1), according to the CONSORT guideline for reviewing randomized controlled trials [12]. All items were scored and given the following codes:

+	(1 point) good, clearly described and taken into account;
+/−	(half a point) moderately well described, not entirely clear;