



Zero fluid balance and normotension prevents complications, not the amount of fluid per se

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Dear Editor,

In their non-randomized retrospective study, the authors found that the intraoperative fluid administration did not affect the complication rate or length of stay after radical cystectomy in patients included in an enhanced recovery protocol [1]. This conclusion is misleading and contradicts the findings of several prospective randomized studies in major abdominal surgery [2–4].

Possible reasons for not finding a difference may be the following:

- Intraoperative fluid restriction or optimization is one aspect of enhanced recovery protocols [5, 6]. Thus, all patients included in the above-mentioned study received i.v. fluid according to a similar protocol. Fluid restriction aiming at a zero fluid balance was equal to fluid optimization using goal-directed therapy in colorectal surgery [7, 8].
- Cystectomy patients qualifying for an ERAS protocol (good performance status, i.e., 74% with a Charlson comorbidity index of 0 or 1) and low tumor burden (78% organ-confined disease, 8% pN+) easily tolerate fluid overload and thus are less likely to suffer from fluid-induced complications.
- The study described the amount of i.v. fluid administered but gave no data concerning the fluid balance. The amount of i.v. fluid administered (IN: crystalloids, col-

loids, and blood products) should always be correlated with the amount lost (OUT: blood loss, urine output, etc.), but this was not done by the authors.

- Higher-than-normal fluid load in a patient with high blood loss or long surgical time (up to 10 h) may be necessary to prevent complications. Comparison of low-to-high median values of fluid given is thus inadequate. The goal of modern intraoperative fluid management is a zero balance of fluid, aiming at avoiding interstitial edema without resulting in tissue hypoperfusion and thus supporting oxygen delivery. Positive fluid balance of 2–3 L within 24 h postoperatively resulted in delayed return of bowel function [4, 9].

Analgesics, narcotics, and regional anesthesia result in vasodilation, and consequently in hypotension. This effect should be compensated with vasopressors such as norepinephrine to normalize the blood pressure intraoperatively, instead of overfilling the vascular system with crystalloids, which inevitably also accumulate in the interstitium, resulting in edema. In a recent RCT, aiming at normotension during the early perioperative period (i.e., a systolic blood pressure within 10% of the value preoperatively) resulted in fewer complications. This approach could only be achieved by the concomitant administration of vasopressors [10].

Thus, the message is not only to be restrictive with the use of crystalloids, but also to give it in combination with vasopressors. The beneficial effects after cystectomy, as demonstrated by our RCT, are obvious, and include a significantly reduced overall 90 day major complication rate, reduced blood loss, and fewer blood transfusions, and earlier return of gastrointestinal function [4]. This in a setting where most of the ERAS elements cited by Bazargani et al. were implemented as well (preoperatively: education, no enteral bowel preparation, VTE prophylaxis, oral hydration up to 2 h before induction; intraoperatively: opioid-sparing with epidural analgesia, fluid restriction and normotension; postoperatively: multimodal analgesia, VTE prophylaxis, no

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nasogastric tube, neostigmine, early ambulation, and early oral feeding) [4, 11]. Finally, as suggested by the authors in their conclusions, randomized clinical trials and well-powered studies are already available.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval This is a letter to the editor not directly involving human participants or animals.

Informed consent Not required.

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