Fluid Therapy Today: Where are We?

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We have read with great interest what written by Licker et al. with the title "Fluid therapy in thoracic surgery: «a zero-balance target is always best!".

Irrespective of the type of surgery, less fluid or too much fluid could be both harmful (1).

Why should we restrict fluids in thoracic surgery?
An association has been found between the incidence of acute lung injury (ALI) and/or adult respiratory distress syndrome (ARDS) and the volume of fluid infused in the intraoperative and postoperative periods (2, 3).

On this basis, a conservative strategy about "fluid maintenance" and "fluids challenge" seem to be a rational approach. In this way we totally agree with Licker et al. that 1-3, as we stated, or 3-4 mL/kg/h, as they stated, of intraoperative fluids maintenance is a reasonable choice.

But apart from intraoperative bleeding condition, each time a fluids challenge (FC) should be administered the clinician should understand whether the patient has a preload reserve that can be used to "restore tissue perfusion", with particular attention *"when the patient needs it!"*

Why we have to measure cardiac output (CO), in selected high risk surgical patients?
Because fluid test can be negative and further FC has to be avoided. This is mandatory and in thoracic anesthesia with the thorax open, the anesthetist cannot use hemodynamic dynamic indices (4, 5). Only a CO (or simply the stroke volume) measurement can help you to understand if the patient is a fluid responder or not (6).

Goal directed therapy (GDT) is intrinsically linked to the concept of restricted fluid regime, but not all patients can restore tissue perfusion with a FC (i.e. limited cardiac reserve), and an inotrope may be used, or on the other hands some patients could not tolerate fluids (i.e. advance diastolic dysfunction grade III or IV). This approach can be see as a "tailored hemodynamic optimization" instead of following normal hemodynamic values (7, 8).

The evidence in literature so far in very limited and sometimes with conflicting results (9, 10) Hemodynamic functional dynamic indices, pulse pressure variation (PPV) and SVV, are the only reliable predictors of fluid responsiveness under strict conditions, while in routinely clinical practice factors including low tidal volume, cardiac arrhythmias, and the calculation method (the software) can substantially reduce their predictive value (4).

In thoracic surgery, the "open chest" preclude its use (5). We disagree with Licker et al. also because "volume responsiveness" is not equal to volume deficiency. To cite a recent editorial by Takala, (11) *"giving volume to fluid responders as long as they respond should not become the iatrogenic syndrome of the decade".*

However, it is also true that trans-esophageal echocardiography (TEE) in the last decade has became increasingly used to identify an unexpected situation in

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case of low-risk patient undergoing low-intermediate risk surgery as "reactive" hemodynamic approach (12).

Hemodynamic monitoring for which patients?
We think that the benefits of GDT are greater in patients who are at higher risk of complication, more than mortality (ASA 3, 4). In these patients, postoperative recovery in the intensive care unit (ICU) should be planned before surgery for all patients requiring postoperative organ support (i.e. cardiac, respiratory, renal support) in fact the goals of GDT should be maintained for up to 6-8 post-operative hours (13).

Should we give fluids to correct oliguria?
Today everybody agree that initial intraoperative oliguria (<0.5 mL/kg/h for 3-4 hours) should not be used as the sole trigger for fluid administration, including high risk surgical patients!

This must be taken into our mind to improve the quality of anesthesia management we suppose to know very well.

Anyway, postoperative AKI has to be prevented since the immediate postoperative period, and not only in thoracic surgery! "Fluid therapy" could be minimized if any patient would be free to drink clear fluid (first of all they have to drink water) since the first post-operative hours… and not the day after the surgery. This is the best way to balance the appropriate fluid need in the human body… if the patient drinks! We should apply the bundles we considered appropriate including the Enhanced Recovery After Surgery (ERAS) program (14), Fastrack or the most recent Perioperative Surgical Home (PSH) pathway (15).

Brandstrup demonstrated that in colo-rectal surgery a restricted approach reduced post- operative complications and death (16). Some studies in vascular patients undergoing major abdominal aortic surgery failed to identify specific superior of this fluid regimens (17) and the available result obtained with the "zero-balance" approach mainly in colon-rectal surgery should not be translated "tout court" in thoracic surgery.

Finally, several studies seem to suggest that in low-risk patients undergoing minor to intermediate risk surgery - video assisted thoracic surgery (VATS) -, liberal strategy (non restrictive) may be preferable because it reduces nausea, vomiting, drowsiness, dizziness and length of stay (18, 19).

What type of fluid should be given?
Normal saline solution has been used for over 50 years as an intraoperative, resuscitation and maintenance fluid; however its excessive use can lead to hyperchloremic acidosis (20). There is currently a debate regarding the morbidity associated with this condition, although its incidence is considered to be very low. The British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients recommend the use of balanced crystalloids rather then just saline solution to avoid hypercloremic acidosis (21). So we agree with Licker et al. about normal saline but disagree about colloid. The use of colloids in place of crystalloids, is disputed given the uncertainty regarding their safety and is outside the scope of this debate. Briefly, the European Medical Agency – EMA - after suspending hydroxyethyl starch (HES) use in June 2013 revised its decision in October announcing that the HES may continue to be used in certain conditions i.e. patients with acute hypovolemia secondary to blood losses in the operating room and without renal insufficiency. EMA a part, starches, on their side, seem to have a physiological rationale very interesting for their use in patients with an intact capillary (22).

How can we conclude?
The gray zone from a point of view of the statistical results in studies, close to this specific field, suggests us to give intraoperative IV fluids only tailoring the approach on the single patient (23).

Usually patients scheduled for elective surgery (including thoracic surgery) are not hypovolemic. In the intraoperative period if the patient is hypovolemic, it is rarely (bleeding) and needs fluids, we have to give fluids only if the patient is a fluid responder. This is mandatory in case of high-risk surgical patients. With the chest open, only a CO monitoring, according to the SV improvement, leads the anesthetist to the right way to give fluids or not, to reach the right hemodynamic target.

The last but not the least, if the patients drinks water until 2 hours before the surgery and as soon as possible after the surgery (ERAS, PSH program etc…), we do not need to give so many fluids!

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