All about ERAS

Goal Directed Therapy in ERAS: a critical appraisal of the literature

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Traditional liberal intraoperative fluid management for abdominal surgery was based on flawed historical concepts developed with flawed studies. With the advent of Enhanced Recovery After Surgery (ERAS) and avoidance of chemical and mechanical bowel preparation, fluid and electrolyte resuscitation following bowel preparation is unnecessary or at least attenuated significantly. There is also increasing realisation of the limitations of traditional approaches to fluid management. Thus:

- Overnight starvation does not result in a significant volume deficit
- "Third-space losses" as defined by Shires do not exist and actually represent an indicator artefact
- Bowel evaporative losses are actually minimal
- Evidence from the obstetric anaesthetic literature suggests that volume preloading of neuraxial blocks is ineffective at improving blood pressure or preventing the need for vasopressors.

Two concurrent streams of research evolved in the late 1990's to mid 2000's looking at intraoperative fluid management. One was from surgical research into nutritional sodium management and fluid restriction. This has matured into the "goal" of neutral fluid balance. The other was from anaesthetic/critical care work, refining earlier work by Shoemaker on superoptimisation. This focused on dynamic monitors for fluid status & optimal tissue perfusion using Oesophageal Doppler & Arterial pressure waveform analysers (Goal Directed Fluid Therapy-GDFT or GDT). Both strategies showed benefits over traditional "liberal" fluid management but meta-analysis reveals significant heterogeneity between studies that makes comparison and implementation difficult.

More recent meta-analyses (including these studies) have highlighted the lack of dominance of either strategy though overall a trend in favour of GDT may be implied. It is as yet unproven in a wider context and when compared to more modern fluid management concepts.

Because of uncertainty as to which particular strategy is more beneficial in elective colorectal procedures, recent studies (including two conducted in Australasia) have examined which of these regimes might be the better. These have shown that, within ERAS protocols utilising neutral fluid balance regimes, GDT conveys no added benefit in all comers and potentially harm in lower risk patients. Similarly, the primary outcomes and methods utilised in these studies are heterogeneous and difficult to compare. This is a valid criticism across the entire GDT literature with 118 differing goal/method combinations found in a recent systematic review of GDT.

In anaesthetic practice, the definition of what should be the "goal" is unclear within the context of a dynamically changing intraoperative state (e.g. laparoscopic surgery, changing pulmonary compliance, vasopressor adjustments & epidural sympatholysis). A recent observational study of healthy patients calls into question what exactly constitutes "optimal fluid balance". The original designers of GDT algorithms aimed for stroke volume maximisation to maximise DO2 to the GI tissues. Maximisation does not necessarily reflect optimisation of wider fluid balance. Given the evolution of our understanding of the microcirculation and the glycocaylx model, the "top of the starling curve" may in fact stray too close to the point at which atrial naturietic peptide (ANP) is released, allowing rapid increases in extravascular lung water and tissue oedema. These venous curves also vary with endothelial damage (e.g. sepsis). Whilst this would be expected to support the use of GDT in acute/unwell cases, there is very little evidence to support this indication (presumably due to difficulty in study design). It further questions where the "sweet spot"/"goal" should be of balancing cardiac output v tissue oedema and where optimal DO2 might lie.

More recent meta-analyses co-published with the Optimise study and including the studies in modern fluid administration context have highlighted the lack of dominance of either strategy though overall a trend in favour of GDT may be implied. However, this is as yet unproven in a wider context and when compared to these more modern fluid management concepts.

Multiple questions hence remains unresolved: What is "optimal fluid balance" and what goal do we aim for intraoperatively? Does the surrogate outcome of "fluid responsiveness" translate into "actually requiring fluid" and improved clinical

outcomes? What fluid management algorithms are most suitable now that starch-based colloids are falling from favour-given that GDT protocols have all been constructed and largely studied with starch or gelatin based colloid solutions? Which patient subgroups are likely to benefit from GDT?

It is the opinion of the presenter that the failure of GDT in recent studies to show significant improvements does not necessarily reflect a failure in the concept but rather a failure in implementation due to over simplification of the process and erroneous assumptions in physiology. It is also likely that wider implementation of a complex intervention such as this into wider clinical practice, coupled with the learning curves required, will reduce the expected clinical impact, especially during the early "learning phase".

GDT represented an improvement in fluid management compared with traditional liberal regimes but when compared with a neutral fluid balance protocol (a different sort of goal direction), such improvements are harder to demonstrate. It may be that GDT should be reserved for patient subgroups such as the physiologically unwell. Very little work has been conducted in acute colorectal surgery in either fixed fluid regimes or GDT. Extrapolating the results of elective surgical studies into patients with activated surgical stress responses and lack of preoperative optimisation may prove problematic.

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