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FLUID THERAPY - AN EVIDENCE BASED APPROACH?

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INFUZIONA TERAPIJA - PRISTUP ZASNOVAN NA DOKAZIMA?

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Summary. *The use of fluids in the critically ill is fundamental and there are several key questions: How much? How do you know how much? How much of what? The purpose of fluid therapy is optimising the cardiovascular system. The dilemma between choosing colloides over crystalloides, and viceversa, is still present, so it remains the object of the debates and opponed opinions.*

This study shows caracteristics, benefits and deficiencies of balanced solutions and colloides.

Key words: *fluid therapy, critically ill, balances solutions, colloides*

Sažetak. *Primena infuzione terapije u kritično obolelih je fundamentalna. Ključna pitanja su: koliko?, kako znati koliko? i koliko čega treba primeniti? Svrha primene infuzione terapije jeste optimizacija funkcije kardiovaskularnog sistema. Još uvek postoji dilema da li su prvi izbor koloidni ili kristaloidni rastvori, pa je to predmet debata i suprostavljenih stavova.*

U radu su prikazane karakteristike, prednosti i nedostaci primene balansiranih solucija i koloida.

Ključne reči: *infuziona terapija, kritično oboljenje, balansirane solucije, koloidi*

Introduction

The use of fluids in the critically ill is fundamental and there are several key questions.

How much?
How do you know how much?
How much of what?

These questions are asked daily. The evidence base is surprisingly small and the answers to these simple questions are determined by convictions and beliefs rather than science. That outcomes are often favourable are a testimony to the robustness of human physiology rather than to the wit of man, except when it goes wrong.

The emphasis is entirely on how much fluid to give not what fluid and while there has been interest in 'which' fluid for some time it is always secondary to 'how much' The reasoning is clear. The circulation is a hydraulic system and we are far more concerned with maintenance of the hydraulic competence of the system than on what is in the system. It would not work in Formula 1.

The situation can be considered in terms of driving forces and fluids Table 1.

Filling the space and optimising the cardiovascular system

There is universal agreement that inadequate filling resulting in hypoperfusion is potentially damaging especially if sustained. Colloids are more effective and longer lasting than crystalloids in normal physiological circumstances.[1] With illness there may be alterations in endothelial integrity and leakage of larger molecules. This whole area is being reviewed currently as there is increasing evi-

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Table 1. Driving forces in fluid management

Force	Implication
Fill the space	Able to fill the intravascular space
Optimisation	A full cardiovascular system
Cost	Financial / side effects easy in / easy out.
Blood loss	Avoiding blood transfusion
Restrictive fluid regimens	Adequate fluid rather than generous
Efficiency of fluid	Crystalloid versus colloid
Value added	Albumin as a colloid
Value subtracted	Secondary effects of unbalanced solutions.

dence that there is a barrier, the glycocalyx, that is crucial to fluid movement and that many different factors including illness but also fluid loading that can alter the integrity if this lining.[2-4] The net result is increased fluid and molecular flux. In overall terms it is still a leaky system that develops. The work of Shoemaker and others has emphasised the importance of maintaining a functional cardiovascular system for organ perfusion and well being and linked it to outcome. He also introduced the idea of protocols for resuscitation. More recent work by Rivers confirmed in the resuscitative setting the importance of diagnosing inadequacy of the circulation.[5]

There is still considerable discussion about how to optimise the circulation. In the operating theatre Doppler is popular and is associated with more fluid and better outcomes.[6-8] Paradoxically restrictive goal directed fluid therapy in similar populations is associated with better outcomes but with less fluid.[9-14]

Too much is not good as was probably indicated in the study of children with malaria who received up to 40 ml/kg of albumin or saline.[15]

In ICU the situation is confounded by an increasing array of devices for measuring cardiac output and flow with varying degrees of invasiveness.[16]

Cost

Crystalloids are very cheap while colloids are more expensive. No evidence required. Which crystalloid is now a moot point with wealth of inconsequential evidence building against normal saline in favour of balanced solutions.[17, 18,19] There is definite trend towards balanced solutions and a fear of the renal and hyperchloraemic effects of saline.[20,21] Colloids have more material related side effects - no evidence required.

Blood

The thresholds for transfusion have now fallen through the floor. To date there appears little hazard until below 7 g/dl except if there is ischaemic heart disease. The patient should be stable, have good cardiac function and intravascularly replete so that flow can compensate for content. The combination of a low haemoglobin and low cardiac output is potentially very poor. Less is known about well being and recovery times with low haemoglobins but essentially it means that blood should only be used when necessary because the haemoglobin is so low that oxygen transport is realistically threatened.[22-27]

Restrictive fluid regimens

Fast track studies in major surgery use less fluid and seem to indicate better bowel function earlier and short postoperative hospital stay. There are similar findings in many other branches of surgery such as kidney transplantation Many of the protocols in place may need to be redressed.[28-32] This was clearly shown in the FACTT study albeit in critically ill patients where a change in the protocols' target was helpful.(FACTT). Not all are positive [10]

We have come through an era of glorious overfilling in response to identifying the fact that we were under resuscitating previously and we now are entering an era of more conservative fluid management which will require protocol revision first and foremost. How much is enough?[9]

The colloid crystalloid debate

If the volume administered is an issue then colloids are beneficial. For intravascular repletion smaller volumes of colloids would achieve the same

endpoints as larger volume of crystalloids. The crystalloid colloid debate and the albumin debate derived from Cochrane publications added nothing to the issue except further confusion while the SAFE study returned the argument to the position it was in 10 years ago. The albumin issue will run and run. It is the gold standard colloid although to date no specific benefits have been shown which doe not prevent enthusiastic advocacy of a range of benefits that might be present.[33-35] Starch is a potential candidate although high molecular weight starches are under a cloud with the potential for renal failure and the newer starches have yet to have the studies performed.[36]

Balanced solutions

It is easy to demonstrate a hyperchloraemic acidosis using saline and applying the Stewart hypothesis but much harder to show detriment. Brueger and colleagues clearly showed an acidosis developing intraoperatively but it cleared spontaneously within 24 hours.[37, 38]

There is some suggestion that hyperchloraemia may have an effect on the kidney in terms of less natiuresis. It may alter the renal vasculature but this has not been confirmed.[39] Gut effects have been reported.

That hyperchloraemia causes acidosis seems irrefutable but evidence for its importance remains elusive.[38, 40]

Colloids

The available colloids are albumin, gelatins and starches. The latest Cochrane collaboration publication is non contributory in so much as it finds no difference between thee tested colloids and hence by inference no indication.[41] Albumin had bad press from the Cochrane collaboration but was vindicated by the SAFE study.[35, 42]The starches are under a cloud as the larger starches (200) have fallen from favour and use with suspicion of renal detriment. More recently the smaller starches (130) are also considered as potentially having problems although this requires confirmation.[36, 43-45] Gelatins remain but are also under threat.[46-48]

Where does this leave us?

Give enough fluid but not too much.

Be wary of protocols that define filing pressures prospectively.

Avoid blood.

Colloids use less fluid.

Saline gives an acidosis but clear detriment hard to find.

Table 2. Driving forces in fluid management. The new evidence scale ; Evidence is good E, iffy e, none n. (little n in the hope some information will materialise soon)

Force	Implication	Conclusion and evidence
Fill the space	Efficiency of filling the intravascular space	Use colloid E
Optimisation	A full cardiovascular system	Optimise /resuscitate E
Cost	Financial / side effects easy in / easy out.	Crystalloid wins E
Blood loss	Avoiding blood transfusion	Don't use blood E
Restrictive fluid regimens	Adequate fluid rather than generous	Increasing evidence e
Efficiency of fluid for restrictive	Crystalloid versus colloid	Colloid makes sense n
Value added	Albumin as a colloid	Wishful thinking n
Value subtracted	Secondary effects of unbalanced solutions.	Balanced better Common sense n
Ideal fluid	Efficient low volume and balanced	Prefer balanced colloid n

Conclusion

Fluid management is a combination of predicting losses, measuring losses and measuring the effects and consequences of fluid depletion using physiological responses and monitoring techniques. These are usually surrogates of actual volume status and inform as to whether extra fluid is needed.

Weighing all the evidence, circumstantial and hard and applying it to a question that is tangential to the evidence the answer is clearly.....

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