

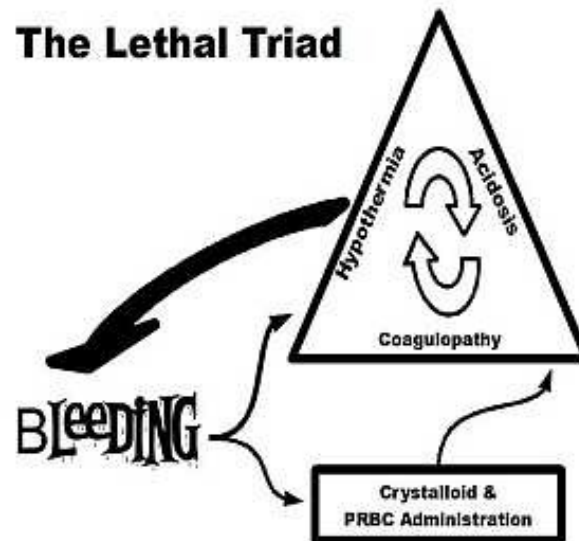


Blood and fluid therapy in perioperative resuscitation in traumatic injuries Eric Revue, MD

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Traumatic Injuries

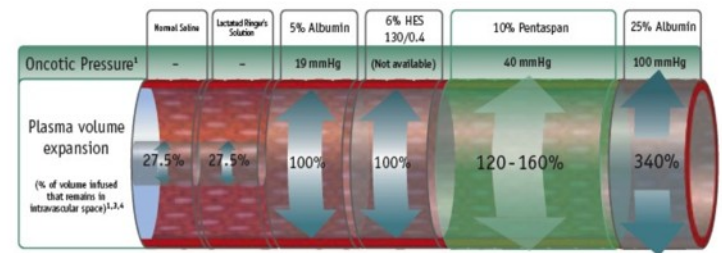
- Trauma is the leading cause death in young adults
- 80% of deaths: Severe bleeding, head -SC injuries
- The most preventable death is *severe bleeding*



Fluid Resuscitation

What are the questions?

- Goals of fluid therapy ?
- Goals of early resuscitation
- Which type of fluid is best?
- How much fluid is enough?
- What is the latest evidence supporting guidelines?
- Special considerations ?



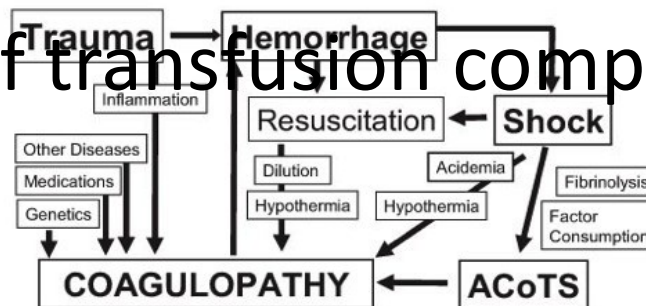
¹ Adapted from Roberts and Bustin;² Pentaspan Product Monograph;³ Inno and Carlson;⁴ Voluven Product Monograph⁵; Plasbumin[®]-5 Prescribing Information;⁶ and Plasbumin[®]-25 Prescribing Information⁷

Volume infused: 500 mL of Pentaspan and 6% HES 130/0.4, 5% albumin and 25% albumin, and 1000 mL of normal saline (0.9% NaCl solution) and Lactated Ringer's solution. Comparative clinical significance has not been established.

Goals of Fluid Therapy:

“not fluid resuscitation but hemorrhage control”

1. Restore volume
 2. Restore blood - oxygen carrying capacity
 3. Normalize coagulation status
- Early, complete restoration of tissue oxygenation
 - Minimal biochemical disturbance
 - Preservation of renal function
 - Avoidance of transfusion complications

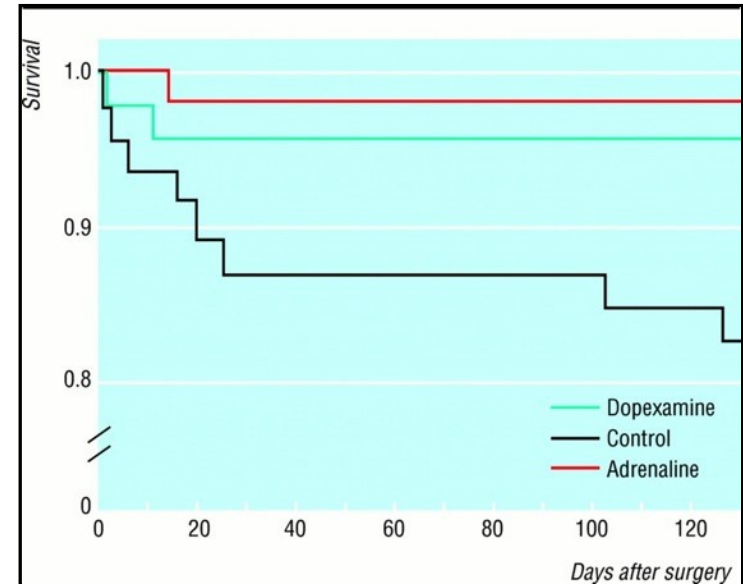


Goals for Early Resuscitation

- Systolic BP 80-100 mmHg
- Hematocrit 25-30%
- PT, PTT, INR in normal range
- Platelet count > 50,000
- Normal ionized calcium
- Prevent acidosis from worsening
- Core temp ≥ 36 C

Peri-operative

- Goal-directed therapy was aimed at optimising oxygen delivery to tissues with:
 - Fluids Extra **1500** ml fluids pre-op
 - Inotropes
- Guided by invasive PA catheter monitoring



Wilson J et al. Reducing the risk of major elective surgery: randomised controlled trial of preoperative optimisation of oxygen delivery. *BMJ* 1999; **318**: 1099-103

What type of fluid is best?

Crystalloids	Colloids
Saline	Albumin
Dextrose	Gelatins
Hartmann's	Starches

It depends on the patient and your situation

- Is your patient a trauma or a medical patient?
- Is there a high risk of bleeding?
- Is cost an issue?
- Does your patient have allergies?



ORIGINAL ARTICLE

A Comparison of Albumin and Saline for Fluid Resuscitation in the Intensive Care Unit

The SAFE Study Investigators*

- Prospective, 7000 patients randomized to albumin versus saline for fluid resuscitation

- Showed that albumin or normal saline results in similar mortality

The SAFE study investigators. *NEJM* 2004;350:2247-56

Crystalloids

- There is no proven benefit of one crystalloid over another
- Each patient scenario may benefit from different characteristics of each solution
- Knowledge of the advantages and disadvantages of each solution translates to patient benefit

Colloid myth-busting

- More effective plasma expansion
 - Theory, not borne out in literature
 - Over time, both are equally effective
 - Adequate resuscitation achieved with 1-2 fold of total crystalloid compared to colloid
 - Colloids do not stay intravascular longer, and may leak into the interstitium
- Synthetics equally safe, less expensive than albumin
 - Not enough evidence; may contribute to renal failure, coagulopathy and tissue storage
 - Albumin may be safer in cirrhosis/SBP, hypovolemic pregnant woman or newborn, harmful in TBI

“It is time to leave emotions aside when discussing the most appropriate volume replacement strategy in trauma patients and to concentrate on the available scientific evidence.”

“There is no evidence from randomised controlled trials that resuscitation with colloids reduces the risk of death compared to crystalloids in patients with trauma, burns and following surgery.

As colloids are not associated with an improvement in survival, and as they are more expensive than crystalloids, it is hard to see how their continued use in these patient types can be justified outside the context of randomised controlled trials”

The crystalloid-colloid debate has evolved into a colloid-colloid debate

Fluid choice for resuscitation of the trauma patient: a review of the physiological, pharmacological, and clinical evidence

Boldt CAN J ANESTH 2004 / 51: 5 / pp 500–513

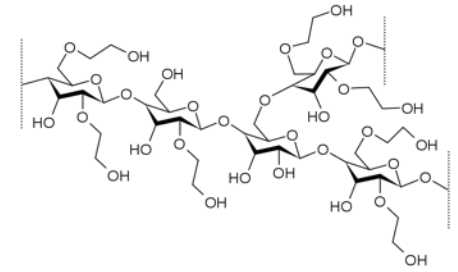
Roberts I, Alderson P, Bunn F, P Chinnock, K Ker and Schierhout G.

Colloids versus crystalloids for fluid resuscitation in critically ill patients (Cochrane Review).

The Cochrane Library, Issue 4, August 24th, 2004

Hydroxyethyl Starch

“Hespan”



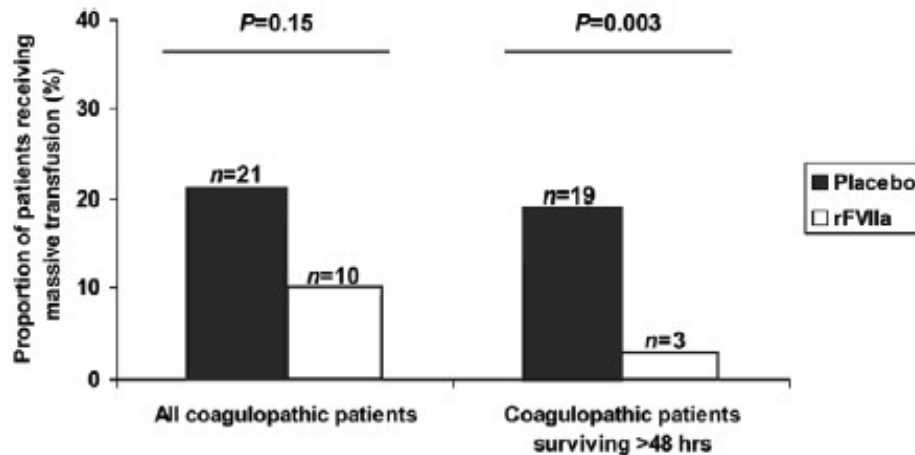
- Advantages
 - Low volume, easy to transport
 - Rare anaphylaxis
 - Preserves splanchnic perfusion
 - Used in US military in limited volume to reduce risk of coagulopathy
- Disadvantages
 - Can cause renal failure in septic shock patients
 - May cause coagulopathy and hyperchloremic acidosis
 - Theoretical maximum daily dose = 1.5 liters
 - May accumulate in plasma and tissues

Colloid conclusions?

- HES has best risk/benefit profile
 - Not enough data
 - Synthetics cause more anaphylaxis than albumin
- Newer HES is safer
 - Inconclusive literature
 - Used extensively in Scandinavian and Swiss ICU's
 - Canadian survey shows that marketing may influence practice

Adjunctive therapy by Recombinant activated factor VII

Figure 2



Conditions

- No acidosis (pH > 7,00)
- Temp > 34 °C
- Platelets > 50,000/ mm³
- Fibrinogen > 1g/l

Non indication use in

- Prehospital Cardiac arrest
- Very bad prognosis
- Severe TBI with GCS 3
- Head Trauma with severe wound by gunshot

Recombinant activated factor VII as an adjunctive therapy for bleeding control in severe trauma patients with coagulopathy: subgroup analysis from two randomized trials

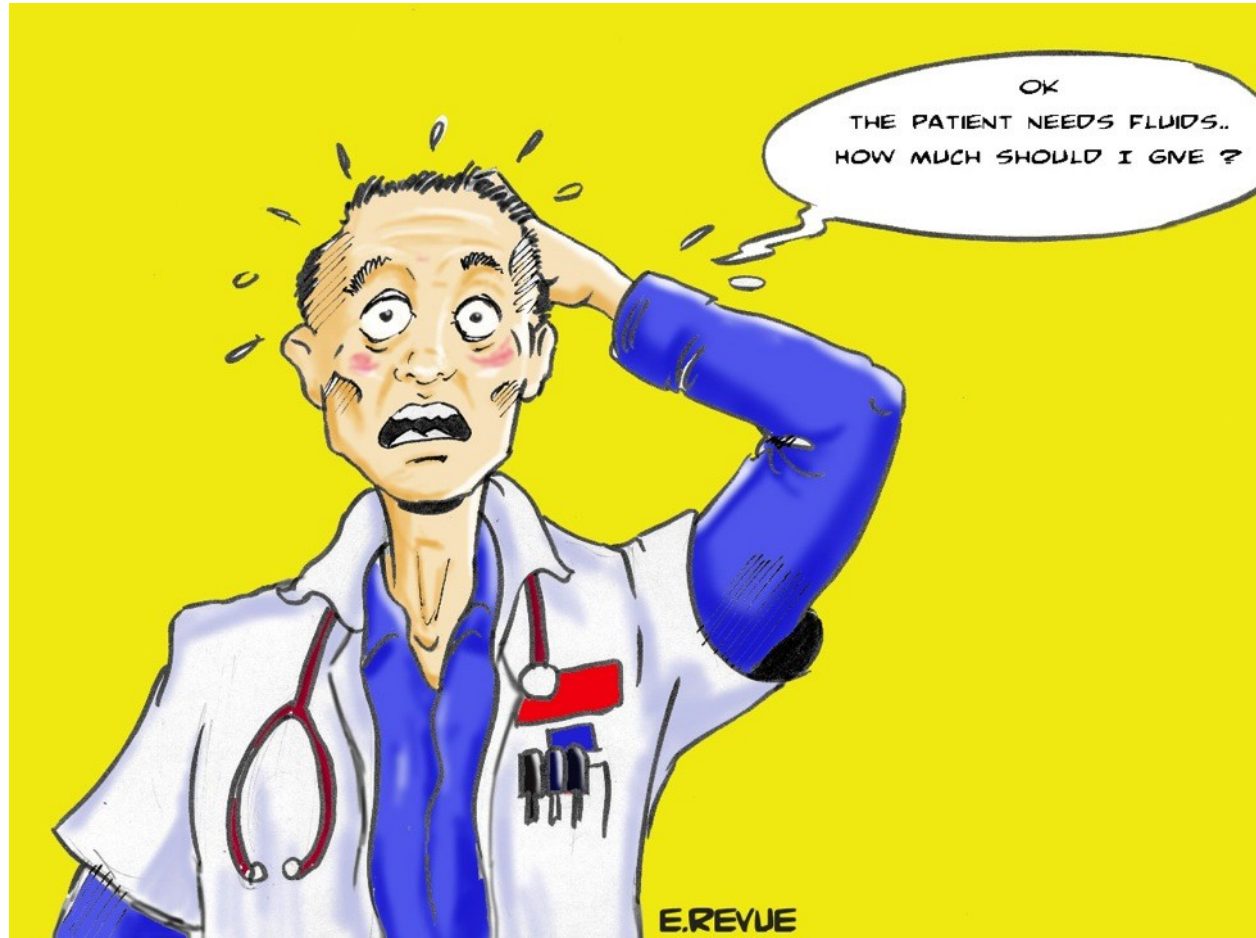
Sandro B Rizoli¹, Kenneth D Boffard², Bruno Riou³, Brian Warren⁴, Philip Iau⁵, Yoram Kluger⁶, Rolf Rossaint⁷, Michael Tillinger⁸ and the NovoSeven® Trauma Study Group

Blood

- Limit transfusions
- Transfusion $< 7\text{g/dl}$
- Maintenance level 7 – 9 g/dl
- Older patients and those with ischemic heart disease may need higher Hb
- Alternative choices
 - Autologous blood salvage
 - Blood substitute
 - modified hemoglobins



Assessment of volume status



High volume fluid controversy

- US military recommendations:
 - Hypotensive resuscitation should be used until hemorrhage control is obtained
 - Resuscitation should be used until hemorrhage is controlled
 - No data exists to show that colloids are superior to other fluids for resuscitation

Recommendations for trauma resuscitation



Look at the patient:

Pulse, Blood pressure, Capillary refill,
Mucous membranes
Peripheral circulation, Thirst

- Prehospital
 - Resuscitation should be used as much as possible (blood:plasma)
- In-hospital
 - Resuscitation should be the goal until hemorrhage is controlled (blood:plasma:platelets)
 - Management of initial coagulopathy of severe blood loss is best achieved by early plasma infusion

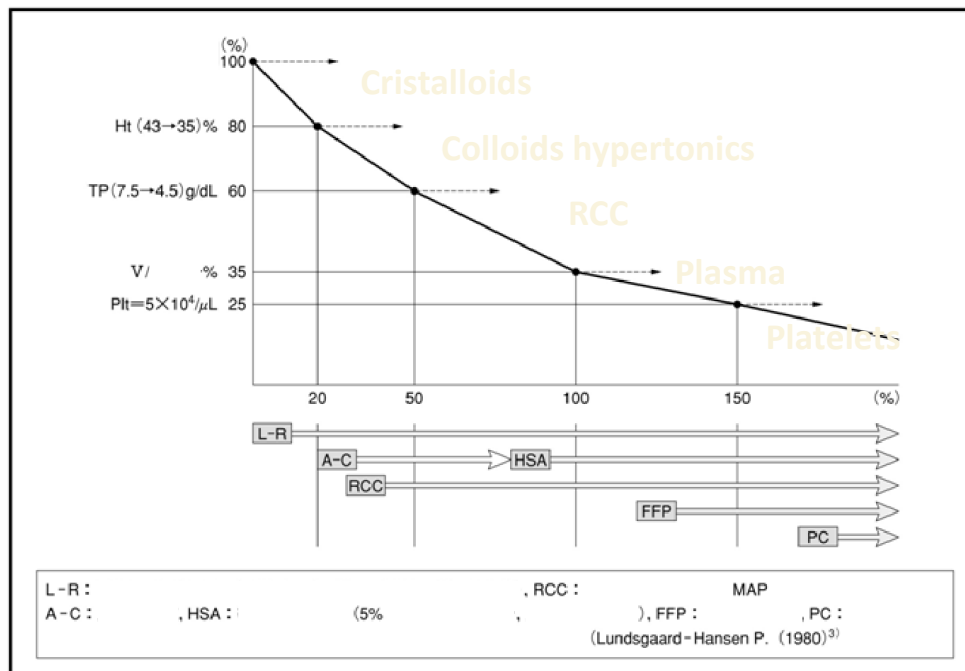
Strategies in traumatic hemorrhage

- Earliest prehospital management “in the field”
- 2 IV lines (or intraosseous) infusion “blood pump”
- Stable = **cristalloid** ;
- Collapse bleeding loss $> 20\%$ or SBP < 80 mm Hg= **collo**
- Objective
- Massive t
- EBV = 5 L lost or 10-12 units pRBC transfused



Strategy :

3 situations = 3 objectives



Resuscitative strategies in traumatic hemorrhagic shock

Bouglé *et al. Annals of Intensive Care* 2013, **3**:1

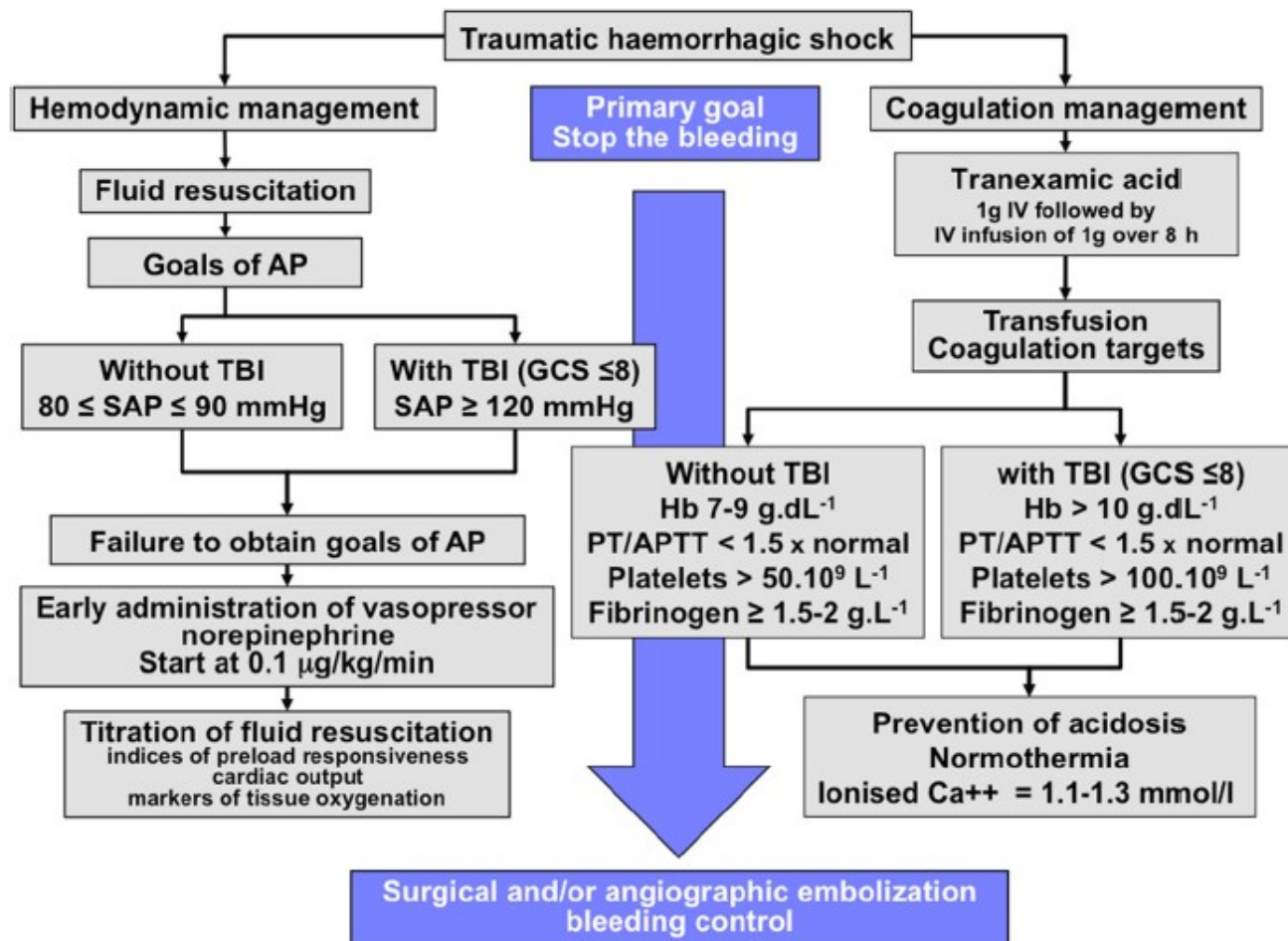
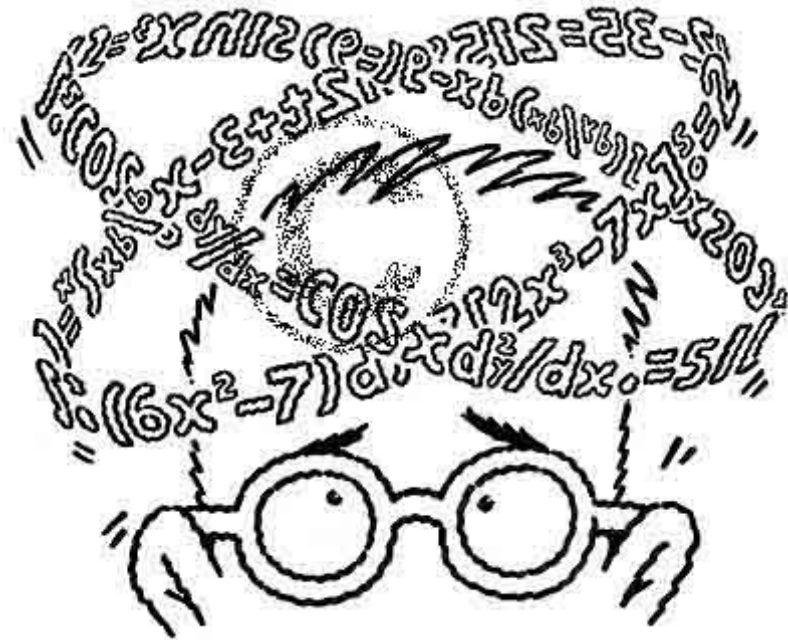


Figure 1 Flowchart of initial management of traumatic hemorrhagic shock. In the acute phase of traumatic hemorrhagic shock, the therapeutic priority is to stop the bleeding. As long as this bleeding is not controlled, the physician must manage fluid resuscitation, vasopressors, and blood transfusion to prevent or treat acute coagulopathy of trauma. AP, arterial pressure; SAP, systolic arterial pressure; TBI, trauma brain injury; Hb, hemoglobin; PT, prothrombin time; APTT, activated partial thromboplastin time.

Time to put it all together!



- Resuscitation fluid as necessary
- After resuscitation, titrate fluid as necessary to CLINICAL end points
- Too much fluid can harm
 - Tissue edema, organ failures
 - Pulmonary edema, ventilation failure
- Beware the 'accidental' fluids



Fluid Management

*“the bottle does not matter as much as the drunkenness.”
(Alfred de Musset)*

1. It's not what you use but how you use it
 - No evidence of benefit for any one fluid over another
2. Treat patient not numbers
 - Warm, well perfused, conscious, passing urine
3. Too much fluid as harmful as not enough

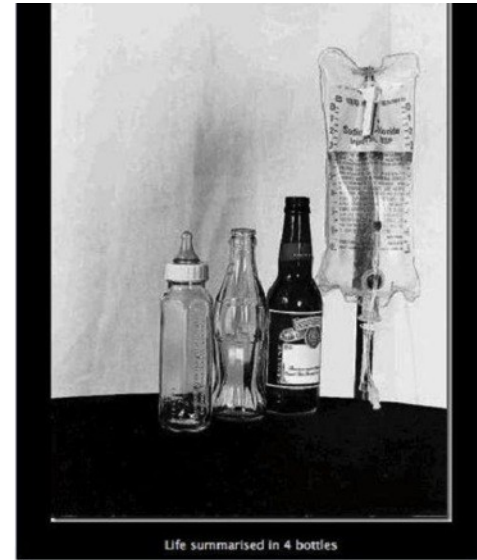
Choice of fluids depends on...

- Benefits and risks, costs
- Prehospital strategy
- Situations (severe wound, hemorrhagic shock, neurologic lesions..)
- Delay for evacuation transport
- Decision to maintain Blood Pressure ?
- Hemodynam
- Use of medication



Which fluid ?

- It probably doesn't matter!
- Avoid dextrose (water) as large volumes will be required, worsening tissue oedema
- If using crystalloid, the patient will require 1.4 times the volume compared to colloid
- Crystalloid *may* be better in trauma
- Colloid *may* be better in critically ill / sepsis



Conclusions 1

- ‘Not too much, not to little, but just right’
- Be cautious applying magic therapies from single center studies elsewhere in the world
- Know your own environment, epidemiology and resources



Conclusions 2

- Blood products should be given judiciously as appropriate until hemorrhage is controlled
- Overaggressive fluid therapy may exacerbate the lethal triad of coagulopathy, hypothermia and acidosis
- There is no proven benefit of one crystalloid over another
- Colloids do not show an outcome improvement over crystalloids
- Each patient scenario should be considered individually



Lockey, Resuscitation 2001

The concept of “**the golden hour**” was a marketing strategy by Dr. Cowley in 1963 in a letter to the Governor of Maryland, the purpose of which was to get ensure that police helicopters would over-fly local hospitals and bring severely injured pts to his Baltimore

Black Trauma Ce

...with no

But...

ance to support

the time!



The only way to stop the bleeding
is not to waste time !



The most important clotting factor is the surgeon !



Thank you