LESS IS MORE – FLUID RESUSCITATION STRATEGIES IN THE EMERGENCY DEPT

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The fluid debate is over

The New England Journal of Medicine - Oct 1994

Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries.
Bickell W H, Wall M J, Pepe P E et al.

Conclusion: For hypotensive patients with penetrating torso injuries, delay of aggressive fluids resuscitation until operative intervention improves outcome.

Archives of Surgery
1996

Emergency Medical Services (EMS) vs Non EMS Transport of Critically Injured Patients
Demetriades D, Chan L, Cornwell E E et al.

Conclusion: Subgroup analysis showed that patients with ISS>15 were twice as likely to die if transported by EMS.


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What does EMST/ATLS say?

Classes of haemorrhagic shock according to percentage of blood loss:

Class 1 – initial stage (<15%)

Class 11 – compensatory stage (15% – 30%)

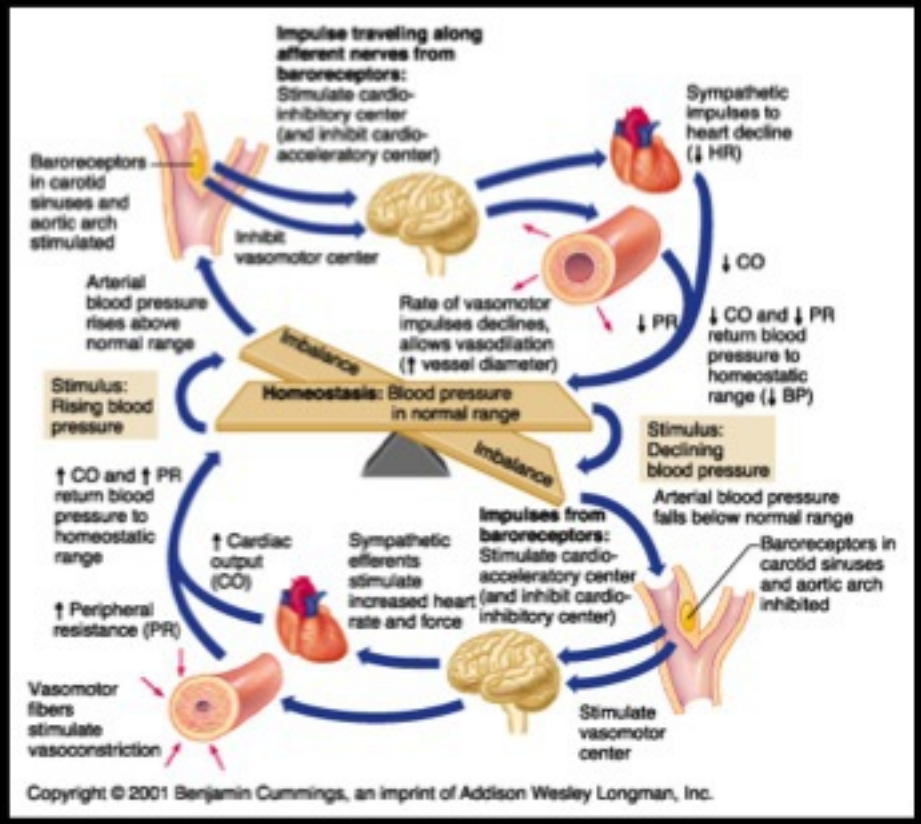
Class 111 – progressive stage (30% – 40%)

Class 1V – refractory stage (>40%)

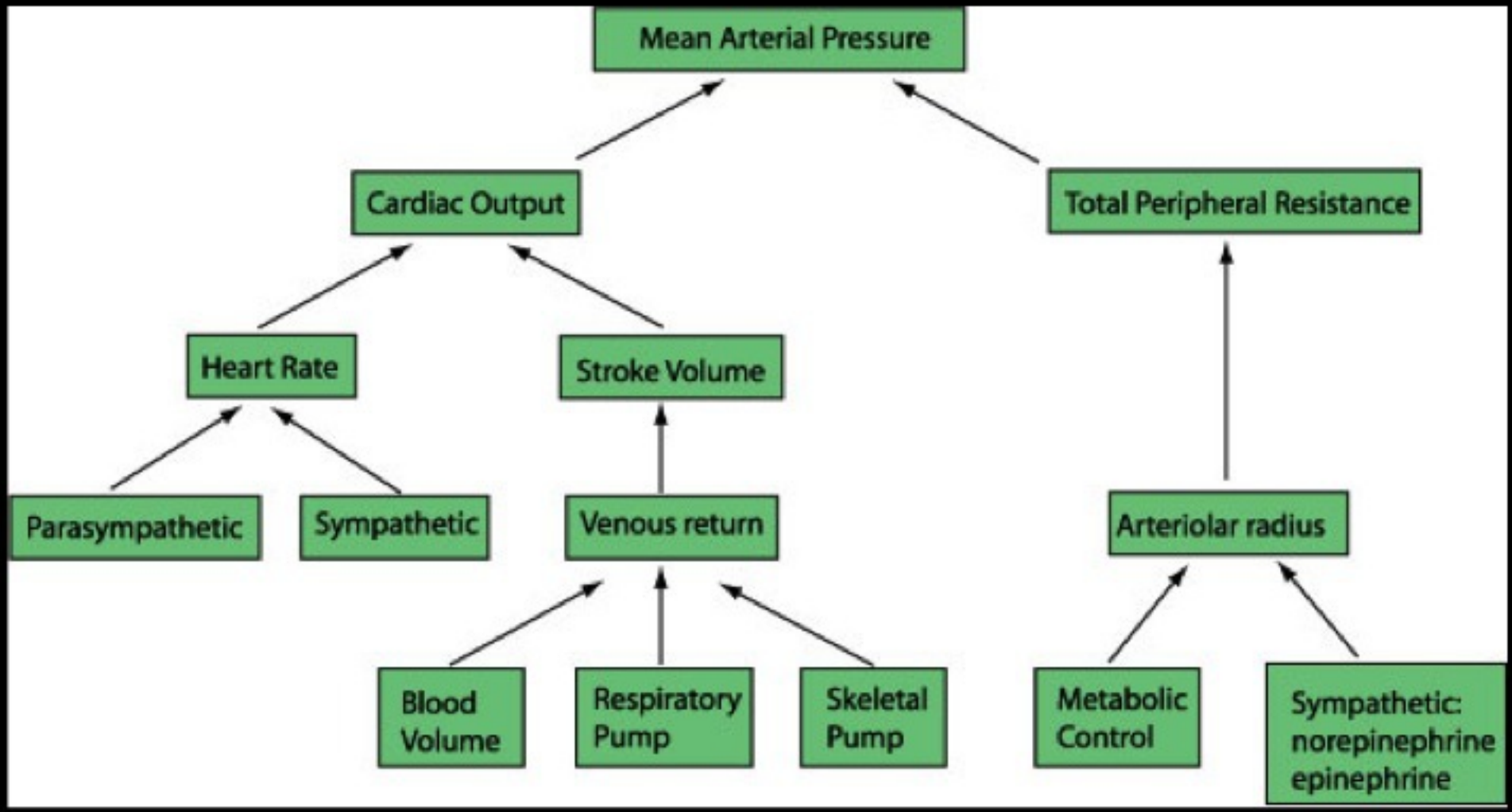
The ATLS guidelines recommend crystalloid iv – 3ml /1ml blood loss (3-for-1 rule).

What does haemorrhagic shock really mean to the injured body?

Haemorrhagic shock is a state of relative tissue hypoxia as a consequence of blood loss.



MAP = Cardiac Output x Total Peripheral Resistance



Mean Arterial Pressure

MAP = Diastolic pressure + 1/3 Pulse pressure

Pulse pressure = Systolic BP – Diastolic BP

So if BP is 120/90

MAP is 90 + 10 = 100

If BP is 90/60

MAP is 60 + 10 = 70

The pros and cons of fluid resuscitation

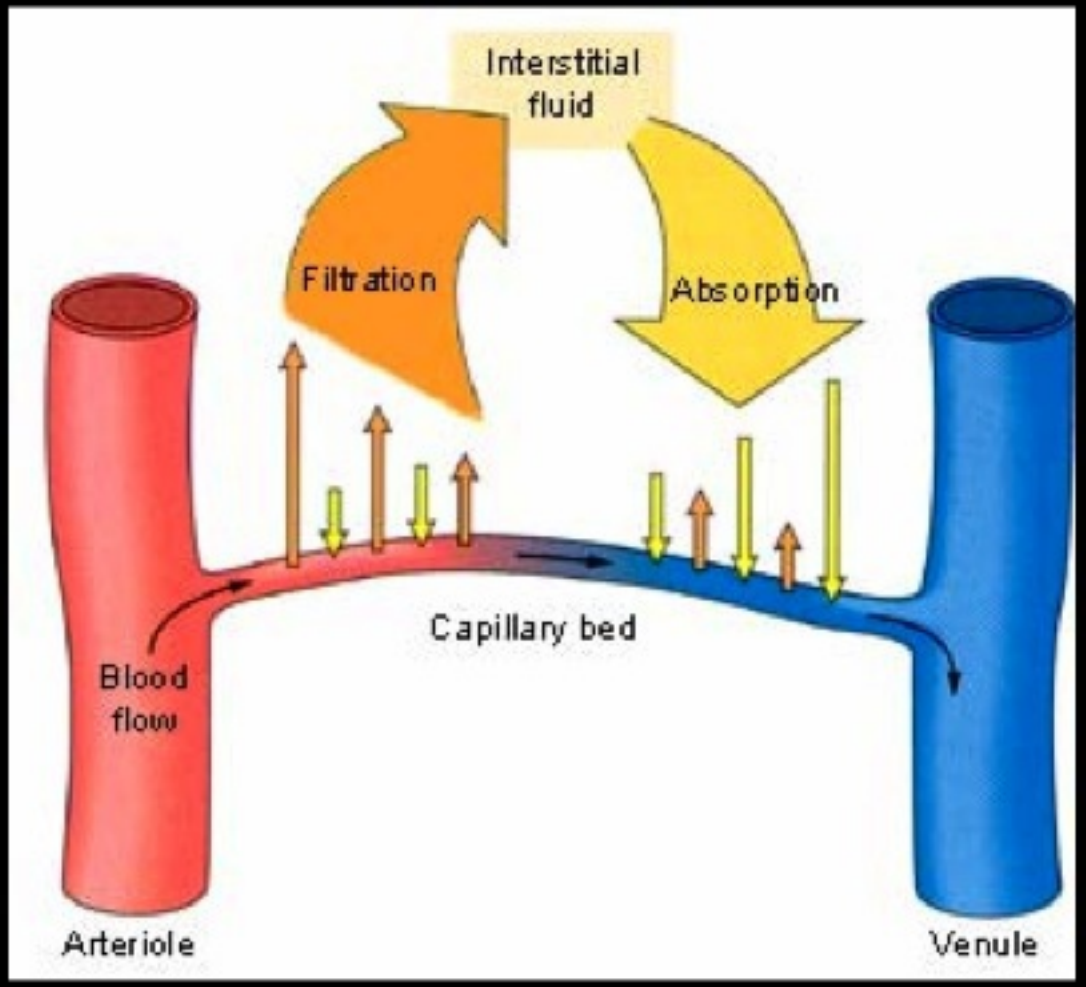
Pros – *aims to restore circulating intravascular volume, normalise pulse and BP. Preserve oxygen delivery to vital organs, prevent tissue hypoxia and end organ damage.*

Cons – *interstitial oedema, hypothermia, acidosis, disrupt homeostatic mechanisms, dilute clotting factors, increase bleeding.*

Triad of Death

Acidosis + Coagulopathy + Hypothermia

Plasma volume expansion



Fluid types

Crystalloids
- Hypotonic
- Isotonic
- Hypertonic

Colloids
- Natural
  - Albumin
- Synthetic
  - Dextran
  - Gelatins
  - Hydroxyethyl starch

No large scale clinical studies exist to support benefit of one group over the other in uncontrolled haemorrhagic shock.

A consensus view

Fluid resuscitation in prehospital trauma care: a consensus view.
Revell M, Porter K, Greaves I:
Emerg Med J 2002; 19: 494–498

It is known that degree of hypotension in trauma is tolerated and may beneficial.

- *Cannulation*
- *Choice of Fluid for Resuscitation*
- *Quantity of Fluid in Resuscitation*

Cannulation

- *Early cannulation is desirable*
- *Technically easier in early shock*
- *Saves time on arrival in ED*
- *Priority to transfer to definitive care*
- *Avoid prolonged on scene – 2 x attempts*
- *Intravenous access in transit ideal*
- *Entrapment – cannulate*

Choice of Fluid

- *Blood and FFP – not applicable pre-hospital*
- *Isotonic saline recommended*
- *Hypertonic solutions for head injuries ??*

Quantity of Fluid

Radial pulse ~ BP >80mm Hg

Femoral or Carotid pulse ~ BP >60mm Hg

- *Fluid should not be given to trauma victims before haemorrhage control if radial pulse can be felt (BP >80mm Hg) – titrate 250mls.*
- *In penetrating torso trauma a central pulse (BP >60mm Hg) – withhold fluid*

The Saline vesus Albumin Fluid Evaluation (SAFE) Study

Multicentre (Aus + NZ), ICU patients randomised, double-blind trial to compare the effect of fluid resuscitation with 4% albumin or saline on 28 day mortality.

Conclusion: In patients in the ICU, use of either 4% albumin or normal saline for fluid resuscitation results in similar outcomes at 28 days. Subgroup analysis showed use of albumin in traumatic brain injury trended to worse outcome ($p = 0.04$)

N Engl J Med 2004; 350:22 2247-2256

The dilema in uncontrolled haemorrhage with brain injury

Permissive hypotension

Cerebral hypoperfusion

Evidence based recomendations

Management of bleeding following major trauma: an updated European guideline by The multidisciplinary Task Force for advanced bleeding care in Trauma.
Used a nominal group process, Grading of Recommendations Assessment, Development And Evaluation (GRADE) based on evidence

Crit Care 2010; 14(2) (341 references!)

31 Recommendations

I. Initial resuscitation and prevention of further bleeding

II. Diagnosis and monitoring of bleeding

III. Rapid control of bleeding

IV. Tissue oxygenation, fluid and hypothermia

V. Management of bleeding and coagulation

Initial resuscitation and prevention of further bleeding

1. *Time elapse between injury and operation to be minimised for patients in need of urgent surgical bleeding control (1A)*
2. *Adjunct tourniquet use to stop life-threatening bleeding from open extremity injury in the pre-hospital setting (1C)*

Diagnosis and monitoring of bleeding

3. *Assess extent of bleeding using a combination of mechanism of injury, physiology, anatomical injury pattern and response to resuscitation (1C)*
4. *Initial normoventilation if there are no signs of imminent cerebral herniation (1C)*
5. *In haemorrhagic shock and identifiable source of bleeding – immediate bleeding control procedure, unless initial resuscitation successful (1B)*

Diagnosis and monitoring of bleeding (cont)

6. *Patients with haemorrhagic shock and an unidentified source of bleeding require immediate further investigation (1B)*
7. *Early FAST or CT to detect free fluid in patients with torso trauma (1B)*
8. *Significant free intra-abdominal fluid and haemodynamic instability require urgent intervention (1A)*
9. *Further assessment with CT for haemodynamically stable torso or high risk mechanisms (1B)*

Diagnosis and monitoring of bleeding (cont)

10. *Single Hct measure not recommended as an isolated marker of bleeding (1B)*
11. *Serum lactate and base deficit are sensitive tests to estimate and monitor the extent of bleeding and shock (1B)*
12. *Measure INR, APTT, fibrinogen & plts (2C)*

Rapid control of bleeding

13. *Pelvic ring disruption with haemorrhagic shock requires immediate pelvic ring closure and stabilisation (1B)*
14. *Ongoing haemodynamic instability despite adequate pelvic ring stabilisation require early preperitoneal packing, embolisation and/or surgical bleeding control (1B)*
15. *Early bleeding control of the abdomen with packing, direct control, local haemostatic methods +/- aorta cross clamping (1C)*

Rapid control of bleeding (cont)

16. *Damage control surgery for severely injured with deep haemorrhagic shock, ongoing bleeding and coagulopathy particularly when in presence of hypothermia, acidosis, inaccessible major anatomical injury, time consuming surgery or concomitant major injury outside abdomen (1C)*
17. *Topical haemostatic agents in combination with other surgical measures (1B)*

Tissue oxygenation, fluid and hypothermia

18. *In initial phase a target BP of 80 to 100 mm Hg until major bleeding stopped if no brain injury (1C)*
19. *Crystalloids initially for bleeding trauma patient (1B). Hypertonic solutions be considered during initial phase (2B). Colloids be considered in haemodynamically unstable patients (2C)*
20. *Early application of measures to reduce heat loss and achieve normothermia (1C)*

Journal of Trauma
March 2011; 70: 3

Hypotensive resuscitation strategy reduces transfusion requirements and severe postoperative coagulopathy in trauma patients with haemorrhagic shock: Preliminary results of a randomised controlled trial.

Morrison CA, Carrick MM, Norman MA et al

Conclusion

Hypotensive resuscitation is a safe strategy in trauma and results in a significant reduction in blood product transfusion and overall iv fluid use.

Target MAP 50mm Hg rather than 65 mm Hg significantly decreases postoperative coagulopathy and early postoperative death.

Take home message

- *Literature inconclusive*
- *Moderate hypotension well tolerated in fit trauma patient – target BP 90mm Hg*
- *Exanguinating penetrating injury is different to blunt injury*
- *Brains do not tolerate hypotension*
- *Best fluids N Saline or Hypertonic Saline*
- *Colloids no advantage over crystalloids*
- *Less is more – sometimes.*