Intravenous fluids – is less better or not in trauma?

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Objectives

- Why do we give IV fluids at all?
- Are IV fluids useful in themselves?
- What about blood and blood products?
- What is the evidence for and against IV fluid administration in trauma?
- Putting it all together

Why do we give IV fluids at all?

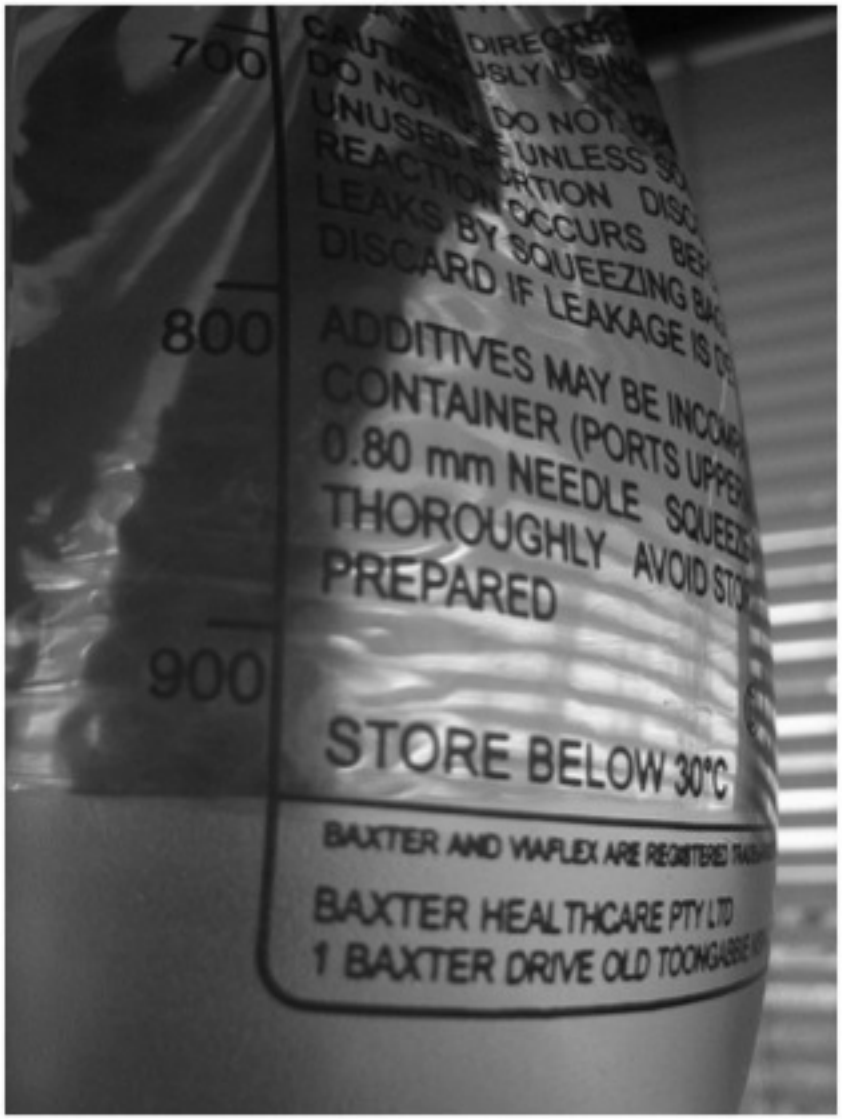
- We don't like low blood pressures
- We prefer to see normal heart rates
- We need to replace the blood loss
- We have to do something to make the patient better, don't we?

Why do we give IV fluids at all?

- We really give them as we know that blood loss causes shock
- Shock causes circulatory failure, gut, renal and neurological damage and organ failure
- Poor management of shock leads to death

Data

- Burris et al, J Trauma 1999
  - Rats with standardised aortic trauma
  - Variable fluid resuscitation
- Rats with no fluids all died soon
- Rats with lots of fluid (MAP 100mmHg) had a higher mortality than rats with controlled blood pressure (MAP 80)
- More rebleeding when MAP increased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Are IV fluids useful in themselves?

- IV fluids increase the intravascular volume and pressure and flow

- They restore some perfusion to regional vascular beds that have shut down due to hypovolaemia or other forms of shock (e.g. obstructive), reducing cellular hypoxia

Benefits of IV fluids

- Available universally, long before blood
- Can sustain flow to tissues when shock reaches critical levels beyond which death will rapidly occur
- Cheap and non-allergenic (crystalloids)

Any drawbacks to IV fluids?

- The patient has usually lost blood, with cells and coagulation factors, not saline
- Saline can only replace saline, not cells
- Blood that is lost is usually at 37°C, saline is normally given back at 20-25°C

Any drawbacks to IV fluids?

- IV fluids are easy to store and quick to use
  - Very tempting in prehospital care and the ED
- Stay in intravascular space for short time
- If used alone, need large volumes of crystalloid for effective resuscitation

Any drawbacks to IV fluids?

- Large volume infusions of crystalloid can cause gut oedema, abdominal hypertension and abdominal compartment syndrome

- Large volumes of fluid can ‘pop the clot’ from major blood vessels and cause further (unseen) bleeding

What about blood and blood products?

- Blood has cells and coagulation factors
- Older blood has less of both, and even less functioning cells and active clotting factors
- Blood needs to be collected, screened, typed, stored in a fridge and crossmatched

What about blood and blood products?

- Blood administration seems more logical than IV fluids alone
- Blood administration can cause transfusion reactions and blood borne disease
- Usually available as packed red cells and component therapy in civilian practice

Prehospital IV cannulae?

- No evidence to support placement of IV cannulae at scene
  - Simply delays departure for definitive care

- Evidence that cannulation can be done en route without delays – this is acceptable

Evidence for IV fluid administration in trauma

- Almost none for prehospital administration
- Very little high quality evidence in favour of IV fluid administration in the ED
- Fluid administration *may be* justified if there is a pressing need to intubate the patient

Evidence against IV fluid administration in trauma

- Bickell et al NEJM 1994
  - Prospective single centre pseudo-RCT
  - Penetrating torso injuries only
  - No fluid for one group, standard IV fluid resuscitation for the other
  - Preoperative fluid volumes were 386mL in the 'no volume' group and 2611mL in the 'normal' group
  - Better survival in the 'no fluid' group (p=0.04)

So we should stop fluids?

- Several caveats about this study:
  - 65% gunshot wounds
  - 30% stab wounds
  - Not your average trauma population……

- This study specifically examined penetrating truncal trauma, not blunt trauma

Blunt trauma

Very different pathology

- Blunt trauma – multiple bleeding points, usually 1 or 2 major bleeding regions which need control, lots of oozing and contusion

- Penetrating trauma – usually 1 major bleeding region which needs to be stopped

Head injury

- Most patients with blunt trauma have significant head injuries
  - Priority is to avoid hypoxia and hypotension
  - Hypotension causes a decreased cerebral perfusion pressure and cerebral ischaemia
  - A single episode of hypotension increases mortality dramatically
  - Cerebral autoregulation is impaired after trauma

Putting it all together

Putting it all together

- Penetrating trauma is ‘easy’
  - Avoid IV cannulation at scene
  - Avoid IV fluids en route and in the ED
  - Shock needs surgery to stop bleeding
  - Fluids should be restricted as much as possible before definitive haemostasis occurs in the operating room – ***hypotensive resuscitation***
  - Early surgical control of bleeding is the key

Putting it all together

- Blunt trauma with conscious patient and evidence of shock and/or bleeding
  - Avoid IV cannulation at scene, rapid ED transfer
  - IV cannulation en route if possible but avoid IV fluids in transit and in the ED ***as long as conscious level remains acceptable – hypotensive resuscitation***
  - Identify and stop surgical bleeding as quickly as possible
  - Fluids should be restricted as much as possible

Putting it all together

- Blunt trauma with head injury and reduced conscious level (GCS<13) and shock (SBP<90mmHg)
  - Avoid IV cannulation at scene, rapid ED transfer
  - Cannulate in transit and given a 250mL bolus of IV crystalloid (0.9% saline or Ringer's lactate) to keep systolic at ~90mmHg – not higher unless signs of raised ICP (prehospital or ED)
  - Repeat bolus as necessary to maintain SBP ~90mmHg, not higher
  - On arrival at ED, locate and stop surgical bleeding rapidly

Putting it all together

- Blunt trauma with head injury and reduced conscious level (GCS<13) and shock (SBP<90mmHg)
  - Give blood as early as possible if further fluids are required, and consider FFP and platelets early
  - Fluids should be restricted as much as possible before definitive haemostasis occurs in the operating room
  - Try to maintain a balance between excessive bleeding in the truck and decreased cerebral perfusion pressure causing further cerebral ischaemia
  - Early surgical control of bleeding and avoidance of overinfusion of crystalloids are the keys

What if someone is about to die (systolic BP ~ 40mmHg)?

- No data to inform us in this scenario
- Seems logical to give some fluid to maintain a chance of survival
- Reality is that unless injury to a single system is present which is rapidly ‘fixable’, outcomes are generally appalling

Summary

- IV fluid administration is a good thing
  - The question is the timing and volume

- Avoid large volumes of IV fluids before stopping bleeding in penetrating injury and in neurologically intact blunt trauma

- Hypotensive resuscitation depends on having a perfused brain, nothing more

Summary

- If you cannot assess the brain ‘minute-by-minute’, then do not embark on hypotensive resuscitation – give repeated 250mL boluses until haemostasis is achieved

- Surgical control of bleeding is far more important that fluid replacement
  - This should be the goal of every trauma system


Injury 2010