FLUIDS IN TRAUMA – A HISTORICAL UPDATE

1600 - WILLIAM HARVEY
CIRCULATION OF BLOOD
( AIR GOES IN AND OUT
BLOOD GOES ROUND AND ROUND )
1800 – PHYSIOLOGICAL SALINE
1900 – MAJOR BLOOD TYPES
HISTORY - CONTINUED

- WORLD WAR 1 – CANNON ET AL 1918
- “IF THE PRESSURE IS RAISED WITHOUT A SURGEON TO CHECK THE BLEEDING BLOOD WILL BE LOST”
- VIETNAM WAR 1960s – LARGE VOLUME CRYSTALLOID RESUSCITATION – MADE SENSE
Old Doctrine

- Give 2 litres of Ringers Lactate and watch the response!

- ATLS 7th edition early 1990s

Large bore cannulae x 2 (at least)

Level 1 Blood warmer
Continue to fill up!
Stay in the race!

Faster! Faster! Faster!
Pre Hospital Phase

- Houston Texas
- NEJM OCT 1994
- 598 patients
- SBP <90
- Pre hospital and ED fluid resuscitation
- Survival rate 70% vs 62% (p=0.04)
- Not applicable to blunt trauma esp traumatic brain injury

Immediate versus Delayed Fluid Resuscitation for Hypotensive Patients with Penetrating Torso Injuries

William H. Bickell, Matthew J. Wall, Paul E. Peppe, R. Russell Martin, Victoria P. Ginger, Mary K. Allen, and Kenneth L. Mattox

ABSTRACT

Background Fluid resuscitation may be detrimental when given before bleeding is controlled in patients with trauma. The purpose of this study was to determine the effects of delaying fluid resuscitation until the time of operative intervention in hypotensive patients with penetrating injuries to the torso.

Methods We conducted a prospective trial comparing immediate and delayed fluid resuscitation in 598 adults with penetrating torso injuries who presented with a prehospital systolic blood pressure ≤ 90 mm Hg. The study setting was a city with a single centralized system of prehospital emergency care and a single receiving facility for patients with major trauma. Patients assigned to the immediate-resuscitation group received standard fluid resuscitation before they reached the hospital and in the trauma center, and those assigned to the delayed-resuscitation group received intravenous cannulation but no fluid resuscitation until they reached the operating room.

Results Among the 269 patients who received delayed fluid resuscitation, 203 (76 percent) survived and were discharged from the hospital, as compared with 193 of the 309 patients (62 percent) who received immediate fluid resuscitation (P = 0.04). The mean estimated intraoperative blood loss was similar in the two groups. Among the 238 patients in the delayed-resuscitation group who survived to the postoperative period, 55 (23 percent) had one or more complications (adult respiratory distress syndrome, sepsis syndrome, acute renal failure, coagulopathy, wound infection, and pneumonia), as compared with 69 of the 227 patients (30 percent) in the immediate-resuscitation group (P = 0.08). The duration of hospitalization was shorter in the delayed-resuscitation group.

Conclusions For hypotensive patients with penetrating torso injuries, delay of aggressive fluid resuscitation until operative intervention improves the outcome.
PRE HOSPITAL CARE – CRITICAL GOALS

1. STOP THE EXTERNAL BLEEDING
2. RAPID TRANSPORT
3. RESUSCITATE TO MAINTAIN MENTAL STATUS AND PERIPHERAL PULSES
PRE HOSPITAL CARE

- A PROSPECTIVE MULTICENTRE CANADIAN STUDY IN 2003 ANNALS OF SURGERY
- 9405 PATIENTS
- INCREASED MORTALITY WITH EVERY ATLS INTERVENTION
- SEAMON ET AL – RETROSPECTIVE STUDY J TRAUMA 2007
- 180 PENETRATING TRAUMA REQUIRING ED THORACOTOMY
- PRE HOSPITAL PROCEDURES – INDEPENDENT PREDICTOR OF BAD OUTCOME
- VASCULAR ACCESS NOT ESSENTIAL
- MINIMAL FLUIDS IF PULSE PRESENT
FLUIDS - How much of what?

• How much?
• How fast?
• What fluid?
• For How long?

What is stable?

STABLE IS A STATE OF MIND!
Permissive Hypotension

- Do not drown your patients!
- Accept Lower BP
- Radial pulse – enough
- Do the ATLS/CTLS dance and stop the bleeding!
LACTATED RINGER SOLUTION

- CREATED BY HARTMANN IN 1930s
- METABOLISED IN LIVER TO PYRUVATE OR CO2 AND H2O
- RELEASE OF HYDROXIDE WHICH IS CONVERTED TO BICARBONATE
- OFFERS PHYSIOLOGICAL BUFFER TO ACIDOSIS
COLLOIDS

• SALINE VS ALBUMIN FLUID EVALUATION (SAFE) STUDY NEJM 2004
• 7000 CRITICALLY ILL ICU PATIENTS
• 4% ALBUMIN Vs N SALINE
• NO BENEFICIAL EFFECTS ON MORTALITY MORBIDITY OR LOS IN ICU
• COCHRANE REVIEW IN 2007 -
• NO REDUCTION IN DEATH / EXPENSIVE
NORMAL SALINE

• CAUSES HYPERCHLOREMIC ACIDOSIS WHEN GIVEN IN LARGE VOLUMES

• UNCONTROLLED HAEMORRHAGIC SHOCK IN PIGS – TODD ET AL 2007

• HIGHER VOLUME REQUIRED / MORE ACIDOTIC / LOWER FIBRINOGEN AND WORSE COAGULOPATHY
RESUSCITATION INJURY

CAPILLARY PERMEABILITY INCREASES
CELLULAR SWELLING AND DYSFUNCTION
FLUID OVERLOAD AND OEDema BEGETS FURTHER FLUIDS AND OEDema
VIETNAM WAR –ACUTE LUNG INJURY DA NANG LUNG
ADULT RESPIRATORY DISTRESS SYNDROME (ARDS)
ABDOMINAL COMPARTMENT SYNDROME
HYPERTONIC SALINE

SINCE 1980s
VOLUME EXPANSION AND RESTORATION OF T CELL FUNCTION IN ANIMAL STUDY – 1997
COCHRANE REVIEW 2004
NO DIFFERENCE IN MORTALITY BETWEEN HYPERTONIC AND ISOTONIC SALINE
COOPER ET AL – JAMA 2004 PROSPECTIVE RANDOMISED STUDY
RCT 229 PATIENTS WITH TBI 250 MLS 7.5%SALINE VS RINGERS
NO DIFFERENCE IN MORTALITY OR GLASGOW OUTCOME SCALE EXTENDED ( GOSE )
GIVE BLOOD EARLY

- Do not fill up with fluids
- Do not cheat
- Emphasis on early blood and products

• Stop the bleeding
BLOOD substitutes

• Ideal fluid

• safe

• Carries O2

• Cheap

• Easy to store

• More research needed

• New developments in Fluid resuscitation - Hasan B Alam
  Surgical clinics of N America Feb 2007
SUMMARY
PRE HOSPITAL PHASE

• RAPID TRANSPORT
• AVOID TIME CONSUMING ATLS PROCEDURES - LEVEL II
• IV ACCESS NOT MANDATORY
• IV FLUIDS TO KEEP VEIN OPEN
• RESUSCITATE TO ADEQUATE MENTAL STATUS AND PERIPHERAL PULSES
SUMMARY – IN ED

- **CHOICE OF FLUID**
  - NO EFFECT ON OUTCOME  LEVEL I
- **LACTATED RINGER HAS**
  THEORETICAL ADVANTAGES  LEVEL III
- **AVOID LARGE VOLUME CRYSTALLOID**
  RESUSCITATION  LEVEL III
- **UNCONTROLLED HAEMORRHAGE AND**
  NO TBI SBP 70 – 90  LEVEL III
SUMMARY – IN ED

- INITIATE MASSIVE TRANSFUSION PROTOCOL IN SELECTED PATIENTS
- USE FIXED RATIOS OF BLOOD AND BLOOD PRODUCTS  LEVEL II
- GIVE TRANEXAMIC ACID TO ALL PATIENTS WITH UNCONTROLLED HAEMORRHAGE AND REQUIRING TRANSFUSION  LEVEL I
CONCLUSION

- Debate continues on ideal fluid in trauma resuscitation
- No difference between colloid and crystalloid
- Avoid large volumes of N saline
- Use blood and blood products early
- Stop the bleeding!
REMEMBER

“NOT EVERYTHING THAT COUNTS CAN BE COUNTED AND NOT EVERYTHING THAT CAN BE COUNTED COUNTS”

(ALBERT EINSTEIN)
Thank You!