Permissive Hypotension vs Fluid Resuscitation in Trauma Patients

KATE GANCARCZYK, RN, MSN, TNCC, ENPC, ECRN

Objectives

- **The purpose of the program is:** This is a fifty minutes presentation that discusses current studies and recommendations on permissive hypotension versus fluid resuscitation in actively bleeding trauma patients.
- **At the end of the session, the attendee will be able to:**
- Explain the definitions of permissive hypotension and fluid resuscitation.
- Describe the clinical manifestations of decreased organ perfusion and pathophysiology of coagulopathy in actively bleeding trauma.
- Discuss the current clinical practice guidelines for permissive hypotension and fluid resuscitation as preferred treatment of actively bleeding trauma patients.

Relevance

- Trauma remains the leading cause of mortality among persons 1 to 44 years old in the United States and accounts for almost 9% of total mortality worldwide *(Gourgiotis et al., 2013).*
- Hemorrhage is considered responsible for approximately 50% of trauma deaths within the first few hours (Gourgiotis et al., 2013).
- Hemorrhagic shock is a principal cause of death among trauma patients accounting for approximately 30–40% of deaths within the first 24 hours after injury (Carrick, Leonard, Slone, Mains, & Bar-Or, 2016).

History (Eick & Denke, 2018)

- 1960s- EMS started fluid resuscitation in the field
- Early protocols called for 3L of 0.9Nacl for 1L blood loss
- 1990s concept of permissive hypotension studied on animals then humans
- 2000s Massive Transfusion Protocols and rapid surgical repair

Types of Resuscitation

- Fluid
- Hemostatic
- Surgical/ Interventional
- Chemical

Fluid Resuscitation

- Restoration of systemic blood flow and adequate tissue perfusion in critically ill patients
- Volume expansion and oxygen carrying capacity of blood (Chatrath, Khetarpal, Ahuja, 2015).
- Minimize organ failure related to hypoperfusion (Kolarik & Roberts, 2017)
- Crystalloids (0.9 NaCl, Lactated Ringers)

Permissive hypotension

- Implies accepting an adequate, not normal, blood pressure (Nevin & Brohi, 2017)
- Subnormal blood pressure to minimize hemorrhagic blood loss (Chatrath, Khetarpal, Ahuja, 2015).
- Target resuscitation to SBP of 70-90 mmHg, normal mentation and palpable peripheral pulses (Chatrath, Khetarpal, Ahuja, 2015).
- MAP 50 mmHg (Giannoudi & Harwood, 2016).

Hemostatic resuscitation

- Emerging trend
- Early administration of blood products (PRBC, FFP, Platelets, Cryoprecipitate)
- Blood products better expand volume without fluid shifts into the interstitial space (Kolarik & Roberts. 2017).
- Decrease in amount of blood products consumed, the amount of secondary injuries related to resuscitation, and increased mortality of the hemorrhagic trauma patient (Eick & Denke, 2018).
- Massive Transfusion Protocol- ratios of 1:1:1

Other (Eick & Denke, 2018)

- Hemostatic agents, chemical or medication, to cease the bleeding in a trauma patient
  - dressings, sprays, polymers, glues
  - tranexamic acid (TXA)- antifibrinolytic agent
  - recombinant factor VIIa- enhances clot formation
- Damage control Resuscitation
  - OR/IR

Trauma Lethal Triad

- Trauma- induced coagulopathy
- Hypothermia
- Acidosis

Trauma Induced Coagulopathy (Carrick, Leonard, Slone, Mains,& Bar-Or, 2016)

- Coagulopathy of trauma arises from decreased circulating concentration various clotting components
- Present on admission to the hospital in approximately 25% of trauma patients
- Large amount of fluids diluting clotting factors
- Increase of blood pressure with fluid administration dislodges the thrombus that is already forming

Hypothermia

- High risk due to physical exposure, environment, intoxication (Giannoudi & Harwood, 2016).
- Causes and exacerbates bleeding abnormalities through multiple mechanisms (Giannoudi & Harwood, 2016).
- Inhibit the generation of thrombin and the availability of fibrinogen
- Moderate hypothermia (32–34 °C), directly reduces coagulation factor activity by approximately 10 % for each degree fall in temperature, whilst also inhibiting platelet aggregation (Giannoudi & Harwood, 2016).
- Infusing 2 liters of 25-degree Celsius saline or lactated Ringer's solution decreases a 70-kilogram patient's body temperature by up to one-third of a degree Celsius (Carrick, Leonard, Slone, Mains,& Bar-Or, 2016).

Acidosis (Giannoudi & Harwood, 2016)

- Inadequate circulation:
  - Generates toxic metabolites,
  - Promotes anaerobic metabolism
  - Increases lactic acidosis
- Fall in pH from 7.4 to 7.0 reduces factor VIIa's activity by 90 %, thus causing coagulopathy
- PH< 7.2 is associated with:
  - Decreased cardiac contractility and output
  - Vasodilation
  - Hypotension
  - Bradycardia

Permissive hypotension vs Fluid resuscitation ???

Crystalloids- Research (Eick & Denke, 2018)

- Freely permeable to the vascular membranes 75% of these solutions are moved into the interstitial space
- Approximately 25% of that bolus remains in the circulatory system within 30 min of administration
- Increase coagulopathy due to the binding of the crystalloids to plasma proteins
- Adverse effect on the activation of hemostatic factors at the blood vessel endothelium, leading to clotting disturbances and then exsanguination (Gourgiotis, 2013).
- Immediate fluid resuscitation caused increases in the rate, volume, and duration of hemorrhage

Cont.

- NS can produce "hyperchloremic acidosis"
- Room temperature fluids promote hypothermia, which increases coagulopathy
- Increased mortality with large-volume resuscitation (Albreiki & Voegeli, 2017)
- Increased tissue edema
- Acute Respiratory Distress Syndrome (ARDS) (Kolarik & Roberts, 2017)
- Diminished inflammatory response

Permissive hypotension- Research

- European Journal of Trauma Emergency Surgery 2018 (Albreiki & Voegeli, 2017)
  - 1157 patients
  - Mortality rate of low versus large volumes of fluid were 21.5% and 28.6% respectively
  - Fluid resuscitation using more than 1.5 l was highly associated with the mortality rate of nonelderly trauma patients

Cont

- Delayed fluid vs immediate fluid administration showed increased survival in the delayed versus immediate resuscitation group (70% versus 62%) and shorted hospital stay for delayed group.(Carrick, Leonard, Slone, Mains,& Bar-Or, 2016).
- BLUNT vs PENETRATING study revealed blunt trauma subgroup that received controlled resuscitation (>1L of fluid) had decreased mortality (3.2% versus 17.7%) (Carrick, Leonard, Slone, Mains,& Bar-Or, 2016).
- Widely used in military with combat injuries

Special Consideration

- Traumatic Brain Injury (TBI)
- Spinal Cord Injury
- Older Population
- Chronic Cardiovascular Conditions

Special Considerations

- Careful balance the need for cerebral perfusion (Wiles, 2017)
- Hypotension is well recognised as a risk factor for poor outcomes, with an admission SBP < 110 mmHg being associated with a 92–98% increase in the risk of death (Wiles, 2017)
- European trauma guideline suggest a target MAP(≥80 mmHg) 85–90 mmHg for TBI patients (Maegele, Frohlich, Caspers, & Kaske, 2017).

Nursing Implication

- TREAT THE PATIENT, NOT NUMBERS
- Communication with Trauma Surgeon and EMT
  - Pre-arrival assessment
  - Pre-arrival interventions
- Prepare for immediate blood administration
- Prepare for OR/IR
- Measures to prevent Hypothermia, Acidosis, Coagulopathy
- Consideration for different types of injuries

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