Fluid Resuscitation in a Trauma Patient and Anesthetic Considerations

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Introduction

Trauma mortality expands across all age groups and is the third most common cause of mortality. Due to this, it remains a major public health concern and leads to high-cost expenditures (Dattatri et al., 2021). Understanding trauma and management to improve mortality rates has advanced due to an improved understanding of shock pathophysiology, changes in hemodynamics, fluid resuscitation, and response to resuscitation. The importance of anesthetic involvement with trauma patients is now acknowledged since anesthesia practitioners provide clinical care in a perioperative space. Therefore, pre-hospital care, emergency department resuscitation, surgical procedures, and rehabilitation treatment are of importance to anesthetic management and impact the choice of anesthetic treatment.

Given that trauma patients present with different forms of trauma, emphasis will be placed on a fundamental understanding of the pathophysiology of hypovolemic shock, the dangers of uncontrolled hemorrhaging, standard fluid resuscitation, monitorization of patient response, and anesthetic considerations. Factors that support hemodynamic targets depending on the types of traumas will be presented along with resuscitation strategies and their transition over time upon evidence of improvement in mortality rates. The intent is to gear knowledge obtained within academic training towards the concept of trauma and its implications.

Resuscitation Monitoring

	Rapid Response	Transient Response	Minimal or No Response
Vital Signs	Return to Normal	Recurrence of decreased BP and increased HR	Remain Abnormal
Estimated Blood Loss	Minimal (<15%)	Moderate and ongoing (15% – 40%)	Severe (>40%)
Need for Blood	Low	Moderate to high	Immediate
Blood Preparation	Type and Crossmatch	Type – Specific	Emergency Blood Release
Need for Operative Intervention	Possibly	Likely	Highly likely
Early Presence of Surgeon	Yes	Yes	Yes

Responses to Initial Fluid Resuscitation (Adewale et al., 2009).

Shock

	Class 1	Class 2	Class 3	Class 4
Blood Loss (mL)	Up to 750	750 – 1,500	1,500 – 2,000	> 2,000
Blood Loss (% Blood Volume)	Up to 15%	15% – 30%	30% – 40 %	>40%
Pulse Rate (bpm)	<100	>100	>120	>140
Blood Pressure	Normal or Increased	Decreased	Decreased	Decreased
Respiratory Rate	14 – 20	20 – 30	30 – 40	>40
Urine Output (mL/hr)	>30	20 – 30	5 – 15	Negligible
CNS/Mental Status	Slightly Anxious	Mildly Anxious	Anxious, confused	Confused, lethargic
Fluid Replacement	Crystalloid	Crystalloid	Crystalloid and blood	Crystalloid and Blood

Classification of Hemmorhagic Shock (Facs et al., 2018)

Target Goal Resuscitation

Damage Control Resuscitaion (DCR) is the accepted strategy of fluid resuscitation. It consist of permissive HOTN, hemostatic resuscitation, and damage control surgery (Chang et al., 2017). There are three types of traumas penetrating, blunt, and trauma associated with a traumatic brain injury (TBI). For each type of trauma, a systolic blood pressure target goal is set; 60-70mmhg for penetrating; 80-90mmhg for blunt trauma; and 100-110mmhg for trauma with TBI (Ramesh et al., 2019). Permissive hypotension isn't acceptable for TBIs in comparison to the other traumas. In TBI the priority goal is to prevent secondary brain injury by maintaining adequate perfusion pressure. Intracranial pressure is increased in TBI which will impact cerebral perfusion pressure (CPP). Therefore, in addition to the target systolic pressure, Wise et al. (2017) recommends a target mean airway pressure (MAP) greater than 80mmhg and CPP approximately 60mmhg.

The consensus of fluid administration established by the Advanced Trauma Life Support (ATLS) is 1L of warmed balanced crystalloid such as lactated ringer (LR) which expands the extracellular volume. After initial resucitation the patient is monitored for for response to resuscitation. The patient is accessed for a Rapid Response, Transient Response, or Minimal to No response.

Conclusion

Hemorrhagic shock may progress fast with rapid blood loss of the patient and prompt adequate fluid administration of warmed 1L of balanced crystalloid fluid is necessary. The patient should be monitored for their response to resuscitation to access their progression via invasive and non-invasive techniques. DCR is the standardized strategy approach to prevent secondary injury from dilutional coagulopathy or dislodging soft clots. From lab results, blood loss, and the patient's physical presentation, blood administration is prompted. MTP ratio of RBCs, FFP/cryoprecipitate, and platelets in a 1:1:1 should be timely initiated to maintain the physiological constitution of blood and replace intravascular loss. Patients should be continually assessed for hemodynamic considerations to be transitioned to post-resuscitation.

Anesthetic Consideration

All patients should be pre-oxygenated with 3-5 vital capacity breaths or 3-5 minutes on high oxygen flows. In the incidence of facial deformity from trauma or unable to pre-oxygenate patient, do not delay induction. The same applies to invasive monitoring such as central lines and arterial lines. Peripheral access should already be obtained in the emergency room and if invasive monitoring isn't, do not delay induction. Obtain invasive access after the patient is asleep. In hypovolemic shock, the patient typically presents as tachycardic with hypotension due to loss of blood and the heart's attempt to get blood to oxygen-deprived tissue. The provider should be mindful of administering drugs that further decrease systemic vascular resistance. Tobin et al. (2018) suggest reducing the propofol dosing and considering using ketamine for patients in hypovolemic shock. In addition, all trauma patients are automatically deemed a difficult airway and full stomach which indicates an RSI induction. Adjuncts to intubation are always available but it is crucial to select devices with prior experience. Awareness of the contraindications for RSI muscle relaxants succinylcholine and modified RSI muscle relaxants with rocuronium should be considered (Tobin et al., 2018). Maintenance and resuscitation consist of their considerations as well. POC testing and ABGs, previously mentioned, are ideal to begin at the start of the case to guide the maintenance phase of fluid and blood administration.

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