Spring 2016

Recommendation for Permissive Hypotension for Trauma Patients in the Prehospital Setting in Peninsulas Emergency Medical Services Council, Inc.

Seth Craig
Rappahannock Community College

Recommendation for Permissive Hypotension for Trauma Patients in the Prehospital Setting in Peninsulas Emergency Medical Services Council, Inc.

Seth Craig
Rappahannock Community College
EMS Professional Development (EMS 201)

Abstract

Permissive hypotension should be part of the Trauma Protocol of the Peninsulas Emergency Medical Service (PEMS) Region to prevent further injury to patients with traumatic injuries. Currently the Trauma Protocol states: “Suspected hypovolemia 20 mL/kg 0.9% normal saline up to 1000 mL bolus, continuously reassess need for further fluid” (page 1 of 2, Trauma). There is no guidance in the current PEMS Trauma Protocol to indicate how to determine the “need for further fluid,” which would lead a prehospital medical provider to attempt to achieve a normotensive blood pressure. Current research, however, supports permissive hypotension.

The importance of blood pressure for organ perfusion is well researched and documented. Permissive hypotension is the practice of maintaining systolic blood pressure below the average, or normative blood pressure. Complications from an attempt to establish or maintain normotensive blood pressure in hemorrhagic shock through excessive fluid resuscitation may include increased arterial and venous pressure, dilution of clotting factors, and decreased blood viscosity. Increased arterial and venous pressure can impede hemostasis because the high pressure may cause clots to break loose once they are formed or not be able to form at all.

Keywords: prehospital, permissive hypotension, PEMS, protocol

The importance of blood pressure for organ perfusion is well researched and documented. Blood pressure is the force that blood exerts against the inner walls of the arteries and consists of two measurements. The first measurement is the systolic pressure, the amount of pressure against the vessel walls at the peak of ventricular contraction of the heart. The second measurement is the diastolic pressure, which is the pressure when the ventricles are at rest. Blood pressure is reported as systolic/diastolic. These pressures are a reflection of the force of the heart as it circulates the blood throughout the body and perfuse the tissues. Therefore, blood pressure is one tool used to monitor perfusion and emergency medical personnel have strived to maintain normotensive blood pressure for patients in hemorrhagic shock in the prehospital setting. The current 2016 PEMS, Inc. Adult Trauma Protocol states "suspected hypovolemia 20 mL/kg 0.9% normal saline up to 1000 mL bolus, continuously reassess need for further fluid" (page 1 of 2, Trauma). The current Adult Trauma protocol does not provide any guidelines to determine the need for further fluid. Therefore, a standard practice in the prehospital setting is to monitor blood pressure and attempt to attain and sustain a normotensive value. Current studies indicate that this practice may actually be causing more harm to patients. Therefore, it is necessary to provide guidelines for prehospital medical providers, and many emergency medical agencies are practicing permissive hypotension in the field. Permissive hypotension is the practice of maintaining systolic blood pressure below the average, or normative blood pressure.

Blood pressure is maintained through the ventricular contractions, blood volume, and vessel size. A traumatic injury can compromise the blood vessels allowing blood to escape and reducing blood volume. A reduction in blood volume will decrease blood pressure if the body cannot compensate for the blood loss by increasing ventricular contractions or reducing blood vessel size. This blood loss is a major life threat to most trauma patients.

To halt this potential life threat, medical professionals have suggested administering more fluid than blood lost to increase blood pressure and improve perfusion. Administered fluid volume to blood volume loss ratios have ranged from 3:1 up to 8:1 to obtain a normotensive blood pressure in the prehospital setting. According to Beeson (2013), research has shown this disproportional volume ratio is actually contraindicated and injurious for the patient for many reasons.

Complications from an attempt to establish or maintain normotensive blood pressure in hemorrhagic shock through excessive fluid resuscitation may include increased arterial and venous pressure, dilution of clotting factors, and decreased blood viscosity. Gourgiotis (2013) reported that increased arterial and venous pressure can impede hemostasis because the high pressure may cause clots to break loose once they are formed or not be able to form at all.

These complications must be taken into consideration in the treatment of a patient. Increased arterial pressure may increase intracranial pressure, another complication from normotensive resuscitation if a brain bleed is present. If the patient is experiencing a brain bleed, administering fluid will increase intracranial pressure which in turn may cause more brain damage. Permissive hypotension may be better treatment for the patient if any fluid is administered to prevent aggravating an intracranial bleed.

Another complication from attempting to establish normotensive blood pressure is the type of fluid administered. The intravenous fluid that is characteristically used in the prehospital setting is 0.9% normal saline. This fluid was not created for treatment of hemorrhagic shock, but initially developed for treatment of dehydration. Rhee (2010) showed that this fluid has no real equivalence to the saline concentration in blood and dilutes the clotting factors and other biological functions of blood. This dilution of clotting factors is contraindicated when attempting

to promote hemostasis. Blood does more than just fill blood vessels, it transports oxygen, nutrients, and waste products. Normal saline is not designed to perform this function.

According to Rhee (2010), in high volumes, crystalloids can also create inflammation. The research conducted by Rhee et al., (2010) recognized that there are toxicities associated with fluids. Just like any substance, administered in excess can be harmful. The study found that when using human blood, when blood was diluted with various resuscitation fluids, "the inflammatory changes depend on the fluid" (p. 319). When fluids are administered to attain normotensive pressure, the effect can be injurious. The authors recommended administering fluids as "damage control" and not to achieve normotensive pressure.

Although it may appear counterintuitive, permissive hypotension may be more beneficial for patients than attempting to establish normotensive blood pressure. According to Schmidt (2012), research demonstrates that permissive hypertension does not have a significant negative impact on regional organ perfusion compared to normotensive resuscitation. Although the study completed Schmidt et al., (2012) used an animal model to simulate a penetrating vascular injury, the research is a good indication that permissive hypotension should be considered. Dutton et. al. (2002) randomized patients presenting in hemorrhagic shock into one of two protocols: a.) either the systolic blood pressure (SBP) was maintained at a normotensive pressure above 100 mm of Hg or b.) it was maintained at a hypotensive pressure around 70 mm Hg. Through this study, the researchers found that mortality was not affected by permissive hypotension.

A few EMS systems around the PEMS Region currently have protocols established regarding permissive hypotension in the prehospital setting for the trauma patient. Old Dominion Emergency Medical Services Alliance (ODEMSA) 2015 protocol 4-2 states "avoid overly aggressive fluid administration; provide fluid boluses to maintain systolic BP between 90-

100 mmHg; alternatively, a mean arterial pressure of 65 mmHg is equally desirable. MAP is approximately equal to:

Diastolic BP + 1/3(Systolic BP- Diastolic BP)"

The Tidewater Emergency Medical Services Council (TEMS) 2013 Injury-Trauma protocol states "the goal of IV fluid administration is to maintain a systolic BP of 90 mmHg." These protocols reflect current research in permissive hypotension in prehospital medical care for trauma patients. It is recommended that PEMS protocols also reflect current research. A PEARL for the PEMS trauma protocol could be stated as: "provide fluid boluses to maintain a systolic blood pressure between 90-100 mmHg."

Permissive hypotension should be considered in patients in hemorrhagic stroke or experiencing significant blood volume loss. Permissive hypotension helps to reduce the risks of normotensive pressure in the trauma patient, including increased arterial and venous pressure, dilution of blood clotting and decreased blood viscosity. Since the fluids used in volume replacement have significant drawbacks, further research should be done to improve the fluids emergency medical professionals use in the field. For these important reasons, guidelines should be established in the PEMS, Inc. Adult Trauma Protocol to allow prehospital medical providers to sustain permissive hypotensive values to prevent further injury to patients.

References

Beeeson, J. and T. Starnes. Permissive hypotension in trauma resuscitation. *J. of Emergency Medical Services*. 2013; 38(4).

Dutton, R. et al. Hypotensive resuscitation during active hemorrhage: impact on in-hospital mortality. *The J. of Trauma Injury, Infection, and Critical Care.* 2002; 52:1141-1146.

Gourgiotis, S et al. Permissive hypotension in bleeding trauma patients: helpful or not and when? *Critical Care Nurse.* 2013; 33(6):18-5.

Old Dominion EMS Alliance, Inc. 2015 Regional Prehospital Patient Care Protocols. Protocol 4-2.

Peninsulas EMS Council, Inc. Regional Patient Care Protocols, Policies, and Procedures. 2016. Adult Trauma, 1-2.

Rhee, P. Nonolligative properties of intravenous fluids. *Current Opinion in Critical Care*. 2010; 16:317-322.

Schmidt, B et al. Permissive hypotension does not reduce regional organ perfusion compared to normotensive resuscitation: animal study with florescent microspheres. *World J. of Emergency Surgery*. 2012; 7(Suppl 1):59.

Tidewater EMS Council, Inc. Regional Medical Protocols, Eleventh Edition, July 2013. Revised September 2015. Injury-Trauma.