



Tricky Trauma: Cutting Edge Aeromedical Interventions In the Rural Setting

Adam Goodcoff OMS-III¹, L. Michael Peterson D.O.²

West Virginia School of Osteopathic Medicine - Lewisburg, WV¹, HealthNet Aeromedical Services – Charleston, WV²

Introduction

Management of trauma has evolved rapidly within the last 50 years. The ability to provide blood products, liquid never-frozen plasma, and Plasma-Lyte through inline warmers has redefined pre-hospital trauma and critical care transport. This case was selected because these interventions play an especially significant role in rural areas where access to care is sparse and transport, even by air, can be over an hour to the nearest trauma facility. Health Net Aeromedical (Charleston, WV) provides these services to rural West Virginia offering lifesaving care to many without access.



Case Description and Interventions

- The patient is a 70-year old male who rolled a lawnmower coming to rest on a 20% grade hill with the mowing deck imbedded in his left femur and right pelvic region.
- The mowing blade was buried in the right lower quadrant with uncontrolled bleeding in the abdomen and pelvis
- Initial pressure 76/50 patient maintained his own airway saturating 95%
- Two IV's delivered 1000ml NS, bulky dressings and pressure covered the wounds.
- Interosseous access was obtained to provide Plasma-Lyte solution via an inline warmer prior to extrication.
- The mower blade could not be disassembled and had to be withdrawn from the abdomen to allow transport.
- Prior to the removal, a low dose of fentanyl was administered to decrease pain without dropping the patient's pressure. Orders to initiate liquid never-frozen plasma were obtained.
- Patient was given bicarbonate and calcium gluconate for cardioprotection and protection from hypocalcemia from citrate binding in PRBC.
- After extrication, crews began infusion of O negative packed red blood cells. The patient remained alert and oriented throughout extrication with pressures remaining around 85/40.
- Patient was given 2g Cefazolin in-flight per mechanism of injury protocol.
- Consideration was given to additional transfusion and decided against to allow permissive hypotension. Despite the 1.5-hour time from arrival to transfer of care, this patient survived.

Differential Diagnoses / Problem List

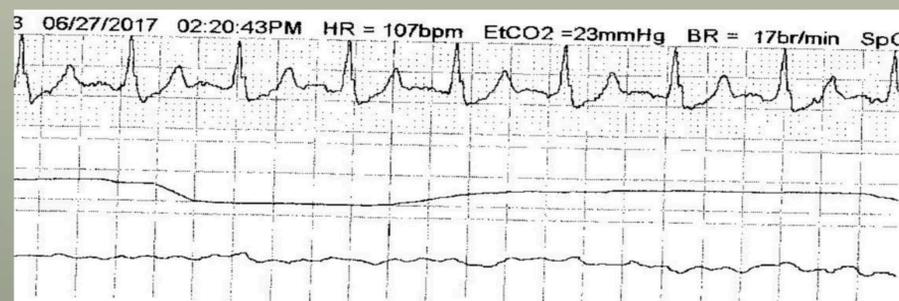
Severe / Emergent	Moderate / Urgent	Mild / Non-Emergent
Abdominal Impalement	Lower extremity crush injury	Acute Kidney Injury
Hemorrhage in abdomen uncontrolled	Rhabdomyolysis	Hypocalcemia
Hypovolemic Shock	Hyperkalemia	Wound Infection - consider Clostridium Perfringens given mechanism of injury
Metabolic Acidosis	Hypothermia	Prolonged limb ischemia



Trauma Resuscitation and Volume Repletion

- Consider Plasma-Lyte or Lactated Ringer's over NS when acid-base status is of concern
- As per protocols at Health Net Aeromedical, plasma and blood should be given simultaneously if possible through an inline warmer.
- If unable to establish two lines, plasma should be given first.

Figure 1: Below, ECG captured by flight crew



To Remove or Not to Remove

- The mower deck/blade assembly could not be removed by the fire department as it was a one piece unit.
- As such, in this case, removal of the blade was the only option to extricate the patient.
- The crew secured venous access with some volume repletion prior to attempting removal.

Key References

- Holcomb JB, Donathan DP, Cotton BA, et al. Prehospital transfusion of plasma and red blood cells in trauma patients. *Prehospital Emergency Care*. 2015;19(1):1-9.
- Borgman M, Spinella P, Perkins J, et al. The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital. *The Journal of Trauma: Injury, Infection, and Critical Care*. 2007;63(4):805-813.
- Glassberg E, Nadler R, Gendler S, et al. Freeze-dried plasma at the point of injury: From concept to doctrine. *Shock*. 2013;40(6):444-450.
- Matijevic N, Wang Y, Cotton BA, et al. Better hemostatic profiles of never-frozen liquid plasma compared with thawed fresh frozen plasma. *The journal of trauma and acute care surgery*. 2013;74(1):84.
- Mikhail J. The trauma triad of death: Hypothermia, acidosis, and coagulopathy. *AACN clinical issues*. 1999;10(1):85-94.
- Malinoski DJ, Slater MS, Mullins RJ. Crush injury and rhabdomyolysis. *Critical Care Clinics*. 2004;20(1):171-192.
- Young J, Utter G, Schermer C, et al. Saline versus plasma-lyte A in initial resuscitation of trauma patients: A randomized trial. *Annals of Surgery*. 2014;259(2):255-262.

Discussion

- With the use of prehospital plasma and blood, traumatic hemorrhage survival has become a reality¹. The transfusion of both blood and plasma was introduced and validated in the military setting and has become common in civilian medicine² resolving both volume and coagulopathy issues³.
- Liquid never-frozen plasma has better coagulation profile over a longer refrigerated life than thawed plasma⁴.
- Providing both O negative blood and never-frozen plasma through inline warmers helps combat the trauma triad of death; hypovolemia, hypothermia, and coagulopathy⁵
- Currently Health Net is one of few agencies in the country to carry these items on board. Given the rural setting in West Virginia, this patient likely would not have survived transport to a trauma center without transfusions.
- In this case, the flight crew decided to start an infusion of Plasma-Lyte, calcium gluconate and bicarbonate prior to any patient movement. This was due to concerns of volume status and the risk of cardiac arrest from rhabdomyolysis⁶. Plasma-Lyte has been shown to have less impact on acid-base status in trauma resuscitation when compared to normal saline⁷ and was thus less likely to further exacerbate disturbances.

Conclusion

Given the rural setting, it is likely this man would have expired had it not been for the availability of the blood products and plasma provided by this aeromedical flight crew. This case emphasizes trauma management in the rural setting and the importance of early transfusion to combat the trauma triad of death. The ability to provide liquid never-frozen plasma, plasma-Lyte and packed red cells via inline warmers helped stabilize this patient and ultimately save his life.