Analysis of Whole Blood Infusion During Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in a Swine Model of Hemorrhagic Shock

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Background

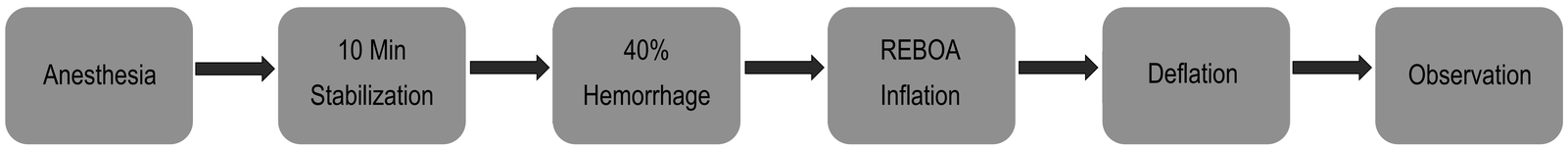
- Uncontrolled hemorrhage from noncompressible torso hemorrhage (NCTH) is a leading cause of potentially survivable deaths on the battlefield.
- The two interventions that have demonstrated significant potential for saving the lives of patients with NCTH and shock during the prehospital phase of care are whole blood resuscitation and Zone 1 Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA).
- Zone 1 REBOA in conjunction with damage control resuscitation may be an effective management. strategy in the prehospital or austere phase of care.

Objective

To determine if the volume of whole blood (WB) administered simultaneously during Zone 1 REBOA inflation, positively affects physiologic state before and after balloon deflation and improves survival in a swine model of hemorrhage.

Methods

- Eighteen male swine (*Sus scrofa*) weighing 70-90 Kg
- 40% controlled hemorrhage
- REBOA inflated 10 minutes post hemorrhage
- Randomized to zero, one or three units (500 mL each) of autologous WB 15 minutes after balloon inflation
- Balloon deflated after 30 minutes
- Normal saline administered (up to 3L) following deflation if MAP < 60 mmHg
- Subjects were observed for 120 minutes following balloon deflation or until death criteria was met
- Physiological parameters, blood gas analysis and chemistries were collected

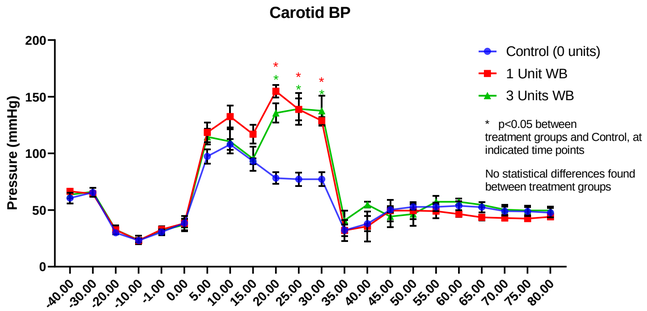


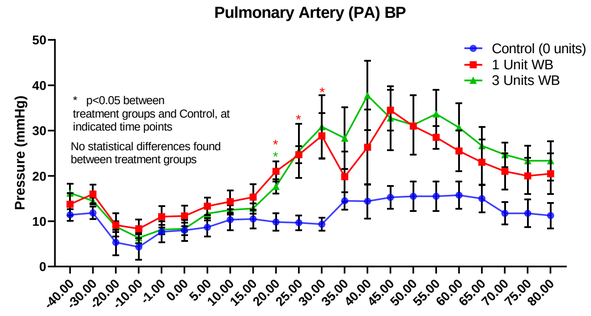
Results

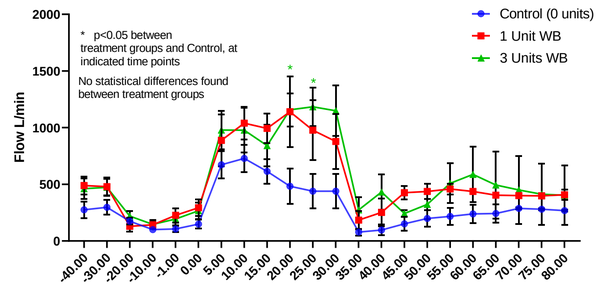
Survival, blood loss and time to death

Cohort	Control (Zero Units)	One unit WB	Three units WB
Survival (%)	66%	33%	50%
Blood Loss (%)	41.4%	37.9%	40.2%
Avg. time to death post deflation	83 min	45 min	65 min

Hemodynamic parameters







Graphs indicate carotid blood pressure (BP), pulmonary artery (PA) BP and carotid flow. Following blood infusion, both the group with one unit and the group with 3 units had significantly higher blood pressure ($p<0.01$), pulmonary artery pressure ($p < 0.01$), and carotid artery flow ($p < 0.01$) than the control group.

Limitations

- Animal model
- n= 18

Conclusions

No improvement in outcomes was observed with simultaneous administration of whole blood during Zone 1 REBOA. Moreover, elevated hemodynamic values may be unsafe, particularly if pulmonary or neural injury has occurred.

Acknowledgements

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The experiments reported herein were conducted according to the principles set fort in the National Institute of Health Publication No 80-23, Guide for the Care and Use of Laboratory Animals and the Animal Welfare Act of 1966, as amended.

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