Comparison of Different Resuscitation Fluids (Hydroxocobalamin vs. Whole Blood vs. Lactated Ringers) Over Time In Volume-Controlled And Uncontrolled Hemorrhage Models In Swine (*Sus scrofa*)

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Background

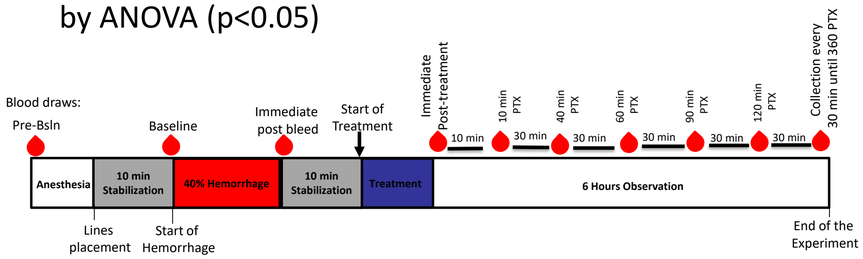
- Traumatic hemorrhage is the leading cause of preventable death in civilian and military environments
- Blood components are frequently unavailable in the prehospital setting due to increased costs and lack of resources, training and viable portable refrigeration
- Hydroxocobalamin (HOC), a synthetic form of vitamin B12, works as an antidote for cyanide toxicity and increases blood pressure via nitric oxide scavenging

Objectives

1. **Evaluate whether the administration of HOC following hemorrhagic shock can improve hemodynamic parameters**
2. **Determine whether those effects are comparable to whole blood (WB) and lactated ringers (LR)**

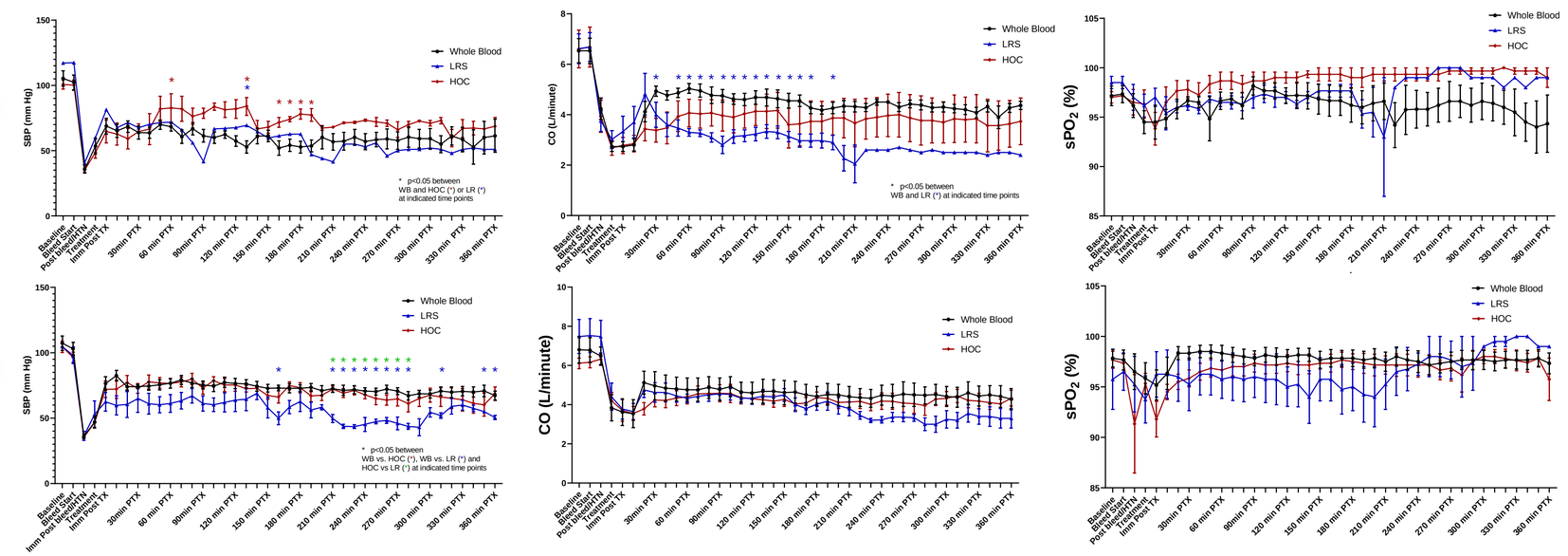
Methods

- Thirty-six swine (*Sus scrofa*) weighing 65kg – 85kg used in 40% total blood volume hemorrhage
  - 18 controlled hemorrhage (CH)
  - 18 uncontrolled hemorrhage (UH)
- Randomized treatment: 500mL WB, LR or HOC
- Animals were monitored for six hours after treatment
- Hemodynamic parameters, blood gas analysis and chemistries were collected throughout the duration of the experiment
- Data reported as ± SEM, statistical analysis performed by ANOVA ($p<0.05$)



Results

Hemodynamic parameters



Arterial Blood Gas analysis parameters

	Controlled Hemorrhage (CH)			Uncontrolled Hemorrhage (UH)		
Parameter	WB	LR	HOC	WB	LR	HOC
Lactate	4.9±0.4	4.3±0.6	4.2±0.2	2.1±0.1	4.9±0.4	3.9±0.2
K^+	5.2±0.2	4.9±0.2	5.1±0.1	4.4±0.1	5.3±0.3	4.7±0.1
O_2	100±1.4	103±3.2	112±1.4	108±1.1	98±2.2	102±1.4
CO_2	34±0.8	36±0.6	35±0.3	35±0.4	35±0.4	34±0.2
Ca^{2+}	1.18±0.02	1.23±0.01	1.27±0.01	1.2±0.01	1.2±0.01	1.2±0.01

- Swine averaged a blood loss of 41%±0.02 for CH vs. 33%±0.07 for UH
- During both uncontrolled hemorrhage (UH) and controlled hemorrhage (CH), HOC groups maintained a higher systolic blood pressure (SBP), cardiac output (CO), SPO_2 and vascular resistance (SVR) that was comparable to WB and above LR levels.

Conclusions

HOC administration resulted in improved hemodynamic parameters, and similar Ca^{2+} levels compared to LR and were equivalent to WB in both controlled and uncontrolled hemorrhage. HOC may be a viable alternative when WB is not available.

Limitations

- Animal model
- n=36

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