Prolonged Aortic Occlusion Worsens Neurologic Outcomes without Affecting Brain Lesion Size in a Swine Model of Traumatic Brain Injury and Hemorrhage

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Introduction

- Traumatic Brain Injury (TBI) and Hemorrhagic Shock (HS) are leading caused of death.¹
- Hemorrhage control= priority
- Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) catheters offer control of non-compressible torso hemorrhage, with significant ischemia consequences.
- P-REBOA developed to allow some distal blood flow \rightarrow toleration of prolong occlusion.^{2,3}
- Unclear is safe with concomitant TBI

Research Objectives

Determine the long-term, neurologic impact of prolonged partial occlusion in a clinically relevant model of TBI and vascular hemorrhage.⁴

Methods

- Yorkshire swine, 40-45kg (n=5/group), anesthetized and instrumented.
- Injury:8mm diameter controlled cortical impact (moderate TBI) and right common iliac artery injury
- Randomization:
 - P-REBOA group: 2 hours of p-REBOA deployment at D-SBP=40mmHg
 - Control group: Immediate repair and 2-hours of observation
- **Outcome:** Brain lesion size and daily Neurologic Severity Scores for 72 hours.



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Results



Figure 1: There is no difference in intracranial pressure (ICP) or hemodynamics between the groups. Animals in the p-REBOA group had a decrease in D-SBP which correlated to p-REBOA deployment.



Figure 2: There is no difference in brain lesion sizes, but animals in the p-REBOA group had worse neurologic function. On post operative day (POD) 3, animals were euthanized and brains harvested. A) Brain lesions sizes were similar between the groups (p=0.548). B) Animals in the p-REBOA group had higher NSS on POD 2 and 3 compared to controls (p=0.047 and p=0.006 respectively).

72h

	Time Point	Control (Median ± SD)	P-REBOA (Median ± SD)	p- value
	Lactic Acid (mEq/L)			
	Baseline	1.3 ± 0.31	1.70 ± 0.25	0.25
	Post Occlusion	0.7± 0.13	1.70 ± 1.70	0.011
	End	0.55 ± 0.26	1.0 ± 0.49	0.12
	POD 1	1 ± 0.21	0.9 ± 0.61	0.57
	POD 2	0.7 ± 0.37	1.4 ± 0.87	0.42
	POD 3	0.8 ± 0.15	1.35 ± 0.57	0.17
	AST (U/L)			
	Baseline	22 ± 5.36	26 ± 6.28	0.71
	Post Occlusion	21.5 ± 4.83	27 ± 15.0	0.20
	End	26.5 ± 3.86	27 ± 28.31	>0.99
	POD 1	112 ± 43.17	80 ± 155.51	0.56
	POD 2	39 ± 41.51	32 ± 83.35	0.13
)	POD 3	30 ± 15.97	24 ± 27.69	0.06
)	Creatinine (mEq/L)			
	Baseline	1.1 ± 0.21	1.10 ± 0.09	0.43
	Post Occlusion	1.15 ± 0.13	1.50 ± 0.35	0.23
	End	1.05 ± 0.24	1.40 ± 0.40	0.67
	POD 1	1.20 ± 0.16	1.10 ± 0.17	0.47
	POD 2	1.00 ± 0.12	1.10 ± 2.16	0.42
	POD 3	1.0 ± 0.17	1.20 ± 3.91	0.14

Figure 3: Key markers of ischemia-reperfusion were not significantly different between groups.

Conclusion

• Animals had higher post-operative neurologic severity following prolonged partial aortic occlusion, regardless of lesion size.

References

**, p=0.006

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