Hemodynamic responses to guideline compliant chest compressions during pseudo-electro mechanical dissociation in swine

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Purpose: We sought to compare the hemodynamics of standard chest compressions during pseudo-electro mechanical dissociation (P-EMD) with the hemodynamics of untreated P-EMD

METHODS

- 11 female swine ~30 kg
- Monitoring
 - Accelerometer
 - Pressures (Aortic and Right Atrial)
 - Flows (Carotid and Jugular)
 - Intra-Cranial Pressure
 - Cerebral NIRS
 - Transesophageal Ultrasound
- Reduce FiO2 to induce P-EMD (Systolic < 50 mmHg)
- Treat P-EMD with chest compressions or leave untreated for 45 second intervals
- Hemodynamics were averaged over each 45 second interval and compared using ANOVA.

Figure 1. Protocol Schematic showing P-EMD induction via hypoxia and delivery of chest compressions

RESULTS

Figure 2. Sample data showing FiO2, aortic pressure and right atrial pressure as a function of time

Table 1. Physiology of untreated P-EMD and P-EMD treated with CPR.

Measure	P-EMD	Std CPR
Mean AOP [mmHg]	28.4 ± 8.2	31.8 ± 7.8
Mean RAP [mmHg]	5.9 ± 2.4	27.4 ± 15.6
Mean CPP [mmHg]	7.9 ± 2.9	5.7 ± 3.0
Mean ICP [mmHg]	27.3 ± 7.9	26.0 ± 10.0
Mean EtCO2 [mmHg]	36.8 ± 5.5	35.4 ± 8.4
Mean Carotid Blood Flow [mL/min]	64.2 ± 54.9	95.0 ± 81.1
Mean Jugular Blood Flow [mL/min]	6.6 ± 10.2	32.1 ± 102.1
Mean Heart Rate [BPM]	83.0 ± 10.2	

Reported values are mean ± SD; Bold indicates ANOVA comparison $p > 0.5$

DISCUSSION

- Our hypoxia induced P-EMD model results in low blood pressures, but does not lead to bradycardia.
- Std CPR can improve and impair blood pressure during P-EMD, as shown in Figure 3.
- Std CPR did not change many aspects of P-EMD hemodynamics. Std CPR increased mean RAP, and increased mean jugular blood flow.
- It is not clear if Std CPR would be more beneficial during P-EMD with bradycardia.

Figure 3. Standard chest compressions can improve and impair the blood flow generated by the heart during P-EMD.

Conclusion: In these experiments, chest compressions did not result in a demonstrable improvement in the hemodynamic status of the animals during P-EMD. More research is required to understand if the hemodynamic benefit of chest compressions is dependent on heart rate during P-EMD.