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Comparison of an Endotracheal Cardiac Output Monitor to a Pulmonary Artery Catheter

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Background

In combat, initial resuscitation and life saving measures are initiated by securing a patent airway and administering fluid therapy. While methods of fluid resuscitation remain controversial, maintenance of a patent airway and hemodynamic stability as indicated by invasive monitoring can influence the overall outcome of an injured individual. A patent airway may be maintained via an endotracheal tube. The use of invasive monitoring, however, is complicated by several factors including the extent and type of injuries suffered by the patient. It is imperative for those wounded in battle that we explore potential technologies that can aid in the management of effective fluid resuscitation while considering the limitations presented by remote locations and limited resources.

Objective

The purpose of this study was to explore the accuracy and precision of a FDA approved device, the CONMED endotracheal cardiac output monitor (ECOM) ™ apparatus, by comparing it to the Edwards Vigilance II monitor (Edwards LifeSciences, Irvine, CA) pulmonary artery catheter (PAC) under hypothermic and hemorrhagic conditions.

Methods

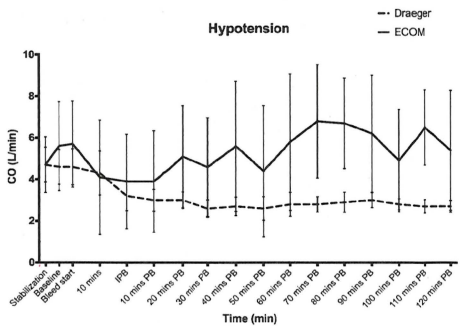
Power analysis (G*Power 3.1) suggested 8 animals would be sufficient for comparisons. After induction of anesthesia, instrumentation, and stabilization in experiment 1 (hemorrhage), animals were exsanguinated to produce Type III hemorrhagic conditions. Cardiac output (CO) values were collected from the PAC and the ECOM over a 3 hour period. In experiment 2 (hypothermia), swine were cooled to a temperature of 33°C using the Stryker Gaymar TP700 cooling device and CO values recorded from both instruments. The protocol was approved by the Wilford Hall Ambulatory Surgical Center's Institutional Animal Care and Use Committee (FWH 20140100A).

Results

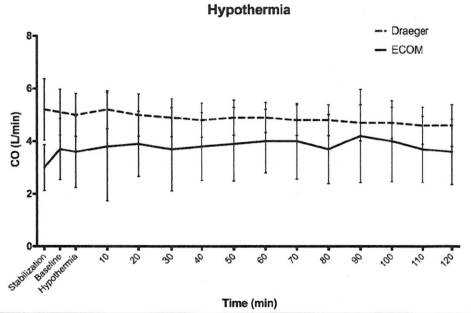
Using GraphPad Prism® to conduct non-linear fit analyses comparing the slopes of the curves for ECOM versus PAC, we found that the curves from the ECOM data were significantly different from the PAC data curves under both conditions, but more pronounced differences were found under hemorrhagic conditions.

Results Continued

Graph 1.



Graph 2.



Limitations

Animal model
Controlled hemorrhage model

Conclusions

Although the ECOM apparatus simplifies data acquisition while limiting potential complications associated with the PAC, the ECOM does not appear to reliably reproduce CO values acquired from a traditional PAC under hemorrhagic or hypothermic conditions.

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