COMPARING CONSERVATIVE, STANDARD, AND AGGRESSIVE CLOSED-LOOP FLUID RESUSCITATION: ROBUSTNESS AGAINST WEIGHT AND CARDIAC CONTRACTILITY VARIATIONS

Co-Authors: Christine Lee, BS, Maxime Cannesson, MD, PhD, Joseph Rinehart MD, UC Irvine, Department of Anesthesiology, Orange, United States

Background: In a recent study submitted for publication, closed-loop fluid management was tested *in silico* for stability and robustness against body weight and cardiac contractility. The results of this study showed that the closed-loop fluid administration system LIR™ was in fact highly accurate at resuscitation and that LIR™ was both stable and robust against differences in body weight and contractility. In this study, we compared the performance of conservative and aggressive LIR™ fluid management against the confounders of body size, starting volume status, and cardiac contractility using a control engineering methodology to represent varying physician fluid management preferences.

Methods: Using a simulator and independently-developed hemodynamic simulation model, we ran 500 monte-carlo simulations for each of 3 fluid management strategies by the controller: conservative, standard, and aggressive. Two phases were run: variation in starting blood volume and body weight (Phase 1), and then variation in starting blood volume, weight, and cardiac contractility (Phase 2). The performance of the controller in resuscitating to the target optimal blood and stroke volumes was evaluated in terms of ml of error from optimal.

Results: The Phase 1 mean blood volume errors from optimal for conservative, standard, and aggressive fluid management were -731 ± 342 mL, -192 ± 60 mL, and 278 ± 204 mL, respectively (Figure 1). The Phase 2 mean blood volume errors from optimal for conservative and aggressive fluid management were -482 ± 384 for conservative treatment and 161 ± 282 for aggressive treatment.

Conclusion: The results indicate that LIR™ is capable of stable and robust conservative and aggressive fluid management against starting blood volume, body weight, and contractility.

Figure'1.'Phase'1'Blood'Volume'Results'

Figure 1. Phase 1 Blood Volume Results