Goal-Directed Fluid Optimization Based on Respiratory Variations in the Pulse Oximeter Plethysmographic Waveform during Moderate Risk Surgery

Thuraisingham D.A., Williams W., Ramsingh D., Le K., Lee C.K., Canales C., Cannesson M.

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Background

Respiratory variation in the pulse oximeter waveform is a reliable predictor of fluid responsiveness and is related to the position of the heart on the Frank Starling Relationship(1). Goal-directed intra-operative fluid administration based on the respiratory variation in the pulse oximeter waveform has been shown to be feasible and to decrease postoperative lactate levels in high-risk surgery patients(2). However, most high-risk surgery patients are equipped with an arterial line and this non invasive index is most likely to have clinical applications in moderate-risk surgery patients. The goal of this randomized controlled study was to test the hypothesis that goal directed fluid optimization based on the respiratory variation in the plethysmographic waveform can decrease the incidence of postoperative complications (assessed using the POMS score(3)) compared to a control group.

Methods

Patients were randomized to control group (C) or to Goal Directed Fluid Optimization group (GDFO) by computer generated random numbers. A third group, the retrospective group (R) was included in the study for historical data analysis and comparison of outcome. The R group consisted of patients matched for similar moderate risk surgery. Respiratory variation in the plethysmographic waveform was monitored using the PVI (Masimo Corp., Irvine, CA) and was recorded in the C and GDFO groups. In the C group the anesthesiologist in charge was blinded for the PVI value. Both group received a baseline infusion of cristalloids of 5ml/kg/hr. In the C group, the anesthesiologist in charge of the patient could give fluid based on his or her medical decision. In the GDFO group, the anesthesiologist was aksed to maintain PVI under 15 % by using iterative colloid (Voluven, Fresenius Kabi, Germany) boluses of 200 ml over 15 minutes.

Results

Patient recruitment was as follow: 27 in the GDFO group, 32 in the C group, and 50 in the R group. erage length of stay in the hospital was 4.6 ± 0.6 in the R group, 2.8 ± 0.1 in the control group, and 2.3 ± 0.5 in the GDFO group ($p < 0.05$). The POMS score on post operative day 3 was 1 in the R group, 0.333 in the control group, and 0.333 in the GDFO group ($p < 0.05$). The POMS score on post operative day 5 was 0.5 in the retrospective group, 0.5 in the control group, and 0 in the GDFO group. The POMS score on post operative day 8 was 0.833 in the retrospective group, 3 in the control group and 0 in the GDFO group. No patients in any of the three groups remained as inpatients on post operative day 15.

Conclusions

Goal-directed fluid optimization based on respiratory variation in the pulse oximeter waveform is feasible, may help to standardize intraoperative fluid management, and may result in reduced post-operative morbidity as reflected by the decreased POMS score. Intra-operative fluid optimization and achievement of intra-operative euvolemia results in a faster recovery time and shorter hospital stay.

References

1. Desebbe O et al. Curr Opin Anaesthesiol. 2008 2. Forget P et al. Anesth Analg. 2010 3. Bennett-Guerrero E et al. Anesth Analg. 1999

Figure 1

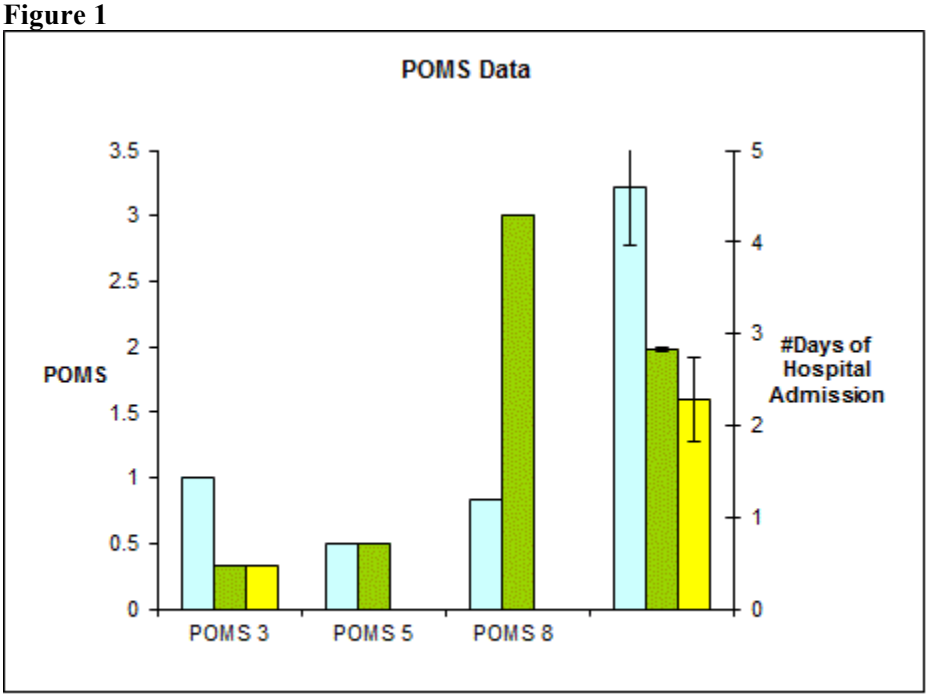

Figure 2

	Retrospective Group (50 patients)		Control Group (32 patients)		GDFO Group (27 patients)	
	AVG	STDERR	AVG	STDERR	AVG	STDERR
total crystalloid	**8.847**	0.785100401	9.21383	1.032051358	6.074448	0.449573055
total colloid	**0.377**	0.14835549	0	0	1.7	0.281148003
Urine Output	**379.9**	50.02348296	311.406	44.67243818	349.3103	92.10480889
EBL	**120.9**	24.8571266	125.844	39.42704853	65.5862	14.60729938
# Days of Hospital Admission	**4.6**	0.640790328	2.82977	0.020514985	2.28088	0.459853489