Assessment of Postoperative Outcomes in Relation to Pleth Variability Index (PVI) Based Goal-Directed Therapy

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Background: By looking at parameters of continuous blood flow rather than static indicators, one can optimize hemodynamics through goal-directed fluid management. Flow-related indices and measures of fluid responsiveness such as stroke volume (SV), cardiac output (CO) and pleth variability index (PVI) are utilized to more accurately predict volume status and allow physicians to identify the position of the heart on the Frank Starling curve. Studies have shown that goal-directed therapy using these dynamic indicators has been able to reduce complications post-surgery, length of hospital stays and mortality rates. The aim of this study was to evaluate whether optimization using the FDA approved Masimo PVI measurement could decrease postoperative morbidity and length of hospital stay in moderate-risk surgery patients.

Methods: Patients undergoing low- to moderate-risk surgeries were recruited, consented and randomized using computer generated random numbers into one of two groups: control and Goal Directed Fluid Optimization Group (GDFO). Intraoperative data was collected as well as postoperative data such as duration of hospital stay and postoperative complications, focusing on postoperative days 3, 5, 8 and 15. PVI was recorded over the whole surgical procedure for both groups using the Masimo Rainbow platform. Both groups received standard patient care with a baseline crystalloid infusion of 5 mL/kg/hr of body weight. In the control group, the anesthesiologist was blinded to the PVI value and fluid administration provided at the provider's discretion. In the GDFO group, the anesthesiologist was able to view the PVI value and aimed to maintain PVI below 15% by administering 200 ml of colloid boluses over 15 minutes. Postoperative complications were assessed using the postoperative morbidity survey (POMS).

Results: A total of 178 patients were recruited in the control group and 165 patients were recruited in the GDFO group. Postoperative complications occurred in 46 control patients and 42 GDFO patients. POMS scores were analyzed for each patient on postoperative days 3 and 5. Days 8 and 15 were excluded from analysis due to insufficient patient data. A Chi-squared test showed no significant difference between scores in the two groups (p=0.257 for POMS day 3 and p=0.220 for POMS day 5). The median length of stay was 2 days for the control group and 2 days for the GDFO group. All the results are reported in Table 1.

Discussion: The results of this study show that PVI-based goal-directed therapy (GDT) may not be as effective for low- to moderate-risk elective surgeries in improving patient outcomes. However, since UCI Medical Center has been implementing OR-wide GDT since 2011, "standard" fluid administration practices may have shifted towards GDT (learning bias). Although there was no significant difference in POMS scores found using PVI, it continues to serve as a non-invasive and continuous monitor of fluid responsiveness. A possible future study may focus on assessing the effect of PVI-based GDT on major elective surgeries.

References:

1. Forget P et al, Anesth Analg 2010

2. Gan TJ et al, Anesthesiology 2002

Figure 1

Table 1. Data analysis results

	Control (n=178)	GDFO (n=165)	*p*-value
Duration of Surgery (h)	3.3±1.7	3.4±2.0	0.54
EBL (ml)	87±151	76±106	0.5
Total crystalloid (ml)	1781±1099	1515±1025	0.05
Total colloid (ml)	54±215	367±367	4.3E-15
Length of stay in hospital (days)	2 [0.91-3.28]	1.98 [0.98-3.89]	0.25
POMS 3 day	1 [0-1]	1 [0-2]	0.26
POMS 5 day	1 [1-1]	1 [0-2]	0.22

Data are presented as mean ± SD or as median [IQR]