Feasibility of Goal-Directed Fluid Management Based on Monitoring of Pleth Variability Index (PVI)

Cecilia Canales, M.P.H., Christine Lee, B.S., Khanh-Van Le, B.A., Cris R. Hanacek, Student, Natalia Newcomb, B.A., Catherine Nguyen, Student, Amy Le, Student, Robert S. Boud, Student, Joseph Rinehart, M.D., Maxime Cannesson, M.D.,Ph.D. UC Irvine, Irvine, California, United States. *Proceeding of the Society for Technology in Anesthesia Annual Meeting*, 2013: A2211.

Introduction

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 decrease postoperative lactate levels in high-risk surgery patients[2]. However, recent studies are questioning the ability of respiratory variations in the pulse oximeter waveform to reliably track fluid responsiveness during high-risk surgery. The aim of this study was to evaluate whether goal directed fluid optimization based on the respiratory variation in the plethysmographic waveform, can be used reliably intra-operatively in patients undergoing moderate-risk surgery.

Methods

After IRB approval and written consent, subjects were randomized to either the control group (C) or the Goal Directed Fluid Optimization group (GDFO) by computer generated random numbers. A third group retrospective group (R) was included in the study for historical data analysis. Respiratory variation in the plethysmographic waveform was monitored using the Pleth Variability Index (PVI) (Masimo Corp., Irvine, CA) and was recorded in the C and GDFO groups. In the C group the anesthesiologist in charge was blinded to the PVI value. Both groups received a baseline infusion of crystalloids 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 based on standard operating room hemodynamic monitors. In the GDFO group, the anesthesiologist was asked to maintain a strict protocol of PVI under 15 % by using iterative colloid boluses of 200 ml over 15 minutes (Figure 1). Data are presented as median [interquartile range]. Statistical analysis was performed with SPSS 20.

Results

Ninety-five subjects were randomized into the C group, eighty-nine into the GDFO group and fifty subjects were included in the R group. In the GDFO group, there was a median of 74 [15-100] percent compliance to the protocol. The Median length of surgery was 3.2 [2.3-4.8] hours in the C group, 2.9 [2.1-4.8] hours in the GDFO group, and 2.8 [2.0-4.5] in the R group. Subjects in the C group received a median 0 [0-0] mL of total colloids and 1810 [1236-2797] mL of total crystalloids (7.33 [5.7-11.1] cc/kg/hr), while the GDFO group received 400[0-550] mL of total colloids (1.26 [0-2.7] cc/kg/hr) and 1186[831-2000] mL of total crystalloids (5.9[4.6-7.9] cc/kg/hr). In the R group, subjects received a median of 1500 [1000-2950] ml of total crystalloid (7.9 [5.2-10.9] cc/kg/hr). The R group did not receive any colloids.

Conclusions

Goal-directed fluid optimization based on respiratory variation in the pulse oximeter waveform is feasible, and may help to standardize intraoperative fluid management as demonstrated by the wider range of crystalloid administration in the C and R groups. Compliance to the goal directed fluid therapy protocol indicated that clinicians were able to easily apply the protocol. Intra-operative fluid administration had greater variation in the control group, where the treating physician was blinded to the PVI value and made determination of fluid status using standard ASA monitors. Future studies should focus on whether tighter control of fluid administration and specifically a goal directed fluid therapy in moderate risk patients improves postoperative outcomes.

References

1. Desebbe O et al. Curr Opin Anaesthesiol. 2008

2. Forget P et al. Anesth Analg. 2010

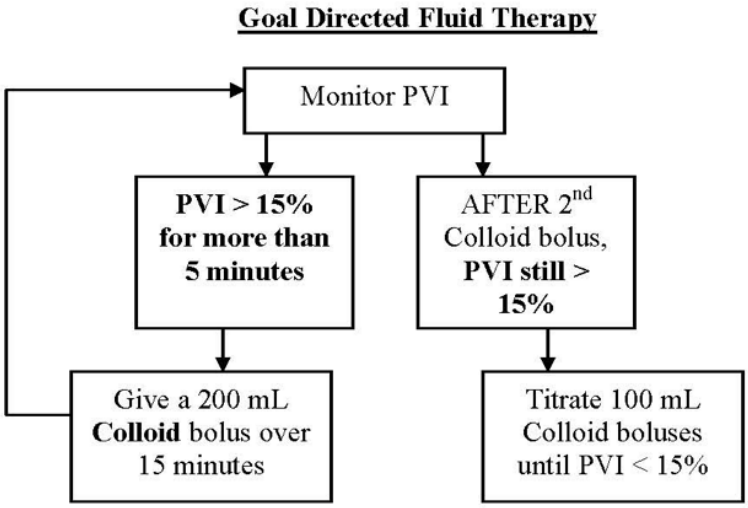

Figure 1