

Continuous Noninvasive Hemoglobin Monitoring for Jehovah's Witness Patients Undergoing Intraoperative Autologous Normovolemic Hemodilution

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Introduction

Intraoperative autologous normovolemic hemodilution (IAHD) is a useful method of blood conservation when patients or their physicians wish to avoid allogeneic blood transfusion,¹ and can be just as effective as preoperative autologous blood donation.² When Jehovah's Witness patients undergo surgical procedures associated with significant blood loss, this method of blood conservation, when used along with other accepted methods, can be very helpful in achieving this goal. We describe the use of noninvasive continuous hemoglobin (Hb) monitoring to guide the process of IAHD, which eliminates the wait time associated with conventional intraoperative laboratory sampling. We also assessed the plethysmography variability index (PVI) as a measure of intravascular volume during IAHD.

Methods

After IRB approval, six Jehovah's Witness patients scheduled for major abdominal or orthopedic surgery underwent IAHD with 3-4 units of blood phlebotomized into CPDA-anticoagulant bags at the beginning of surgery. Phenylephrine was used to support the arterial blood pressure during phlebotomy. 500 mL of hydroxyethyl starch solution and 2 liters of normal saline were given after phlebotomy for hemodilution. At the end of the blood loss phase of surgery, the autologous blood was re-infused. Continuous non-invasive Hb (SpHb) and PVI monitoring were done using a pulse co-oximeter (Masimo®, Irvine, CA). PVI is expressed as the percent change in amplitude of the pulse wave form during one respiratory cycle. These measurements plus laboratory Hb measurements were made at the following intervals: 1 (before incision), 2 (after phlebotomy), 3 (after hemodilution), 4 (after the surgical bleeding), and 5 (after blood re-infusion). Data are given as mean \pm SD.

Results

The SpHb and PVI data are shown in the figure. Mean Hb concentration measured in the laboratory (g/dL) at the 5 specified times were: 1) 12.3 ± 1.4 , 2) 11.6 ± 1.6 , 3) 9.8 ± 0.8 , 4) 9.3 ± 0.7 , and 5) 10.1 ± 0.7 . Mean estimated blood loss was 550 ± 200 mls.

Conclusions

Noninvasive continuous Hb monitoring was useful during IAHD by eliminating the delay in intraoperative decision making that occurs when Hb measurements are obtained by conventional laboratory testing. The PVI was a useful index of intravascular volume during the significant fluid shifts that occur with IAHD, with increased PVI indicating hypovolemia and a decreased PVI indicating adequate fluid resuscitation during hemodilution and blood re-infusion. IAHD along with other accepted methods of blood conservation may help to avoid allogeneic blood transfusion, and the use of continuous noninvasive Hb and PVI monitoring may improve the efficacy and safety of this technique.

References

1. Jarnagin WR et al: Ann Surg 248: 360-9, 2008 2. Goodnough LT et al: Transfusion 40:1054-7, 2000.

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