

## Evaluation of the Masimo<sup>®</sup> Rainbow SET Radical-7 in a 6-month-old pediatric multivisceral organ transplant

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### Abbreviations

g/dl	Grams per deciliter
Hb	Hemoglobin
PICU	Pediatric Intensive Care Unit
PVI	Pleth Variability Index
SpHb	Total hemoglobin
tHb	Intraoperative hemoglobin lab measurements from blood gas analysis

To the Editor:

We report a 6-month-old boy with gastroschisis and intestinal failure who underwent a liver, small bowel, and pancreas transplant. The patient was placed under general anesthesia with endotracheal intubation (sevoflurane, fentanyl, and rocuronium were given as inhalational anesthetics, analgesics, and muscle relaxants, respectively) and a Masimo Rainbow SET Radical-7 ReSposable Pulse CO-Oximeter Sensor (Model R2-20a and R2-20r) was placed on the right thumb. The patient was stable throughout the procedure; however, upon returning to the Pediatric Intensive Care Unit (PICU), the patient was noted

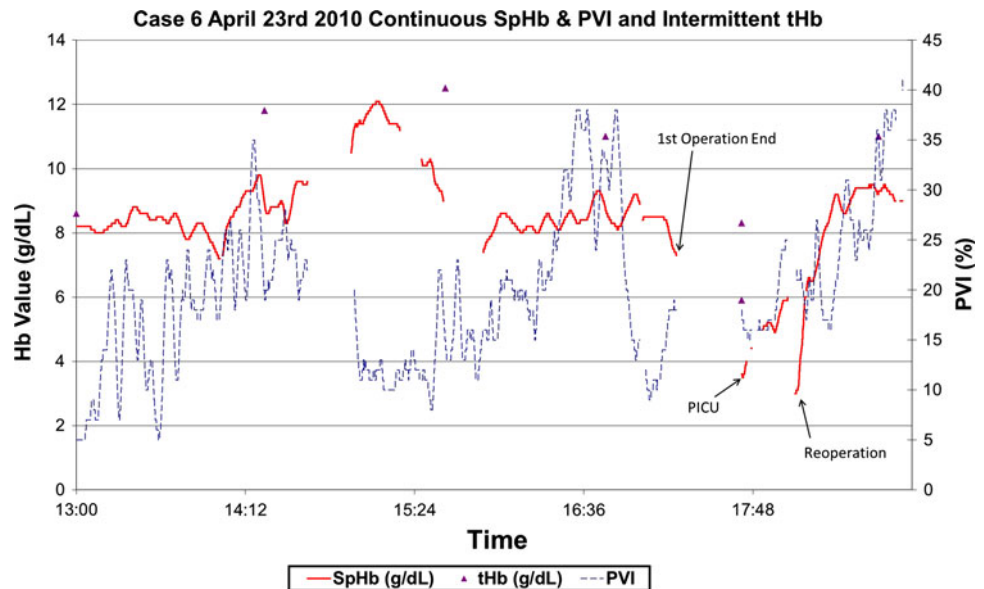
to be hypotensive and tachycardic with low hemoglobin levels during the postoperative period. The patient was returned to the operating room where small bleeding vessels in the area of the pancreas were found and ligated, with subsequent stabilization of the patient's vital signs. More than 150 ml blood was evacuated; however, no major bleeding sites were visible. The patient did have a number of small areas that required hemostasis and new suture placements. A total of 25 units of red blood cells (PRBCs) were given to the patient throughout the case, 19 of which were given during the reexploration (after timestamp 17:48). Blood product was given under the circumstances in which the SpHb was outside the mean targeting range of 8–12 g/dl [1]. Rising PVI is visible at timestamp(s) 14:12 in which the patient exhibited mild hypovolemia and 16:36 where the organs were dissected, removed, and the new organs perfused with blood product (Fig. 1). At both of these points, blood product was given to the PVI increase, which also resulted in an increase in Hb levels.

During multivisceral organ transplantation and isolated small bowel transplantation, patients often suffer large volume loss and expansion, wide fluctuations in red cell volume, and dilutional coagulopathy. Aggressive transfusion of blood products and isotonic fluids can lead to fluid overload, tissue and pulmonary edema, and inadequate perfusion, but failure to maintain intravascular volume can lead to hypotension and inadequate perfusion. The Pleth Variability Index (PVI) from the Masimo Rainbow SET Radical-7 gives us a noninvasive blood constituent monitoring platform that allows for the measurement of multiple blood constituents, fluid responsiveness, respiration rate, and other physiological parameters which previously required invasive blood sampling and time-consuming laboratory analysis [2]. A rising PVI may indicate developing hypovolemia, and a falling PVI post fluid

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**Fig. 1** Real-time total hemoglobin (*SpHb*), Pleth Variability Index (*PVI*), and total hemoglobin (*tHb*) data indicating the close relationship between the *PVI* and hemoglobin and the accurate tracking of the *SpHb* to the blood gas analysis (*tHb*)



resuscitation is evidence of an appropriate fluid responsiveness, an important measure in the critical care/OR environment.

The Masimo Rainbow Set accurately measures transcutaneous hemoglobin measurements, which corresponded directly to the laboratory hemoglobin measurements. Side-by-side comparisons of the simultaneous measurements (*tHb* and *SpHb*) reveal hemoglobin accuracy within 1 g/dl of laboratory values, of which four were within less than 0.6 g/dl Hb value. There is no doubt that the Masimo Rainbow SET Radical-7 has the ability to perform well under physiologically unstable conditions; however, long wait-times for sensor calibration and recalibration are observed fairly frequently [3]. This method of continuous noninvasive hemoglobin monitoring can provide us with a valuable guidance to assessing blood loss and the need for transfusion therapy during surgery.

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**Conflict of interest** None.

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