COMPARISON OF TWO MIXED-VENOUS SATURATION CATHETERS IN CRITICALLY ILL PATIENTS

K. Reinhart, M.D., N. Moser, T. Rudolph, H.-J. Gramm, M.D., J. Goecke, M.D., K. Eyrich, M.D.

Department of Anesthesiology, Klinikum Steglitz, Freie Universität, Berlin, Germany

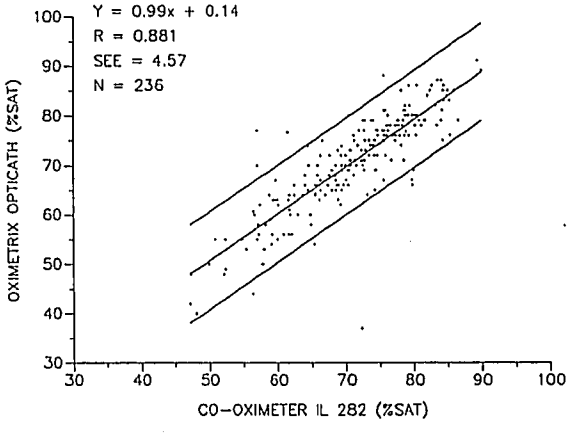
Introduction. Two different devices and catheters are now available for continuous mixed-venous O_2-saturation ($S\bar{v}O_2$) monitoring by reflectance oximetry. Three different wavelengths are employed with Shaw Opticath PA catheters (Oxi)(Oximetrix Corp., Mountain View, CA), whereas the Swan-Ganz oximetry TD system (Edw)(American Edwards Corp., Santa Anna, CA) utilizes only 2 wavelengths. In an animal study where abrupt physiological changes were provoked, a significantly better correlation with the reference Co-oximeter was shown for the Oximetrix product. It was concluded that "the magnitude of the error measured in the Edwards catheters is sufficiently large to be clinically important" (1). We investigated the accuracy and quality of both systems during long-term use under clinical conditions.

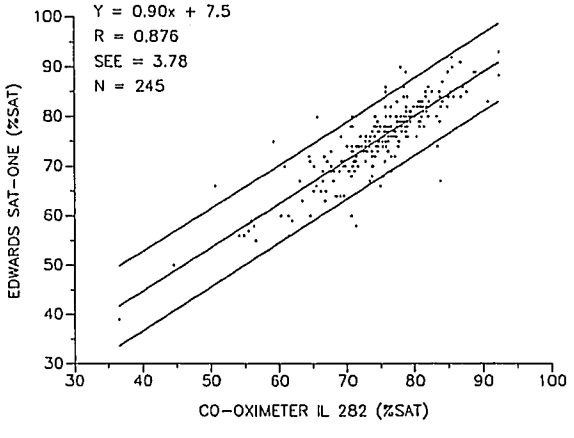
Material and Methods. In a prospective randomized study, 59 critically ill patients requiring invasive cardiovascular monitoring with pulmonary arterial catheters received either an Oximetrix Opticath (n=38) or an Edwards Oximetry TD catheter (n=37) with their informed consent and approval by the Research Committee. Before the catheters were floated into correct position, in-vitro calibration was done according to the manufacturer's instructions. After placement of the catheters and every 12 hours, the current hemoglobin was updated on the American Edwards monitor, and hemodynamic measurements, including arterial and mixed-venous blood samples, were performed. The blood samples were drawn anaerobically and analyzed immediately with an IL 282 Co-oximeter. The Co-oximeter was calibrated daily against known standards. In-vivo recalibration was done if the difference between in-vivo and in-vitro saturation was greater than 3%. Correlation coefficients between in-vivo and in-vitro $S\bar{v}O_2$ were calculated with the values obtained before in-vivo recalibration. Statistical analyses included correlation coefficients for the regression lines between in-vivo reflectance oximeters and the in-vitro Co-oximeter.

Results. Within both study groups, hemodynamics varied over a wide range. The cardiac index in the Oxi group ranged from 1.3 to 10.3 l/min/m² and in the Edw group from 0.9 to 12.6 l/min/m². Oxygen consumption ranged from 45 to 304 ml/min/m² and from 66 to 425 ml/min/m² respectively. Ten Oxi and 5 Edw catheters had to be replaced due to defects. The reasons were balloon ruptures in 5 of the Edw and 5 of the Oxi catheters. In the latter product, there were also leakages in the venous line (n=4) and one thermistor defect.

The figures show regression lines, correlation coefficients (R), standard error of the estimate (SEE) and 95 percentile confidence intervals of the two different catheters vs. the IL Co-oximeter respectively. Deviations from in-vitro $S\bar{v}O_2$ greater than ±5% existed in 48 controls (19%) with the Oxi catheter compared to 33 (13.4%) with the Edw catheter.

Discussion. In-vivo determination of $S\bar{v}O_2$ by both devices correlated well with the Co-oximeter. Deviations of more than 5% from in-vitro controls in 15.4% and 19% of controls for both catheters are a warning against fully relying upon the absolute values of in-vivo measured $S\bar{v}O_2$. This also holds true for the Oximetrix Opticath. Our clinical experience has shown that the advantage of these monitor systems lies in their ability to indicate trends and abrupt changes of the oxygen supply-to-demand ratio immediately at the bedside. In-vitro controls are advisable every 8 to 12 hours for both products.





Reference.
1. Gettinger A, De Traglia MC, Glass DD: Accuracy of two mixed-venous saturation catheters. Anesthesiology 65: A145, 1986.