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Title : ACCURACY OF MEASURED VS. DERIVED $S\bar{v}O_2$

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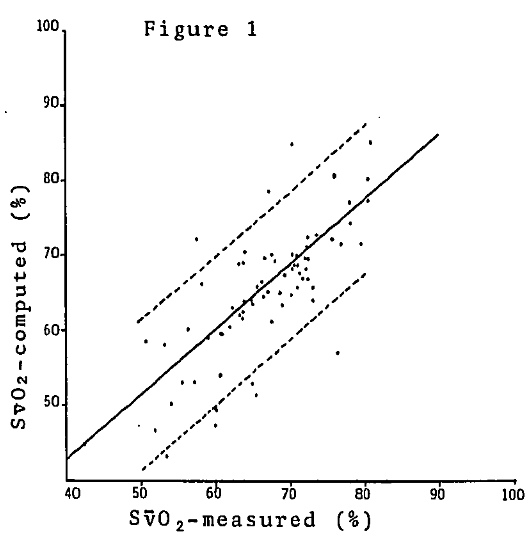
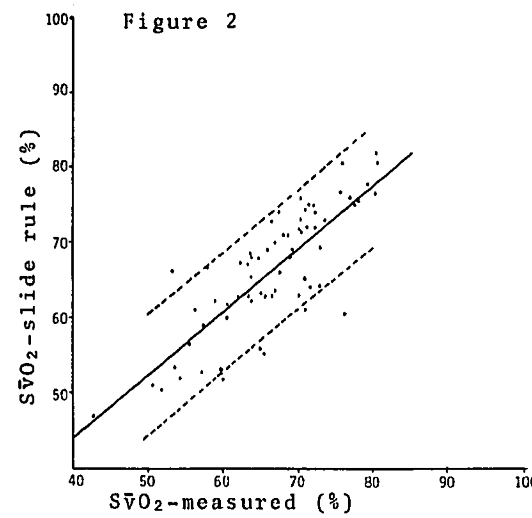
Introduction. Mixed venous O_2 saturation ($S\bar{v}O_2$) is used to calculate venous O_2 content ($C\bar{v}O_2$), which is then used to calculate the arterial content to $C\bar{v}O_2$ difference ($C\{a-\bar{v}DO_2\}$), and the pulmonary venous admixture (Qva/Qt). Mixed venous O_2 tension ($P\bar{v}O_2$) measurements are often used to calculate $S\bar{v}O_2$ from formulas, nomograms, or slide rules. The purpose of this study was to assess the accuracy of derived values for $S\bar{v}O_2$ compared to measured $S\bar{v}O_2$, and to evaluate the effect of any discrepancy on subsequent calculations.

Methods. Sixty-nine clinically indicated pulmonary artery blood samples were drawn from 19 ICU patients (maximum of 5 drawn from any one patient). Patient temperature, arterial and venous PO_2, PCO_2, pH, corrected for patient temperature, and hemoglobin, SaO_2, and $S\bar{v}O_2$ (IL-282 Co-Oximeter) were recorded. $S\bar{v}O_2$ was then derived from $P\bar{v}O_2$ using a digital computer subroutine[1] and a standard slide rule[2]. Measured and derived $S\bar{v}O_2$ values were compared. This study was approved by the institution's Research Committee.

Results. Mean measured $S\bar{v}O_2$ was 66.6% ±7.9% (range 42.5% - 81%). The mean $S\bar{v}O_2$ derived from the computer program was 65.3% ±9.0% (range 43.5% - 85.5%); from the slide rule 66.5%±8.1% (range 47% - 82%).

Figure 1 represents the relationship between measured $S\bar{v}O_2$ and the $S\bar{v}O_2$ derived from the computer program, and Figure 2, the measured $S\bar{v}O_2$ and that derived from the slide rule. The solid line on each graph is the line of regression, and the dotted lines bracket the 90% confidence line.





The regression equation for Figure 1 is: $S\bar{v}O_2$-computed = .87 x $S\bar{v}O_2$-measured + 7.37, sy·x = 5.83, r = .763 ($p < .0005$). For Figure 2: $S\bar{v}O_2$ slide rule = .84 x $S\bar{v}O_2$-measured + 10.39, sy·x = 4.70, r = .891 ($p < .0005$).

Derived $S\bar{v}O_2$ was used to recalculate $C(a-\bar{v}DO_2)$ and Qva/Qt for ten data sets, chosen to span the observed Qva/Qt range. Recalculated $C(a-\bar{v}DO_2)$ varied from "true" $C(a-\bar{v}DO_2)$ (mean 4.1ccO_2/dl) by o.81 using $S\bar{v}O_2$-computed and by 0.89 using $S\bar{v}O_2$-slide rule. Recalculated Qva/Qt differed from the "true" Qva/Qt (mean .25) by .04 using $S\bar{v}O_2$-computed, and by .05 using $S\bar{v}O_2$-slide rule.

Discussion. Using derived $S\bar{v}O_2$ from the extremes of the 90% confidence interval could result in an error in $C(a-\bar{v}DO_2)$ of as much as 1.9 ccO_2/dl (65%), and an error in Qva/Qt of as much as .11 (36%). The above data support our recommendation that accurate evaluation of hemodynamic and pulmonary status of the critically ill patient requires direct measurement of the $S\bar{v}O_2$.

References

1. Kelman, GR: Digital Computer Subroutine for the Conversion of Oxygen Tension into Saturation. J Appl Physiol 21: 1375-1376, 66.

2. Severinghaus, JW: Blood Gas Calculator. J Appl Physiol 21: 1108-1116, 66.