Accuracy of Continuous and Noninvasive Total Hemoglobin Measurement Using Multi-wavelength Pulse-Oximetry in ICU Patients.

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Background

Recently a new technology of noninvasive and continuous hemoglobin measurement based on pulse oximetry (SpHb) was introduced by Masimo Corp. In critically ill patients dysfunction of peripheral perfusion is common, but data regarding measurement precision under these conditions are lacking. We therefore studied the accuracy of SpHb on 71 ICU patients using Masimo Radical-7.

Methods

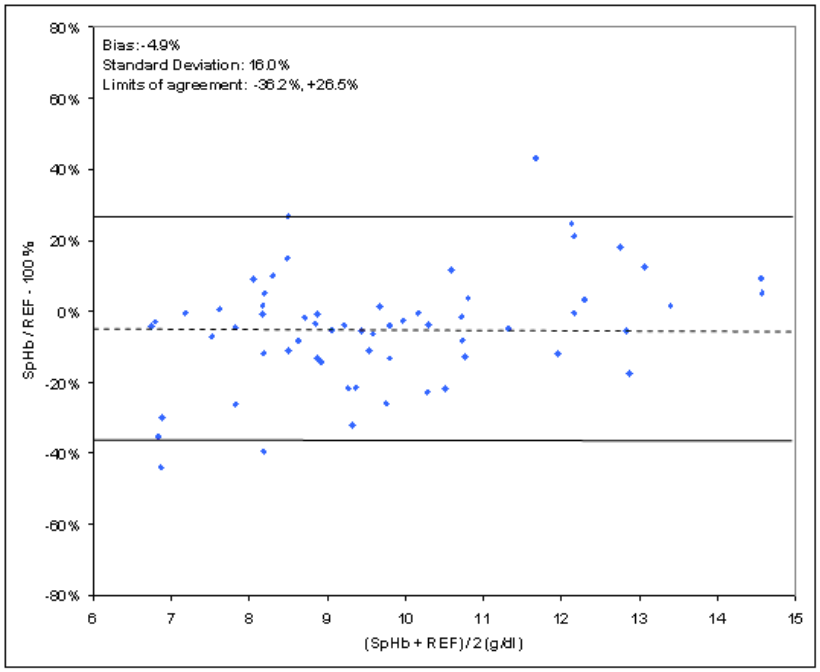
After Institutional review board approval data were collected from patients of an operative ICU. We predefined subgroups according to ACCP/SCCM consensus definitions: No SIRS, SIRS, sepsis, severe sepsis, septic shock (n=5 (7%),28 (39.5%),11 (15.5%),12 (17%),15 (21%)). SpHb and perfusion index (PI; shown by Masimo Radical-7) were measured at 3 times (first value, after 5, 10 min). For reference, we measured hemoglobin in arterial blood (REF) by a lab method (Sysmex XE 5000). Bland-Altman analysis was performed for SpHb vs. REF. Influence of predefined subgroups, PI and APACHE II on SpHb-precision was assessed by linear regression analysis.

Results

Compared to reference method, SpHb showed a systematic hemoglobin underestimation of 4.9%. Limits of agreement (mean +/- 1.96 SD) were -36% to +26% (Fig. 1). Compared to previous studies in non-ICU patients deviation is more pronounced. In 9 patients (12.7%) no SpHb was detected, all showing a perfusion index of ≤ 0.5. Furthermore SpHb precision was independent from predefined subgroups and APACHE II score.

Conclusion

In ICU patients with a wide range of inflammatory states, SpHb-monitoring showed an acceptable accuracy compared to a lab reference method. However, when making transfusion decisions based on SpHb, intensivists should be aware of limitations in precision.


Bias:-4.9%
Standard Deviation: 16.0%
Limits of agreement: -36.2%, +26.5%
80%
60%
40%
20%
0%
-20%
-40%
-60%
-80%
SpHb / REF - 100%
6
7
8
9
10
11
12
13
14
15
(SpHb + REF)/2 (g/dl)

[Figure 1