New Generation and Old Generation Pulse Oximeters in Children with Cyanotic Congenital Heart Disease.

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Background

Pulse oximetry is a standard monitoring for patients in the operating room and in the intensive care unit (ICU) for children and adults. However, most of the pulse oximeters fails to provide accurate measurements in patients with low saturation (SaO2 < 90 %) and/or low peripheral perfusion. In the palliative pediatric cardiac surgery setting, several pathologies induce low peripheral perfusion and cyanosis in the postoperative period. In this setting, arterial oxygen saturation (SaO2) monitoring using pulse oximeter (SpO2) is of major importance. New generation pulse oximeters are supposed to be more accurate in case of low saturation and less sensitive to motion artifact and low peripheral perfusion. The aim of our study was to compare the accuracy of an old generation pulse oximeter (Nellcor N-395, Tyco Healthcare) and of a new generation pulse oximeter (Masimo Blue Sensor, Masimo Corp.) in the postoperative period following palliative pediatric cardiac surgery in children with cyanotic disease.

Methods

We studied 10 children (age 7 days to 53 months, weight 2.9 to 9.8 kgs, height 48 to 86 cm) in the postoperative period following palliative cardiac surgery (3 Norwood procedures for hypoplasic left heart syndrome, 7 cavopulmonary connections). SpO2 were obtained from Masimo Blue Sensor (SpO2ng) and from Nellcor N-395 sensor (SpO2og). Both sensors were located at the same site (finger). At the same time, SaO2 of arterial blood sample was obtained from an intra-arterial catheter located in the radial artery, at the same side than the oximeters. Measurements were performed every 4 hours until discharge from the intensive care unit. Bias and precision between SpO2 and SaO2 were determined using Bland and Altman analysis. A Student t-test was used to compare bias.

Results

We obtained 136 SaO2 determinations. Mean Sa02 was 76 ± 15 % (range from 31% to 100%). Mean SpO2ag (80 ± 9 %) was significantly different from mean SaO2 and from Mean SpO2ng (75 ± 16) whereas no difference was observed between SaO2 and SpO2ng (see Table). In 20 (15 %) cases, SpO2og was not available whereas SpO2ng was available in 136 (100%) cases. In the remaining 116 cases, mean bias for SpO2ng was significantly lower than mean bias for SpO2ag (-0.2 ± 3.6 vs -1.8 ± 6.7; $p<0.05$).

Mean value and Bias of SpO2 old and new generation compared to SaO2

	SpO2og	SpO2ng	SaO2
Mean ± SD	80 ± 9∗†	75 ± 16	76 ± 15
Bias ± SD	-1.8 ± 6.7∗	-0.2 ± 3.6	-

SpO2og: SpO2 old generation, SpO2ng: SpO2 new generation, ∗$p<0.05$ compared to SpO2ng, †$p<0.05$ compared to SaO2

Conclusion

New generation pulse oximeters provide more accurate information and are more reliable than old generation pulse oximeters in the postoperative period following palliative pediatric cardiac surgery for cyanotic congenital heart disease.