

Brief Reports

Usefulness of Oxygen Saturation (SpO₂) Monitoring in Sick Preterm Neonates

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Continuous and precise monitoring of arterial oxygen is important in the management of critically ill patients(1-3). Pulse oximetry has gained widespread use in neonatal oxygen monitoring, but several questions have emerged regarding the accuracy and reliability of pulse oximetry in neonatal oxygen monitoring. There is conventional belief that hyperoxemia is difficult to pick up with pulse oximeter. SpO₂ limits have been mentioned variously as 87-93%, 90-95% and 93-97% by different groups(4). We planned this study to: (a) find out the correlation between PaO₂ and SpO₂ in sick preterm infants, if any; and (b) determine the safe SpO₂ limits for sick preterm babies.

Subjects and Methods

Two hundred and thirty two arterial

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blood gas estimations from 20 sick preterm infants were done while these were on continuous SpO₂ monitor. At the time of study, each infant was judged to be physiologically stable based on the evidence of normal temperature, pulse rate, blood pressure, hematocrit, urine flow rate and skin perfusion (capillary refill after gentle pressure). None of these babies had received adult blood transfusion; 17 of these subjects were being ventilated whereas others were receiving augmented oxygen through the head box. Statistical analysis was done using chi-square test.

Results

Two hundred and thirty two arterial blood gas estimations were obtained from 20 preterm infants with mean birth weight 1499±344g and gestation 31.8±1.7 weeks. There was poor correlation between PaO₂ and SpO₂(r=0.4670) (Fig. 1).

At 87-93% saturation, 78.6% had normoxemia, 20% had hypoxemia and 1.4% had hyperoxemia. Between 90-95% saturation, 85.9% had normoxemia, 8.3% hypoxemia and 5.8% hyperoxemia and between 93-97% saturation, 70.3% had normoxemia, 4.5% had hypoxemia and

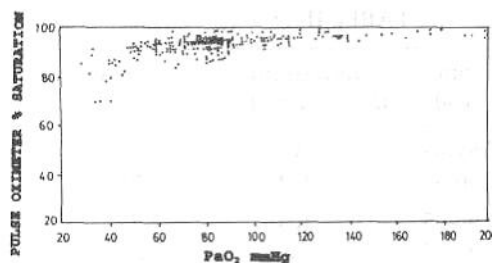


Fig. 1. Comparison of data points-pulse oxygen saturation with PaO₂ in sick preterm infants.

25.2% hyperoxemia. Hypoxemia was significantly more with oxygen saturation of 87-93%, compared to 90-95% ($p < 0.05$) and 93-97% ($p < 0.01$) saturation (Table I). Babies were significantly hyperoxemic in 93-97% saturation compared to 90-95% ($p < 0.001$) and 87-93% saturation ($p < 0.005$) (Table II).

Discussion

The good linear relationship between simultaneous *in vivo* pulse oximetry and *in vitro* measurement demonstrates the reliability of pulse oximeter in infants and children with cardiorespiratory problem. A major goal of continuous O₂ monitoring is to limit the number of episodes of hypoxemia and hyperoxemia that would otherwise go undetected. To avoid hypoxemia and hyperoxemia, Wilkinson and co-workers recommended that the goal for SpO₂ in newborn infants should be approximately 90% (5). In our study, we noted a poor correlation between PaO₂ and SpO₂ ($r=0.4670$)

in sick but apparently stable preterm infants on the both ends of saturation spectrum possibly due to the clinical condition of the baby associated with rapid fluctuations in vital parameters. While evaluating various saturation limits, hypoxemia was found more frequently with SpO₂ of 87-93% ($p < 0.005$) thus suggesting SpO₂ limits of 90-95% to be better in sick preterm neonates. However, 14% babies could still be hypoxemic or hyperoxemic thereby indicating the need for individualizing the SpO₂ levels for better monitoring.

In summary, though pulse oximetry provides simple continuous assessment of oxygenation in neonates, SpO₂ values must always be corroborated with PaO₂ frequently. The SpO₂ limits 90-95% seem to predict maximum chances of normoxemia in sick preterm babies. Periodic arterial blood gas estimations are essential in sick preterm babies, particularly when they receive augmented oxygen.

TABLE I—Detection of Hypoxemia.

SpO ₂ (%)	Normoxemia (51-100 mm Hg)	Hypoxemia (<50 mm Hg)	p value
87-93	55	14	<0.05
90-95	104	10	
90-95	104	10	>0.05
93-97	78	5	
87-93	55	14	<0.01
93-97	78	5	

TABLE II—Detection of Hyperoxemia.

SpO ₂ (%)	Normoxemia (51-100 mm Hg)	Hyperoxemia (>100 mm Hg)	p value
87-93	55	1	<0.3
90-95	104	7	
90-95	104	7	<0.001
93-97	78	28	
87-93	55	1	<0.005
93-97	78	28	

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