



# Oxygen Saturation and Heart Rate Ranges in Very Preterm Infants Requiring Respiratory Support at Birth

Emily Phillipos<sup>1</sup>, Anne Lee Solevåg, MD, PhD<sup>1,2,3</sup>, Khalid Aziz, MBBS<sup>1,2</sup>, Sylvia van Os, RRT<sup>1</sup>, Gerhard Pichler, MD<sup>1,4</sup>, Megan O'Reilly, PhD<sup>1,5</sup>, Po-Yin Cheung, MBBS, PhD<sup>1,2</sup>, and Georg M. Schmölzer, MD, PhD<sup>1,2,3</sup>

**Objective** To evaluate the changes in preductal oxygen saturation (SpO<sub>2</sub>) and heart rate in preterm infants receiving continuous positive airway pressure (CPAP) and/or positive-pressure ventilation (PPV) at birth.

**Study design** A prospective observational study at birth of infants aged <32 weeks separated into 2 gestational age (GA) groups: 23<sup>0/7</sup>-27<sup>6/7</sup> weeks (group 1) and 28<sup>0/7</sup>-31<sup>6/7</sup> weeks (group 2). Infants received delayed cord clamping (DCC) in accordance with institutional protocol. CPAP and/or PPV was applied at the clinical team's discretion. SpO<sub>2</sub> and heart rate were recorded every minute for 10 minutes. Preductal SpO<sub>2</sub> was targeted according to published nomograms. For heart rate, the goal was to maintain a stable heart rate >100 bpm.

**Results** The study cohort comprised 96 group 1 infants (mean GA, 26 ± 1 weeks; mean birth weight, 818 ± 208 g) and 173 group 2 infants (mean GA, 30 ± 1 weeks; mean birth weight, 1438 ± 374 g). In general, infants requiring respiratory support reached target values for heart rate and SpO<sub>2</sub> more slowly than the published nomograms for spontaneously breathing preterm infants without respiratory support. Infants receiving CPAP reached SpO<sub>2</sub> and heart rate targets faster than infants receiving PPV. In group 1, but not group 2 infants, DCC resulted in higher SpO<sub>2</sub> and heart rate.

**Conclusion** SpO<sub>2</sub> and heart rate do not quickly and reliably reach the values achieved by spontaneously breathing preterm infants not requiring respiratory support. (*J Pediatr* 2017;182:41-6).

Clinical signs (eg, tone, heart rate, breathing) are used to guide delivery room resuscitation interventions.<sup>1</sup> Although some healthy, spontaneously breathing term infants immediately after birth may have a heart rate <100 bpm, bradycardia might pose a threat to preterm infants.<sup>2</sup> Guidelines recommend that if heart rate is <100 bpm or the infant is apneic at 1 minute after birth, positive-pressure ventilation (PPV) should be initiated.<sup>1</sup> Once the infant breathes spontaneously, PPV should be stopped and the infant supported with continuous positive airway pressure (CPAP).<sup>1</sup> During mask PPV and CPAP, the fraction of inspired oxygen (FiO<sub>2</sub>) should be adjusted to target a predefined preductal oxygen saturation (SpO<sub>2</sub>) range.<sup>1</sup>

The currently used SpO<sub>2</sub> target range is based on data from healthy term and late-preterm infants<sup>3,4</sup>; data have not been collected from nonvigorous infants born at gestational age (GA) <32 weeks requiring medical intervention. Using the SpO<sub>2</sub> target ranges for more mature or vigorous infants might expose smaller and sicker infants to hypoxia or hyperoxia.<sup>5</sup> The current Neonatal Resuscitation Program (NRP) guidelines recommend initiating resuscitation with a low oxygen concentration (21%-30%) in preterm infants and adjusting FiO<sub>2</sub> to achieve SpO<sub>2</sub> target values.<sup>1</sup> The most appropriate time-specific SpO<sub>2</sub> targets for premature newborns have not been defined, however.

We hypothesized that infants born at GA <32 weeks will have lower SpO<sub>2</sub> values than the current target range proposed by current international neonatal resuscitation guidelines or the NRP.<sup>6</sup> The aim of this study was to assess SpO<sub>2</sub> changes in the first 10 minutes after birth in infants born at GA <32 weeks receiving CPAP and/or PPV relative to published nomograms and recommendations. A secondary aim was to assess whether delayed cord clamping (DCC) influences SpO<sub>2</sub> and/or heart rate in these infants.

CPAP	Continuous positive airway pressure
DCC	Delayed cord clamping
ECC	Early cord clamping
ECG	Electrocardiography
FiO <sub>2</sub>	Fraction of inspired oxygen
GA	Gestational age
ICC	Immediate cord clamping
NRP	Neonatal Resuscitation Program
PPV	Positive-pressure ventilation
SpO <sub>2</sub>	Oxygen saturation

From the <sup>1</sup>Centre for the Studies of Asphyxia and Resuscitation, Royal Alexandra Hospital, Edmonton, Alberta, Canada; <sup>2</sup>Department of Pediatrics, University of Alberta, Edmonton, Alberta, Canada; <sup>3</sup>Department of Pediatric and Adolescent Medicine, Akershus University Hospital, Lørenskog, Norway; <sup>4</sup>Department of Pediatrics, Medical University Graz, Graz, Austria; and <sup>5</sup>Department of Physiology, University of Alberta, Edmonton, Alberta, Canada

A.S. and P.C. are supported by the Canadian Institutes of Health Research (MOP-CIA-299111). A.S. is supported by the South-Eastern Norway Regional Health Authority. M.O. is supported by a Fellowship of the Molly Towell Perinatal Research Foundation. G.S. is supported by the Heart and Stroke Foundation/University of Alberta Professorship of Neonatal Resuscitation and a Heart and Stroke Scholarship. The authors declare no conflicts of interest.

0022-3476/\$ - see front matter. © 2016 Elsevier Inc. All rights reserved.

<http://dx.doi.org/10.1016/j.jpeds.2016.11.014>

## Methods

This observational study was carried out at the Royal Alexandra Hospital, Edmonton, a tertiary perinatal center admitting approximately 360 infants born at <32 weeks to the neonatal nursery annually. The Research Committee and Health Ethics Research Board, University of Alberta (Pro00034524), approved the study. Between June 2013 and August 2014, 270 deliveries of infants at GA <32 weeks were attended by the research team, when available, in addition to the resuscitation-stabilization-triage team usually consisting of a neonatal nurse, neonatal respiratory therapist, neonatal nurse practitioner, and neonatal fellow and/or consultant neonatologist. The research team was not involved in the clinical care of the infants.

The Health Ethics Research Board of the University of Alberta granted deferred consent, because basic monitoring of SpO<sub>2</sub> and heart rate are routinely used in the hospital's delivery room. The study was therefore classified as "minimal risk". Written consent was sought from the parents of the infants as soon as possible after the birth so acquired data could be utilized for research.

Inclusion criteria were inborn infants of GA 23<sup>0/7</sup>-31<sup>6/7</sup> weeks, requiring breathing support in the first minutes after birth, and availability of the research team. Infants were excluded for any congenital abnormality or condition that might have an adverse effect on breathing or ventilation, such as congenital diaphragmatic hernia or congenital heart disease requiring intervention in the neonatal period. Infants were also excluded if parental consent could not be obtained.

A timer was started when the infant was born. Pulse oximetry and electrocardiography (ECG) were initiated as soon as the infant was put on the resuscitation bed. All resuscitative measures were at the discretion of the clinical team, following the 2010 NRP guidelines.<sup>6</sup> In accordance with institutional protocol, infants received DCC for 60 seconds unless deemed inappropriate by the obstetric team (for, eg, lack of vigor, apnea, bradycardia).<sup>7</sup> Resuscitation was started with air in infants of GA ≥29 weeks and with 30% oxygen in infants of GA <29 weeks. Respiratory support was provided using an appropriate-sized round silicone facemask (Fisher & Paykel Healthcare, Auckland, New Zealand or Laerdal Inc, Stavanger, Norway<sup>8</sup>) and a T-piece device (Giraffe Warmer; GE Health Care, Burnaby, Canada). The default settings were a gas flow of 8 L/min, peak inflation pressure of 24 cm H<sub>2</sub>O, and positive end-expiratory pressure of 6 cm H<sub>2</sub>O. Staff were trained to use the T-piece and were familiar with both facemasks. According to the NRP recommendations,<sup>9</sup> the goal was to achieve a preductal SpO<sub>2</sub> of 60%-65% at 1 minute, 65%-70% at 2 minutes, 70%-75% at 3 minutes, 75%-80% at 4 minutes, 80%-85% at 5 minutes, and 85%-95% at 10 minutes, as well as a stable heart rate >100 bpm. If required, the clinical staff changed the FiO<sub>2</sub> by 10% every minute.<sup>10</sup>

A Masimo Radical pulse oximeter probe (Masimo Corp, Irvine, California) was placed around the infant's right hand or wrist to measure preductal SpO<sub>2</sub> with maximum sensitivity and a 2-second averaging time once the infant was placed

on the resuscitation table. Heart rate was measured using 3 Micro-Premie ECG leads simultaneously with pulse oximetry (Vermed, Bellows Falls, Vermont). SpO<sub>2</sub> and heart rate were displayed continuously on an IntelliVue MP50 monitor (Philips Healthcare, Markham, Canada) and stored in a multichannel system (Alpha Trace Medical Systems, Vienna, Austria) for subsequent analysis.

Demographic data were recorded, and the infants were divided into groups according to the World Health Organization classification scheme<sup>11</sup> as extremely preterm, 23<sup>0/7</sup>-27<sup>6/7</sup> weeks GA (group 1) and very preterm, 28<sup>0/7</sup>-31<sup>6/7</sup> weeks GA (group 2). Each group was subdivided by cord clamping technique: immediate cord clamping (ICC), defined as <10 seconds after birth; early cord clamping (ECC), defined as clamping at >10 seconds and <60 seconds (representing intent for DCC that was ended by the obstetric team due to the infant being nonvigorous, apneic, or bradycardic); or DCC, defined as clamping at ≥60 seconds. We also analyzed infants by the receipt of CPAP or PPV. Infants who received PPV during stabilization remained in the PPV group for analysis even in cases where they were transitioned to CPAP. SpO<sub>2</sub> and heart rate data were extracted every minute for the first 10 minutes after birth, and graphs were created comparing the effects of GA, respiratory intervention, and cord clamping groups with the published reference ranges. We chose the heart rate range from Dawson et al because there are no NRP standards for rise in heart rate.<sup>12</sup> The NRP recommends starting PPV only if heart rate is <100 bpm and starting chest compression if heart rate remains <60 bpm despite adequate ventilation. Comparisons have not been made based on birth weight or mode of delivery.

The data are presented as mean ± SD for normally distributed continuous variables and as median (IQR) when the distribution is skewed. Statistical analyses were performed with Stata (Intercooled 10; StataCorp, College Station, Texas). The study is reported according to the STROBE guidelines.<sup>13</sup>

## Results

Infant demographic data are presented in **Table I**, and route of cord clamping and resuscitation are specified in **Table II**. The 270 infants included 97 in group 1 and 173 in group 2.

**Table I. Demographic data**

Characteristics	Group 1 (23 <sup>0/7</sup> -27 <sup>6/7</sup> wk); n = 97	Group 2 (28 <sup>0/7</sup> -31 <sup>6/7</sup> wk); n = 173
GA, wk, mean ± SD	26 ± 1	30 ± 1
Birth weight, g, mean ± SD	818 ± 208	1438 ± 374
Antenatal steroid use, n (%)	87 (84)	163 (94)
Female sex, n (%)	41 (42)	99 (58)
Twins, n (%)	21 (22)	68 (39)
Cesarean delivery, n (%)	64 (66)	128 (74)
Apgar score at 1 min, median (IQR)	4 (2-5)	5 (4-8)
Apgar score at 5 min, median (IQR)	7 (6-8)	7 (6-9)

Download English Version:

<https://daneshyari.com/en/article/5719650>

Download Persian Version:

<https://daneshyari.com/article/5719650>

[Daneshyari.com](https://daneshyari.com)