

The Effect of Postnatal Lying Position on Cerebral Oxygenation in Newborns

Ethical Approval:

The study was approved by the Clinical Research Ethics Committee of Dr Behçet Uz Pediatrics and Surgery Training and Research Hospital (2018/193) and all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/ or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Parents were informed of the study prior to birth and written consent was obtained from those who were willing to participate.

MATERIALS AND METHODS

This was a prospective, randomized, observational study performed in 2 months in the Delivery Room of the Department of Obstetrics and Gynecology by the Newborn Department where approximately 3,500 infants are delivered annually. Stabilization followed the NRP guidelines and is implemented by a neonatology fellow and three pediatric assistants with NRP certificates. Single, term, appropriate for gestational age (AGA) babies who did not need resuscitation and babies in whom skin-to-skin contact cannot be applied were included in the study. Vaginal births were not included, only babies born with cesarean section (CS) and could not be exposed to early skin-to-skin contact were included.

Spinal anesthesia was used for the mothers for CS, mother was not given oxygen therapy until the baby came out. Parents were informed of the study prior to birth and written consent was obtained from those who were willing to participate. The babies were randomized by opening of envelopes containing positional codes and were placed supine, on the right or left side, or prone (15/group).

1. Infant positioning:

When the baby was born, first care was done under the radiant heater. Infants with a need for positive pressure ventilation were excluded; all were placed supine.

2. Medical records and vital parameters:

All evaluations commenced 30 s after delivery and terminated at 10 min. For each infant, the 1st and 5th min Apgar scores were calculated by the same person, and the heart rate (HR), pulse oximetry, and perfusion index (PI) were recorded at 2nd, 5th, and 10th min using a Masimo Radical-7 pulse co-oximetry with an adhesive sensor. The probe was placed preductally (on the right wrist) and then connected to the oximetry. The fraction of inspired oxygen (FiO₂) was only 0.21 ("room-air") during all the stabilization period. In line with the NRP 2015 guideline,

aspiration was not routinely performed in the delivery room; the number of times that touch stimulation was required and the tactile stimulus time were recorded. Although electrocardiography (ECG) recommended in the latest guidelines and reads heart rate much faster, pulse oximetry had to be used in our study because the relationship between position and saturation and cerebral oximetry was evaluated.

3.Cerebral oxygenation:

Near-infrared spectroscopy (NIRS), which measures tissue oxygenation noninvasively, was used to evaluate cerebral oxygenation; the mean values at 5th and 10th min were recorded using a Covidien INVOS 5100C instrument. The cerebral regional cerebral oxygen saturation (rScO₂) is the ratio of cerebral oxygenated hemoglobin (CHbO₂) to the total oxygen bound to cerebral hemoglobin (CHb) and CHbO₂ ($rScO_2 = CHbO_2 / (CHb + CHbO_2)$) ⁽¹⁾. The rScO₂ is the mean oxygen saturation of cerebral arterial, venule, and capillary blood; the venule data is predominate ⁽²⁾. Infrared light reveals the extent of saturation of the so-called watershed zone (a mixture of 33% arterial and 67% venous blood at a depth of 1-1,5 cm) ⁽³⁾. The NIRS probe was placed on both sides of the frontal lobe; the probe was cleaned before placement. The first measured value served as the basal value; rScO₂ changes were then recorded at 2-s intervals to 60 s and the mean calculated. The cerebral rScO₂ is normally 50-80, but may vary by 10-20% at any time ⁽⁴⁾. A decrease >20% for patients with a basal cerebral rScO₂ value >50 and a decrease >15% for those with a basal cerebral rScO₂ <50 indicate cerebral ischemia ⁽⁵⁾. Data were captured at 0.1 Hz and collected for 10 min, after application in each position consequently. Cerebral fractional oxygen extraction (cFOE) was calculated for 5th and 10th min average as $((SpO_2 - rScO_2) / SpO_2)$ (SpO₂: pulse oximetry oxygen saturation) for each position, which reflects the balance between oxygen delivery and consumption in the tissue ⁽⁶⁾.

An infant/pediatric sensor (Covidien INVOS 5100C) costs between \$110 and \$140 each. No outside funding was used for the budget in this study. Within the budget and time period, the maximum number of patients enrolled in the study.

4.Sample Size:

In the investigators' center, monthly birth rate is 300 and since our hospital is the largest perinatology center in our region; the number of births with maternal and neonatal problems is high. When the investigators evaluated our records for the number of infants who were born > 37 GA with CS under spinal anesthesia and did not require any resuscitation efforts; the number was approximately 15 per month. (P=0.05) with a 2-sided a error of 5% and power of 80%, a total sample size of 37 total was required.

references:

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Statistical Analyses:

SPSS 25.0 (IBM Corporation, Armonk, New York, United States) and PAST 3 (Hammer, Ø., Harper, D.A.T., Ryan, P.D. 2001. Paleontological statistics) programs were used in the analysis of the variables. The conformity of univariate data to normal distribution was evaluated with the Shapiro-Wilk test, while homogeneity of variance was evaluated with the Levene test. Mardia for the conformity of multivariate data to normal distribution; while the (Dornik and Hansen omnibus) test was used, the Box-M test was used for variance homogeneity. In the comparison of more than two groups according to quantitative data, Fisher's Least Significant Difference (LSD) tests were used for One-Way Anova post hoc analysis, one of the parametric methods, Kruskal-Wallis H Test, which is one of the nonparametric tests, was used with the results of Monte Carlo simulation technique, and Dunn's Test was used for Post Hoc analyses. The Paired-Samples T test was tested using Bootstrap results, while the Wilcoxon Signed Ranks Test was tested using the monte carlo simulation method to compare two replicate measurements of dependent quantitative variables with each other. While Friedman's Two-Way test was tested using the monte carlo simulation method to test the variables with more than two repeated measurements and to examine the interaction according to the groups, the General Linear Model-Repeated Anova test from parametric methods was used, and the LSD test was used for Post Hoc analyses. In the comparison of categorical variables with each other, Fisher-Freeman-Holton test was tested with Monte Carlo Simulation technique. While quantitative variables were expressed as mean (standard deviation) and Median (Percentile 25 / Percentile 75) in the tables, categorical variables were shown as n (%). The variables were analyzed at 95% confidence level, and a p value less than 0.05 was considered significant.