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STUDY OF PRE-DUCTAL AND POST-DUCTAL OXYGEN SATURATION LEVELS DURING FIRST 15 MINUTES OF LIFE IN HEALTHY TERM NEONATES

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ABSTRACT

Background: Healthy term neonates undergo rapid cardiopulmonary transition after birth, during which oxygen saturation (SpO_2) rises from low fetal levels. Understanding normal pre-ductal and post-ductal SpO_2 trends in the first minutes of life is essential to guide safe oxygen use and resuscitation. **Objectives:** To evaluate pre-ductal and post-ductal SpO_2 patterns during the first 15 minutes of life in healthy term neonates, compare values by mode of delivery, and determine time to achieve $SpO_2 \geq 90\%$. **Methodology:** This single-centre, hospital-based observational study enrolled 110 healthy term neonates (≥37 weeks, birth weight >2.5 kg, APGAR ≥7 at 1 and 5 minutes) delivered vaginally or by LSCS. SpO_2 was recorded using a pulse oximeter on the right hand (pre-ductal) and left foot (post-ductal) at 1–15 minutes. Data were analysed with t-tests and chi-square tests ($p<0.05$). **Results:** Most mothers were 21–30 years, and over half of neonates were male; 80.9% weighed 2.5–2.99 kg and 52.8% were delivered by LSCS. Immediately after birth, mean pre-ductal and post-ductal SpO_2 were 62±3.1% and 58±2% ($p<0.001$), with consistently higher pre-ductal values at 5, 10 and 15 minutes (all $p<0.001$). By 10 minutes, mean pre-ductal and post-ductal SpO_2 reached 92.7±2% and 88.3±2.4%, increasing to 96.8±2.4% and 95±2.9% at 15 minutes. Overall, 88.2% did not require supplemental oxygen. Time to $SpO_2 \geq 90\%$ was significantly shorter pre-ductally than post-ductally (492±35 vs. 631±99 seconds; $p<0.0001$). Vaginally delivered neonates achieved ≥90% saturation faster than LSCS births at both sites ($p<0.0001$), though mode of delivery was not associated with oxygen requirement ($p=0.876$). **Conclusion:** Healthy term neonates show initially lower post-ductal than pre-ductal SpO_2, with gradual convergence by 15 minutes and minimal need for supplemental oxygen. These findings support cautious oxygen use and interpretation of lower early saturation as a physiological transitional phenomenon.

KEYWORDS : Pre-Ductal Oxygen Saturation; Post-Ductal Oxygen Saturation; Term Neonate; Mode of Delivery; Pulse Oximetry

INTRODUCTION

A newborn experiences significant physiological changes as it moves from the intrauterine to the extra-uterine environment.[1] Placenta's role and function ceases once umbilical cord is clamped and cut, marking the beginning of the transitional period from fetus to newborn. In this time, saturation of oxygen (SpO_2) levels rise gradually, initiating from lesser intrapartum levels of about 30-40%.[2] The primary objectives of oxygen therapy for newborns are to deliver enough oxygen to the tissues to prevent anaerobic metabolism and support optimal somatic and brain growth.[3] Adequate oxygen must also be provided to prevent hypoxic pulmonary vasoconstriction, while minimizing the harmful effects of excess oxygen.[4]

Further prolonged exposure to elevated oxygen quantitatively in neonates consequences to various complications, including periventricular leukomalacia, bronchopulmonary dysplasia (BPD), retinopathy of prematurity (ROP), cerebral palsy, and necrotizing enterocolitis (NEC).[5] A small vessel that bridges the fetal pulmonary artery and the aorta is ductus arteriosus. This connection enables oxygen rich blood from the placenta to surpass the lungs, delivering oxygen- and nutrient-rich blood directly into the system and circulation. Pre-ductal and post-ductal saturations refer to the artery oxygen saturation levels in vessels that arise from the aorta, located before and after the ductal opening in the aorta, respectively.[6]

Pulse oximetry is commonly utilized in intensive care set up for pediatrics and neonates, with few pediatricians now viewing it as an essential vital sign. [7] However, before making any changes to the current guidelines on oxygen use during resuscitation, it is crucial to gather data on the typical oxygen saturation levels in healthy newborns.[8] Newer oximeters, such as those featuring Masimo's signal extraction technology, offer better detection of signal and minimize false readings in difficult conditions, providing more reliable SpO2 measurements in newborns. In earlier research on preductal and postductal SpO_2 measurements, pulse oximetry has typically been performed on the right hand (preductal) and one foot (postductal). The left hand has often been excluded due to uncertainty about whether the ductus arteriosus affects its arterial blood flow.[9]

The focus of this study is utilization of pulse oximetry to determine whether oxygen saturation readings from the left hand differ significantly from those derived from the right hand and foot, which represent preductal and postductal sites, respectively.

MATERIALS AND METHODS

Institutional Ethics Committee (IEC) approval was taken for this study. This was a single centre, hospital based, observational study performed over a period of 1 year i.e., from November 2023 to November 2024 in the Pediatrics Department of a tertiary care hospital located in Central India. 110 healthy term neonates, who has a gestational age of more than 37 weeks by date, birth weight of >2.5kg, with APGAR score of >7 in 1st and 5th minute, delivered in this Tertiary Rural Health Care centre by normal vaginal delivery or by LSCS over a period of 1 year were included in the study.

Pre-term and post-term neonates, weighing <2.5kg at birth with risk factors for asphyxia or neonates with Multiple pregnancies and congenital anomalies like congenital heart diseases were excluded. Detailed demographic data with respect to name of mother, gestational age, maternal information like detailed address, education, occupation, monthly income, marital status was noted. Written informed consent was taken from parents. Newborns were considered apparently healthy if they showed no signs of illness when they were born, not requiring supplemental O2 post-delivery, and had APGAR scores between five to ten at one minute and seven to ten at five minutes.

Oxygen saturation (SpO_2) was measured by the principal investigator using a CMS 500 pulse oximeter equipped with an alarm system.[10] To measure pre-ductal SpO_2, with the infant lying quietly on their back, the sensor was placed across the right palm on the ulnar side just below the fingers. For post-ductal SpO_2, the sensor was positioned on the outer aspect of the left foot under the toes. Saturation readings were only recorded when the heart rate measured by auscultation matched the pulse oximeter's reading for a minimum of 20 seconds.[11] Measurements were taken at 1, 2, 3, 4, 5, 10, and 15 minutes after birth. Pre-ductal and post-ductal SpO_2 values were compared across all time points for every infant. Based on delivery method, the neonates were categorized into two groups: Group A- Delivered via vaginal delivery and Group B- Delivered via LSCS. Pre-ductal and post-ductal SpO_2 readings were compared between two groups in all the neonates at different time intervals.

Data collection was managed using Microsoft Excel. The Data were presented as percentages and mean± standard deviation, and statistical analysis was performed using either unpaired or paired t-tests. Chi-square test or Fisher's exact test was applied to determine the significance of differences in frequency distributions. A p-value of less than 0.05 was considered statistically significant. Statistical analyses were conducted using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp, Armonk, NY).

RESULTS:

Table 1. Demographic Profile of the Mothers and Neonates:

Demographic Profile		Number (n=110)	Percentage
Age group (Years)	26-30 years	42	38.2
	21-25 years	41	37.3
	≤ 20 years	15	13.6
	>30 years	12	10.7
Gender of the Neonate	Male	61	55.5
	Female	49	44.5
Socioeconomic Class	Upper Middle	5	4.5
	Lower Middle	20	18.2
	Upper Lower	80	72.7
	Lower	5	4.5
BMI of Mother	Normal 18.5-24.9	50	45.5
	Overweight 25-29.9	29	26.3
	Underweight <18.5	31	28.2

Majority of the mothers were belonging to the age category of 26-30 years (38.2%) and 21-25 years (37.3%) followed by ≤ 20 years (13.6%). The mean age of the mothers was 25.5±3.8 years. More than half of the neonates were males. Three-Fourth of the neonates were belonging to Upper Lower class (72.7%) followed by Lower Middle Class (18.2%). A majority of them (45.5%) had normal BMI, followed by underweight (28.2%).

Table 2. Clinical Profile of the Neonates:

Clinical Profile of the Neonates		Number (n=110)	Percentage
Birthweight of the Neonate(Kg)	2.5-2.99	89	80.9
	3-3.49	14	12.7
	≥3.5	7	6.4
Gestational age of the Neonate (weeks)	37 weeks	7	6.4
	38 weeks	64	58.2
	39 weeks	25	22.7
	40 weeks	14	12.7
Mode of Delivery	Vaginal Delivery	53	48.2
	LSCS	57	52.8

80.9% of the neonates had their birthweight between 2.5 and 2.99kg, followed by 12.7% of them between 3 and 3.49kg. 58.2 % of the neonates had gestational age of 38 weeks followed by 39 weeks in 22.7% of the neonates. More than half of the neonates (52.8%) who were recruited into the study delivered by LSCS (48.2%).

Table 3. Details of O2 Saturation at Different Time Intervals:

O2 saturation at different time lines		Number (n=110)	Percentage
Pre ductal O2 saturation after birth (%)	56-60	26	23.6
	61-65	72	65.5
	66-70	9	8.2
	71-75	3	2.7
Post ductal O2 saturation after birth (%)	51-55	13	11.8
	56-60	86	78.2
	61-65	11	10
Pre ductal O2 saturation at 5 min (%)	66-70	6	5.5
	71-75	13	11.8
	76-80	26	23.6
	81-85	51	46.4
	86-90	14	12.7
Post ductal O2 saturation at 5 min (%)	61-65	5	4.5
	66-70	20	18.2
	71-75	9	8.2
	76-80	76	69.1
Pre ductal O2 saturation at 10 min (%)	86-90	15	13.6
	91-95	85	77.3
	96-100	10	9.1
Post ductal O2 saturation at 10 min (%)	81-85	14	12.7
	86-90	74	67.3
	91-95	22	20
Pre ductal O2 saturation at 15 min (%)	86-90	2	1.8
	91-95	18	16.4
	96-100	90	81.8
Post ductal O2 saturation at 15 min (%)	86-90	9	8.2
	91-95	27	24.5

Nearly two-third of the neonates had saturation between 61 and 65% (65.5%) followed by 56 and 60% (23.6%) neonates. Minimum number of neonates had saturation between 71-75% (2.7%). Three-fourth of the neonates had saturation between 56 and 60% (78.2%) followed by 51-55% (11.8%) and 61-65% (10%) respectively. Pre ductal O2 saturation at 5 min shows that 51 neonates had saturation between 81-85% followed by 76-80% in 26 neonates. Only 6 neonates had saturation between 66-70%. Post ductal O2 saturation at 5 min. 76 neonates had saturation between 76-80% followed by 66-70% in 20 neonates. Only 5 neonates had saturation between 61-65%.

Pre ductal O2 saturation at 10 min shows 85 neonates had saturation between 91-95 % followed by 86-90% in 15 neonates. Only 10 neonates had saturation between 96-100%. Post ductal O2 saturation at 10 min shows 74 neonates had saturation between 86-90 % followed by 91-95% in 22 neonates. Only 14 neonates had saturation between 81-95 %. Pre ductal O2 saturation at 15 min shows 90 neonates had saturation between 96-100 % followed by 91-95% in 18 neonates. Post ductal O2 saturation at 15 min shows 74 neonates had saturation between 96-100 % followed by 91-95% in 27 neonates.

Table 4. Mean & Standard Deviation of the Pre Ductal and Post Ductal:

Time	Pre ductal O2 saturation (Mean ± SD)	Post ductal O2 saturation (Mean ± SD)	P value
After Birth	62 ± 3.1	58 ± 2	<0.001, HS
At 5 minutes	80 ± 4.7	75 ± 4.5	<0.001, HS
At 10 minutes	92.7 ± 2	88.3 ± 2.4	<0.001, HS
At 15 minutes	96.8 ± 2.4	95 ± 2.9	<0.001, HS

The average values and standard deviations of pre-ductal and post-ductal oxygen saturation were calculated, with the resulting p-values indicating a highly significant difference. It showed that there is significant difference in pre ductal and post ductal oxygen saturation at birth, 5 minutes, 10 minutes and 15 minutes.

Need of Supplemental Oxygen:

Above graphs that 97 (88.2%) neonates did not require supplemental oxygen.

Graph 1. Need of Supplemental oxygen:

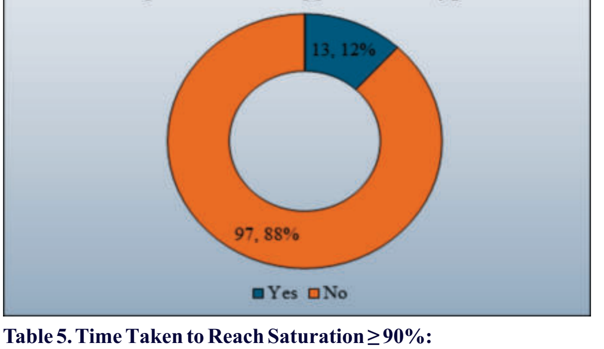

Table 5. Time Taken to Reach Saturation ≥ 90%:

Time taken to reach ≥ 90% (seconds)	Mean ± SD	P value
Pre ductal	492 ± 35 seconds	<0.0001, HS
Post ductal	631 ± 99 seconds	

The duration required to achieve oxygen saturation levels of ≥ 90% for both pre-ductal and post-ductal measurements, shows a highly significant difference was observed in the time taken to reach this threshold between the two sites.

Table 6. Time Taken to Reach ≥ 90%:

Time taken to reach ≥ 90 %	Vaginal delivery (Mean ± SD)	LSCS (Mean ± SD)	P value
Pre ductal	476 ± 36	506 ± 27	<0.0001, HS
Post ductal	583 ± 85	675 ± 92	<0.0001, HS

A highly significant difference was found between infants delivered vaginally and those born via cesarean section, with vaginally delivered neonates reaching the ≥ 90% saturation threshold faster at both measurement sites compared to cesarean-born infants.

Table 7. Pre ductal and Post ductal Oxygen Saturation in Vaginal Delivery and LSCS:

Time	Vaginal delivery (Mean ± SD)	LSCS (Mean ± SD)	P value
Pre ductal O2 saturation after birth	63 ± 2.5	62 ± 3.5	0.01, significant
Post ductal O2 saturation after birth	58.6 ± 1.6	57.7 ± 2.3	0.008, Significant
Pre ductal O2 saturation at 5 min	83.4 ± 2.4	77.5 ± 4.6	<0.0001, HS
Post ductal O2 saturation at 5 min	78.5 ± 1.6	72.9 ± 4.6	<0.0001, HS
Pre ductal O2 saturation at 10 min	93.3 ± 1.9	92 ± 1.9	<0.0001, HS
Post ductal O2 saturation at 10 min	89.4 ± 1.8	87.2 ± 2.4	<0.0001, HS
Pre ductal O2 saturation at 15 min	96.9 ±2.3	96.9 ± 2.5	0.99, NS
Post ductal O2 saturation at 15 min	95.5 ±2.7	95.5 ± 3.1	0.99, NS

Above table showed the pre ductal and post ductal oxygen saturation in neonates delivered vaginally and by caesarean section. It showed that there is highly significant difference in their saturation immediately after birth, at 5 minutes and 10 minutes. There is no significant difference in their saturation at 15 minutes.

Table 8. Co-relation of Mode of Delivery with the Need for Supplemental Oxygen:

Mode of delivery	Supplemental Oxygen		P value
	Yes n=13	No n=97	
Caesarean section	7	50	0.876, NS
Vaginal	6	47	

Above table shows the correlation of mode of delivery with the need for supplemental oxygen. There is no significant difference between mode of delivery and need for supplemental oxygen.

DISCUSSION:

Demographics of Recruited Patients:

In the present study, baseline demographic characteristics were assessed. Majority of mothers were aged between 26–30 years (38.2%) and 21–25 years (37.3%), followed by ≤20 years (13.6%). Only a few were above 30 years (10.7%). The mean maternal age was 25.5±3.8 years. A male sex predilection was noted among neonates (55.5% males vs. 44.5% females). Regarding socioeconomic status, most neonates belonged to upper-lower-class families (72.7%), followed by lower-middle-class (18.2%). Jemy et al.[12] reported a similar median maternal age of 24 years, and their gender ratio (54.9% males, 45.1% females) was consistent with our findings. Zubarioglu et al. [13] found a nearly equal gender distribution (50.3% females and 49.7% males). However, Uslu et al. [14] observed a slight female predominance (52.3%), whereas Khriesat et al.[15] reported near-equal ratios in their populations.

Distribution of Mothers According To Baseline Clinical Variables:

Most mothers had normal BMI (18.5–24.9) (45.5%), followed by underweight (28.2%) and overweight (26.3%) categories. Majority delivered by LSCS (52.8%), while 48.2% had vaginal deliveries. Regarding neonatal outcomes, 80.9% had birth weights between 2.5–2.99 kg, 12.7% between 3–3.49 kg, and only 6.4% exceeded 3.5 kg. Most neonates were at 38 weeks gestation (58.2%), followed by 39 weeks (22.7%). Uslu et al.[14] reported 83.5% cesarean deliveries with a mean gestational age of 32.9±1.04 weeks and mean birth weight of 1888.86 g. Odudu et al.[16] noted a mean gestational age of 38.6 weeks and birth weight of 1992.8 g, with most surgical deliveries being emergency cesarean sections. Zubarioglu et al.[13] observed a mean gestational age of 38.8±1.1 weeks and birth weight of 3082±425.7 g, with 45.4% vaginal and 54.6% cesarean deliveries.

Distribution of Neonates According to Pre-Ductal and Post-Ductal O_2 Saturation After Birth:

During fetal life, oxygen saturation averages around 70%. After birth, effective oxygenation depends on rapid cardiovascular adaptation. Pulse oximetry is routinely used to assess neonatal oxygen levels[17]. However, the exact time when SpO_2 exceeds 90% remains uncertain. Current resuscitation guidelines emphasize the use of lower oxygen concentrations, with continuous SpO_2 monitoring alongside observation of respiratory effort and heart rate [18].

In our study, most neonates had pre-ductal O_2 saturation between 61–65% (65.5%) and 56–60% (23.6%), while few showed values above 70%. Post-ductal O_2 saturation was mostly between 56–60% (78.2%), followed by 51–55% (11.8%). The difference between mean pre-ductal (62±3.1%) and post-ductal O_2 saturation (59±3.1%) was statistically significant (P < 0.001). Uslu et al. [14] reported comparable results, with mean pre-ductal saturation of 61.92±6.76% and post-ductal of 58.07%, also showing a significant inter-site difference. Similar observations of higher pre-ductal levels than post-ductal have been documented in study by Zubarioglu et al[13]. This difference is commonly attributed to transitional shunting through the ductus arteriosus and pulmonary vascular resistance, mechanisms that may persist in late preterms as well.

Odudu et al. [16] found mean pre- and post-ductal SpO_2 values near 96%, reflecting postnatal stabilization. Differences among studies likely arise from variations in methodology, infant characteristics, and oximeter models, as algorithmic discrepancies of up to 2% have been noted across devices. Habib et al. [19] reported mean pre-ductal and post-ductal SpO_2 values of 68% and 60% at one-minute post-birth, again showing significant contrast (P < 0.01). Regional differences are also noteworthy—studies from Argentina and Nigeria reported early postnatal pre- and post-ductal values of 89%/81% and 96%/95%, respectively, consistent with physiologic trends and local conditions including altitude[20].

Distribution of Neonates According to Pre Ductal and Post Ductal O_2 Saturation After Five, Ten and Fifteen Minutes:

Numerous studies using pulse oximetry in the labour room have shown that newborns with normal postnatal transition typically reach adequate SpO_2 values within about five minutes, with both pre-ductal and post-ductal saturations rising progressively after the first 60 seconds of life[21]. In our study, at 5 minutes, most neonates had pre-ductal SpO_2 between 81–85% (46.4%), followed by 76–80% (23.6%), with smaller proportions in the 86–90% and 71–75% ranges and very few below 70%. At 10 minutes, the majority achieved pre-ductal SpO_2 between 91–95% (77.3%), and by 15 minutes, most were in the 96–100% range (81.8%). Post-ductally, at 5 minutes, most neonates had SpO_2 between 76–80% (69.1%), with the remainder predominantly in the 66–75% range. The mean pre-ductal and post-ductal saturations at 5 minutes (80±4.7 vs. 75±4.5) differed significantly (P < 0.001).

By 10 minutes, most neonates had post-ductal SpO_2 between 86–90% (67.3%), with a smaller proportion reaching 91–95%; the mean pre-ductal and post-ductal values (92.7±2 vs. 88.3±2.4) again showed a statistically significant difference (P < 0.001). At 15 minutes, post-ductal SpO_2 was predominantly 96–100% (67.3%), with most others between 91–95%; the mean pre-ductal value was 96.8±2.4 versus 95±2.9 post-ductally, with this difference remaining statistically significant (P < 0.001). These findings demonstrate a gradual convergence of pre- and post-ductal values over the first 15 minutes, while maintaining a small but persistent gradient in the early transitional period.

Khriesat et al.[15] reported that at 2 minutes after birth, mean pre-ductal and post-ductal SpO_2 values were 72% and 64%, respectively, with a significant difference at this time (P < 0.05); however, by 5, 10, and 15 minutes, the differences between the two sites were no longer statistically significant, and by 20 minutes there was no distinction at all. Tiwari et al. found median pre-ductal SpO_2 values of 70.13%, 87.65%, and 92.77% at 1, 5, and 10 minutes, compared with post-ductal values of 62.90%, 84.74%, and 91.53% at the same time points, with statistically significant differences (P < 0.01)[22].

Findings from the present study are in line with this body of evidence, supporting that SpO_2 often remains below 90% until close to 10 minutes of life, even in healthy neonates[1,22]. This issue is particularly important in resource-limited, high-burden settings, where careful allocation of oxygen and monitoring resources is crucial[22]. The delayed attainment of "normal" SpO_2 values is regarded as physiologic, largely reflecting ongoing cardiopulmonary shunting during early transition[1]. Tiwari et al. [22] also showed that by 10 minutes, 74% of neonates had comparable pre- and post-ductal SpO_2 values, supporting a conservative, titrated approach to oxygen therapy in the first minutes of life.

Mariani et al. [23] further demonstrated that, in term neonates, post-ductal SpO_2 remained significantly lower than pre-ductal values at 3, 4, 5, 10, and 15 minutes after birth, while Zubarioglu et al. [13] reported a significant pre-/post-ductal difference over the first 15 minutes. Mariani et al. [23] did not find a significant difference in the first two minutes, which may relate to later onset of measurements and standard oximeter sensitivity settings. Jemy et al. [12] likewise documented significantly higher pre-ductal than post-ductal SpO_2 from 1 to 10 minutes of life, reinforcing this characteristic early gradient.

Distribution of Neonates According to Supplemental Oxygen and Time to Reach Saturation >90%:

In the current study, most neonates (88.2%) did not require supplemental oxygen, indicating that the majority achieved satisfactory oxygenation with routine stabilization measures alone. The mean time to reach pre-ductal SpO_2 >90% was 492±35 seconds, compared to 631±99 seconds for post-ductal SpO_2, and this difference was highly significant ($P < 0.0001$). Infants delivered vaginally reached pre-ductal saturation >90% in 476±36 seconds, whereas those born by LSCS required 506±27 seconds. Similarly, post-ductal saturation >90% was achieved at 583±85 seconds in vaginally delivered neonates and 675±92 seconds in those delivered by LSCS, with both differences being statistically significant ($P < 0.0001$). However, mode of delivery did not significantly influence the need for supplemental oxygen ($P = 0.876$). Uslu et al. [14] reported a comparable pattern, with pre-ductal SpO_2 >90% achieved earlier (9.2±6.4 minutes) than post-ductal values (11.0±7.2 minutes), and earlier attainment of target saturations in vaginally delivered preterm neonates, those with umbilical artery pH around 7.20, and infants of non-smoking mothers, while no significant gender differences were observed.

Multiple studies have suggested that term neonates typically reach pre-ductal SpO_2 >90% at a median of 5.8–7.5 minutes[13]. Dawson et al.[24] further noted that infants born before 37 weeks generally require additional time to achieve this threshold. Kamlin et al. [25] estimated a median of 6.5 minutes for preterm infants to attain SpO_2 >90%, whereas Kopotic et al. [26] observed that SpO_2 of 80% was reached by around 4.4 minutes even in infants receiving supplemental oxygen. Nuntrarumit et al.[27] reported a median of 6 minutes to reach 90% SpO_2 in infants with a mean gestational age of 35 weeks, most of whom were delivered vaginally. Delayed achievement of optimal saturation has been attributed to slower clearance of pulmonary fluid and factors such as maternal smoking, which is associated with earlier delivery and impaired neonatal oxygenation[12,15]. Other determinants include gestational age, probe placement, and umbilical blood gas status. Current evidence and resuscitation guidelines support beginning stabilization, particularly in preterm infants, with lower oxygen concentrations and emphasize combining clinical assessment with continuous SpO_2 monitoring to guide stepwise oxygen titration[12,18].

Comparison of Pre Ductal and Post Ductal O_2 Saturation in Vaginal Delivery and LSCS at Birth, and From 5–15 Minutes

Mode of delivery is an important determinant of early SpO_2 patterns, with several studies reporting higher initial saturation values in spontaneously delivered neonates than in those born by cesarean section[28]. In the present study, comparison of mean pre- and post-ductal SpO_2 in neonates born vaginally versus by LSCS at birth, 5, 10, and 15 minutes showed highly significant differences immediately after birth and at 5 and 10 minutes ($P < 0.0001$), whereas no significant difference persisted at 15 minutes. Odudu et al. [16] found that, on the first day of life, pre-ductal SpO_2 in vaginally delivered neonates was on average 0.8% higher than in those delivered by cesarean, while post-ductal SpO_2 was marginally higher (0.1%) in the cesarean group; however, these differences were not statistically significant ($P = 0.32$ and $P = 0.89$, respectively). Across serial measurements at 5, 10, and 15 minutes, pre-ductal values remained slightly higher in preterm than term neonates, and post-ductal values were higher in preterms between 10 and 24 hours of life, again without statistical significance.

CONCLUSION

In conclusion, the fetal environment is characterized by lower oxygen levels compared to that of a newborn. Despite this, oxygen delivery to fetal tissues remains sufficient due to specific metabolic and circulatory adaptations. In healthy term infants following an uncomplicated delivery, SpO_2 levels are initially low but rise quickly, typically reaching a plateau between 90% and 95% within 3 to 5 minutes after birth. When assessing oxygen saturation in term newborns immediately after delivery, factors such as the site of measurement and mode of delivery should be considered. In our study, the duration needed to achieve SpO_2 levels of more than 90% was notably longer in postductal readings.

These findings emphasize the importance of considering lower threshold values for preductal and postductal SpO_2 when assessing oxygenation in newborns. Soundly designed prospective researched are necessary to better understand the progression of SpO_2 during the early postnatal period in neonates undergoing transitional adaptation.

Limitations

Comparatively small sample size do not have conclusive findings, which should be validated through larger-scale research and a larger sample size of the population in the study could have given more conclusive findings. A multi-centric study (different hospitals) could have increased the inclusion of various demographic groups to draw more generalized conclusion. Additionally, the study did not explore the association between low fetal saturation levels in utero and persistently low pH levels observed immediately when they were born.

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