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Assess Stability of Neonatal Oxygen Saturation (SpO2) with Delay Cord Clamping WhilePracticing Kangaroo Mother Care and Compare it with Defined References Ranges of Oxygen Saturation

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Abstract*: Pulse oximeter is used in the delivery room to assess the cardiopulmonaryadaptationof the newborn to extrauterine environment. WHO (2017) recommended delayed cord clamping (DCC) from 1-3 minutes and applying kangaroo care for all newborns for their benefits.**Aim of the study** was to assess stability of neonatal oxygen saturation (SpO2) with delay cord clamping whilepracticing kangaroo mother care in the delivery room and compare it with defined references ranges of oxygen saturation.**Material and methods**: an observational study was used to carry out the study. The study was conducted at delivery room of Damanhour National Medical Institute. Convenience sample of 150 full term neonate with their mothers were included.**Tool**: Assessment sheet was used to collect required data which is consisted of three parts, part I for maternal assessment, part II for neonatal assessment and part III for Oxygen saturation and heart rate assessmenttill 15 minutes.**Results:** It was found that the SpO2 and the heart rate were increased gradually from birth till 15 minutes for all newborns.In addition, It was observed that the more the delay of cord clamping, the higher the mean of SpO2.Moreover, the differences between the mean participants SpO2 with time of cord clamping after 1, 2 and 3 minutes were statistically significant.**Conclusion:** The study concluded that the delay of cord cutting with practicing kangaroo mother care lead to improve of SpO2 level for theneonates.*
Recommendation*:It is recommended that all stable newborns should have delay cord cutting and be placed andremain in direct skin-to-skin contact with their mothers immediately after delivery for at least 5 minutes this could significantly improve theircardiovascular stability.*
Key wards:*oxygen saturation,delay cord clamping,kangaroo mother care and delivery room.*

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I. Introduction

The most profound physiologic change required of the newborn is transition from fetal or placental circulation to independent respiration. The loss of placental connection means the loss of complete metabolic support, particularly the supply of oxygen and removal of carbon dioxide [(1)]. All newborns are "cyanotic" at birth; the arterial oxygen tension in the normal fetus is approximately 20 mm Hg, equivalent to an oxygen saturation of 60%.Several studies using pulse oximetry in the delivery room have documented that it takes more than 5 minutes for a newborn undergoing normal postnatal transition to attain an oxygen saturation 80%and almost 10 minutes to reach 90% [(2)].

The transition from fetus to newborn is a complex physiological process. There is growing interest in the use of pulse oximetry to assess the condition of newborns immediately after birth. Oxygen saturation SpO2 is an indicator of the percentage of hemoglobin saturated with oxygen at the time of the measurement [(3)]. Pulse oximetry is a technology that enables the noninvasive measurement of oxygen saturation.It is described as a "fifth vital sign" (in addition to temperature, blood pressure, pulse, and respiratory rate) in clinical assessment[(4)]. The obtained reading through pulse oximetry uses a light sensor containing two sources of light (red and infrared) that are absorbed by hemoglobin and transmitted through tissues to a photo detector. The amount of light transmitted through the tissue is then converted to a digital value representing the percentage of hemoglobin saturated with oxygen [(3)].Several studies evaluated the normal reference values for SpO2 during the first 24 hrs of life. During this period newborn infants adapt their circulation to extrauterine life. After an initial increase in SpO2 during the first minutes of life, SpO2 seems to be stable until 20–24 hrs of life with normal range from 94 to 100% [(5)].

Delay cord clamping (DCC) from 1 to 3 minutes after birth is now recommended for all births while providing essential newborn care [6]. DCC leads to greater cardiovascular stability as it allows time for neonates to breathe, increase their pulmonary blood flow and accordingly improved tissue perfusion and oxygen saturation [7]. In addition, Elgzar (2017)[8] found that newborns with delay cord clamping had higherlevels of hemoglobin, hematocrit, and red blood cells compared tonewborns with early cord clamping [8].

Holding the undressed newborn directly on the chest of the mother is known as kangaroo care (KC) or skin- to -skin contact. It has shown both physiologic and behavioral benefits for maintaining a newborn's body temperature and increasing cardiorespiratory stability as well as bonding between the mother and her newborn [9]. Furthermore, WHO (2017) recommended skin-to-skin contact for all full term and healthy newborns because of its benefits in preventing hypothermia and promoting breastfeeding [6].

Significant

Pulse oximetry offers a reliable non-invasive, real-time objective method for monitoring oxygen saturation. Use of the pulse oximeter in the delivery room has demonstrated the efficacy as well as the sensitivity of this tool in assessing the cardiopulmonary extrauterine adaptation of the newborn [10, 11].Pediatric nurses play an essential role inside delivery room to improve quality of neonatal management which contributes to high neonatal outcomes.Pediatric nurses should keep themselves updated with the best evidences while caring for the newborns immediately after delivery. Although WHO (2017) recommended delayed cord clamping (DCC) from 1-3 minutes and practicing kangaroo care for all newborns for their benefits for the mothers and their newborns, both practices are not included as a routine management in our hospitals. So, the current study intended to assess stability of neonatal oxygen saturation (SpO2) with delay cord clamping while practicing kangaroo mother care in the delivery room and compare it with defined references ranges of oxygen saturation.

Aim of the study:

The aim of the study is to assess stability of neonatal oxygen saturation (SpO2) with delay cord clamping whilepracticing kangaroo mother care in the delivery room and compare it with defined references ranges of oxygen saturation.

II. Material and Methods

Material:

Study Design*:*

Prospective, observational study was used which is suitable to answer the researchers' question:

What is the effect of delay cord clamping while practicing kangaroo mother care on stability of neonatal oxygen saturation (SpO2) in the delivery room?

Study Setting:

The study was conducted in the delivery room in Damanhour National Medical Institute affiliated to Ministry of Health in Damanhour City, Al-Behira governorate, in Egypt.

Study Subjects:

Normal, full-term newborns immediately after birth with their mothers were recruited to the study. Newborn who has birth asphyxia or need oxygen therapy or positive pressure ventilation in the delivery room were excluded from the study.

Sampling and Sample Size:

Sample Size: According to Damanhour National Medical Institute statistical center, 2018, flow rate of thelaboring women undergo vaginal delivery were 1098 women at the end of December 2018. More than 10% of flowrate, 150 mothers and their newborns, was recruited for the study using convenient sampling technique.

Tool:

Anassessment sheetwas used to collect the required data. The assessment sheet consisted of three sections:

1. Section A: Maternal assessment: it includes mother's age, gravity and parity.
2. Section B: Neonatal assessment: it includes neonate's temperature, heart rate at birth, Apgar score at 1st and 5th minutes after birth, neonatal weight and gestational age.
3. Section C: Oxygen saturation and heart rate every minute till 5 minute and then at 10 and 15 minutes

III. Methods:

1- An official letter was sent from the Faculty of Nursing, Damanhour UniversitytoDamanhour National Medical Institute in order to obtain the permission for the data collection afterexplaining the aim of the study.
2- Content validity was determined by asking experts in the pediatric nursing to assess the relevance to and coverage of the topic and necessary modifications were done.
3-The researchers attended the delivery with a pulse oximeter and stopwatch. All newborns were wrapped with warmed towels then put on the mother chest to allow skin- to- skin contact between the mother and her baby while maintainnewborn's neck in neutral position to prevent airway obstrction. Practicing kangaroo mother care was continue for 5 minutes.
4-The sensor of pulse oximeter was applied to the palm of the neonate's right hand to obtain preductal SpO2. The sensor was then connected to the oximeter, because this leads to the fastest acquisition of data.
5-SpO2 was continuously monitored; with values recorded: immediately after birth, then at 60-second intervals for the first 5 minutes then at 10 and 15 minutes.
6- The time of cord clamping was documented either 1^{st} , 2^{nd} or 3^{rd} minute .
7- All documented SpO2 were compared with American academy of Pediatrics'defined references ranges of oxygen saturation[(12)].
8-Data were collected over a period of 5 months started from May to September 2019.

Ethical consideration

- Oral informed consent was obtained from the mothers after explanation about the nature and aim of the study.
- Confidentiality was ensured, all data was handled only by the research team and all information given was used for the purpose of the current study.

Statistical analysis of the data

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). Quantitative data were described using mean, standard deviation. Significance of the obtained results was judged at the 5% level.

The used tests were:

1 - Paired t-test

For normally distributed quantitative variables, to compare between two periods

2 - ANOVA with repeated measures

For normally distributed quantitative variables, to compare between more than two periods or stages, and Post Hoc test (Bonferroni adjusted) for pairwise comparisons

3 - Spearman coefficient

To correlate between two distributed abnormally quantitative variables

IV. Results

The study included 150 mothers and their newborns. Distribution of the participant mothers according to their characteristics is illustrated in **table 1**. Mothers' age was ranged from 18 to 40 years with mean age of 26.05 ± 4.15 and 43.3% of theywere primipara and primigravida. Normal vaginal delivery was the mode of delivery for all participant mothers. As regards participants' medical history, majority of the mothers (95.3%) were medically free and 98.7% did not have any complications during pregnancy. **Table 2** presents distribution of the participant newborns according to their characteristics. It was found that participant newborns were equally distributed for both genders. In addition, majority of participant newborns were appropriate for gestational age using intrauterine growth chart.

Time of cord clamping of the participant newborns was 2 minutes for 66.7% and 3 minutes for 26% while cord clamping after one minute was done for 7.3% of them as presented in **table 3**.

Table 4 illustrates distribution of the participant newborns according to their Apgar score. It was found that the Apgar score of participant newborns at the first minute was ranged from 5-7 with mean of 6.21±0.62 while ranged from 7-9 with mean of 8.19 ± 0.71 at the 5th minute after birth and the differences between the first and fifth minute were statistically significant.

Table 5 presents distribution of the participant newborns according to SpO2 and heart rate. It was found that the SpO2 was increased gradually from birth till 15 minutes for all newborns with mean of 58.99±4.12, 61.31±3.93, 62.86±3.86, 64.6 ± 4.06, 67.2 ± 4.31, 77.1 ± 4.17, 86.8 ± 3.31 and 93.9 ± 2.36 percent respectively. Regarding the heart rate of participant newborns, it was also observed that the heart rate was increased gradually from birth till 15 minutes for all newborns with mean of 95.99±4.76, 99.12± 3.98, 112.22±5.60, 116.78±7.35, 124.28±9.15, 144.46±7.32, 150.15±3.88, and 153.47±8.85 bpm respectively. None of participant newborns experienced tachycardia (HR>180 bpm) or bradycardia (HR<80 bpm).

Relationship between time of cord clamping while practicing the kangaroo care and SpO2 of participant newborns is illustrated in **table 6**. It was observed that the SpO2 was increased gradually from birth till 15 minutes for all newborns with time of cord clamping after one, 2 or 3 minutes. In addition, It was found that the more the delay of cord clamping, the higher the mean of SpO2. This was evidenced by higher mean SpO2 among participants newborns with time of cord clamping at two minutes compared with one minute. Furthermore, the mean SpO2 was higher among participant newborns with time of cord clamping at three minutes compared with one and two minutes and the differences between the mean participants SpO2 with time of cord clamping after 1, 2 and 3 minutes were statistically significant.

Comparison between SpO2 of participant newborns with time of cord clamping while practicing the kangaroo care and the mean defined oxygen saturation as published by American Academy of Pediatrics (2016) [(12)]is illustrated in **table 7**. It is observed that the mean SpO2 of the participant newborns was lower than mean defined oxygen saturation in the 1st minute with delay cord clamping either one or two minutes but higher than mean defined oxygen saturation withdelay cord clamping for 3 minutes. In addition, the mean SpO2 of the participant newborns was lower than mean defined oxygen saturation at the 3rd, and 5th minutes with either delay cord clamping for one, two or three minutes. Furthermore, at the 10th minute, the mean SpO2 of the participant newborns was lower significantly ($P \leq 0.05$) than mean definedoxygen saturation with delay cord clamping for one and two minutesand almost equal in the 3rd minutes.

Table (1):Distribution of the participant mothers according to their characteristics (n = 150)

Mothers' Characteristics	No.	%
Age		
<20	4	2.7
20 – 29	120	80.0
30 – 40	26	17.3
Min. – Max.	18.0 – 40.0	
Mean ± SD.	26.05 ± 4.15	
Parity		
0	65	43.3
1	66	44.0
2	19	12.7
Min. – Max.	0.0 – 2.0	
Mean ± SD.	0.69 ± 0.68	
Gravida		
1	65	43.3
2	62	41.3
3	22	14.7
4	1	0.7
Min. – Max.	1.0 – 4.0	
Mean ± SD.	1.73 ± 0.75	
Mood of delivery		
Normal vaginal delivery	150	100.0
Mothers' medical diagnosis		
No	143	95.3
Asthma	6	4.0
Sickle cell anemia	1	0.7
Mothers'pregnancy complications		
No	148	98.7
Abortion	2	1.3

Table (2):Distribution of the participant newborns according to their characteristics (n = 150)

Newborns' Characteristics	No.	%
Gender		
Boy	75	50.0
Girl	75	50.0
Newborn intrauterine growth chart		
Appropriate for gestational age	149	99.3
Large for gestational age	1	0.7

Table (3):Distribution of the participant newborns according to time of cord clamping (n = 150)

Time of cord clamping	No.	%
After 1 minute	11	7.3
2 minutes	100	66.7
3 minutes	39	26.0

Table (4):Distribution of the participant newborns according to their Apgar score (n = 150)

Newborns' Apgar score	At One Minute	At 5 Minute	T	P
Apgar Score				
Min. – Max.	5.0 – 7.0	7.0 – 9.0	39.936*	<0.001*
Mean ± SD.	6.21±0.62	8.19 ± 0.71		

t: Paired t-test for comparing between 1 and 5 minute
*: Statistically significant at $p \leq 0.05$

Table (5):Distribution of the participant newborns according to their SpO2 and heart rate (n = 150)

Newborns' SpO2 and heart rate	Immediately after birth	After one minute	After 2 minutes	After3 minutes	After4 minutes	After 5 minutes	After10 minutes	After15 minutes
SpO2								
Min. – Max.	53.0 –73.0	55.0 –73.0	55.0 –75.0	58.0 –78.0	61.0 –80.0	70.0 –88.0	78.0 –94.0	85.0 –98.0
Mean ± SD.	58.99±4.12	61.31±3.93	62.86±3.86	64.6 ± 4.06	67.2 ± 4.31	77.1 ± 4.17	86.8 ± 3.31	93.9 ± 2.36
P		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*
Heart rate								
Min. – Max.	66.0–112.0	77.0–120.0	101.0–126.0	102.0–143.0	107.0–148.0	117.0–173.0	134.0–158.0	55.0–160.0
Mean ± SD.	95.99±4.76	99.12± 3.98	112.22±5.60	116.78±7.35	124.28±9.15	144.46±7.32	150.15±3.88	153.47±8.85
P		<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

p: p value for Post Hoc test (**adjusted Bonferroni**) for ANOVA with repeated measures for comparison between immediately after birth and each other periods
*: Statistically significant at $p \leq 0.05$

Table (6):Relationship between time of cord clamping while practicing the kangaroo care and SpO2 of participant newborns

Newborns ' SpO2	Cord clamping			F	p
	After 1 minute (n = 11)	After 2 minutes (n = 100)	After 3 minutes (n = 39)		
	Mean ± SD.	Mean ± SD.	Mean ± SD.		
Immediately after birth	56.36 ± 2.87	58.46 ± 3.46	61.1 ± 5.09	9.062*	<0.001*
After one minute	59.0 ± 3.46	60.78 ± 3.51	63.33 ± 4.34	8.828*	<0.001*
After 2 minutes	61.09 ± 2.43	62.27 ± 3.38	64.87 ± 4.58	8.392*	<0.001*
After 3 minutes	62.0 ± 2.1	64.18 ± 3.73	66.44 ± 4.63	7.337*	<0.001*
After 4 minutes	63.45 ± 2.21	67.13 ± 4.12	68.69 ± 4.59	7.000*	<0.001*
After 5 minutes	75.36 ± 2.29	76.81 ± 3.93	78.64 ± 4.8	3.992*	<0.001*
After 10 minutes	84.73 ± 2.15	86.75 ± 3.49	87.56 ± 2.85	3.300*	<0.001*
After 15 minutes	92.18 ± 1.4	93.86 ± 2.38	94.51 ± 2.29	4.447*	<0.001*

F: **F for ANOVA test**
p: p value for association between different categories

*: Statistically significant at $p \leq 0.05$

Table (7):Comparison between SpO2 of participant newborns with time of cord clamping while practicing the kangaroo care and the mean defined oxygen saturation

Time after delivery	Defined oxygen saturation ranges		Time of Cord clamping		
			After 1 minute (n = 11)	After 2 minutes (n = 100)	After 3 minutes (n = 39)
	Min. – Max.	Mean	Mean ± SD.	Mean ± SD.	Mean ± SD.
one minute	60-65	62.25±1.83	59.0 ± 3.46	60.78 ± 3.51	63.33 ± 4.34
t(p)			3.115* (0.011*)	4.188* (<0.001*)	1.554 (0.129)
3 minutes	70-75	72.41±1.61	62.0 ± 2.1	64.18 ± 3.73	66.44 ± 4.63
t(p)			16.441* (<0.001*)	22.064* (<0.001*)	8.052* (<0.001*)
5 minutes	80-85	82.43±1.62	75.36 ± 2.29	76.81 ± 3.93	78.64 ± 4.8
t(p)			10.240* (<0.001*)	14.300* (<0.001*)	4.931* (<0.001*)
10 minutes	85- 95	87.51±1.71	84.73 ± 2.15	86.75 ± 3.49	87.56 ± 2.85
t(p)			4.288* (0.002*)	2.178* (0.032*)	0.110 (0.913)

t: one sample t-test

*: Statistically significant at $p \leq 0.05$

V. Discussion

Umbilical cord clamping (CC) and subsequent cutting are routine procedures performed at delivery rooms , but the optimal time for clamping remains unclear. The past 15 years have seen a shift toward delayed cord clamping (DCC)during the provision of essential neonatal care. DCC is defined as CC performed after 30 to 60 seconds or extending up to 2 to 3 minutes of birth, and/or after cessation of pulsations in the cord. There is growing evidence that delayed cord clamping is beneficial for the most neonats [13, 14].

In stable term neonats, DCC for≥1 min is recommended to improve hemoglobin and hematocrit levels, and increase iron reserves up to6 months after birth[13]. If these stable term neonats are born vaginally, positioning them at mother's abdomen/chest is appropriate which is commonly referred to as kangaroocare (KC) [15].This early skin to skin contact at birth lead to improve breastfeeding duration, cardiorespiratory-metabolic stability at birth and temperature. Despite the reported benefits, direct skin-to-skin contact after birth is not practiced [16]. Therefore, the current study was conducted to assess stability of neonatal oxygen saturation (SpO2) with delay cord clamping while practicing kangaroo mother care in the delivery room and compare it with defined references ranges of oxygen saturation.

In the present study it was found that the SpO2 was increased gradually and significantly from birth till 15 minutes for all newborns. It needs 15 minutes to exceed 90%. Our findings are consistent with Hulsoore (2011) and Dawson et al. (2010) who reported that SpO2 increased steadily over time. Although in study by Dawson et al. (2010) the SpO2 required 8 minutes to exceed 90% in term infants [17, 18]. The same findings of increased SpO2 after delivery was reported by several studies [19 -23].

The current study showed that the mean SpO2 of the participant newborns was higher than the mean defined oxygen saturationat the first minute after birth with delay cord cutting at third minutes. Unexpectedly, the mean SpO2 of the participant newborns was lower than the mean defined oxygen saturationin the 3rd, and 5th minutes with delay cord clamping either for one, two or three minutes. This could be explained in the light ofthe sudden cooling of the newborn body in the delivery room, which lead to hypothermia and may affectneonates' oxygen saturation. As the hospital is in the rural area and there is no protocol in the hospital for monitoring the temperature in the delivery room. While, in the 10th minutes, the mean SpO2 of the participant newborns was equal to the mean defined oxygensaturation with delay cord clamping at 3 minutes. This finding could be interpreted by two reasons: first placing the newborn in direct skin-to-skin contact with his mother as a source of heat that maintain healthy body temperature and prevent hypothermia. The second interpretation is applying nursing measures to maintain the newborns' body temperature as wrapping the baby warmlyor providing a warm environment under servo.

The cardiopulmonary transition of the fetus to newborn is a complex process that requires a few minutes to achieve stabilization [11]. The normal range of heart rate in a healthy neonate duringtransition to pulmonary respiration is not well agreed. Moreover, the published rangesover the past 30 years can have striking disagreement [23]. Many researches addressed that neonates who have delayed cord clamping display better cardiovascular stability, maintain a steady heart rate and have higher mean blood pressure in relation to

those subjected to immediate cord clamping[25-27].Accordingly, it was observed from the current study that the heart rate was increased gradually from birth till 15 minutes for all newborns. Furthermore none of participant newborns experienced either tachycardia or bradycardia. These findings differ from those found by Bancalari et al. (2016) whomentioned that newborns'HR wasrising till 3 minutes after delivery,and then HR decreasedgradually with no bradycardiatill 15 minutes after birth [11].

Regarding the relationship between the time of cord clamping with practicing kangaroo care and the participant newborns'SpO2. It was recognized from the present study that newborns' SpO2 was statistically increased with delay cord clamping after 1, 2 and 3 minutes. These findings could be attributed to the fact that after birth, the neonatal lungs change from liquid to air filled starting the role of gas exchange. Additionally, the transition of cardiovascular system from fetal to a newborn circulation facilitating oxygen delivery throughout the body [28]. On the other hand, delayed cord clamping permit oxygen to be provided though the umbilical vein along with blood volume, which helps to fill the the neonates newly opened up pulmonary circulation [13, 25]. This results are congruent with a study conducted at Nepal (2016) which found that DCC was an effective intervention to ensure higher oxygen saturation among participant neonates at 1, 5and 10 minutes after delivery [29].The present findings also was in agreement witha Meta-analysis which carried out by Boundy et al. (2016) who confirmed theimprovement in neonates' oxygenation associated with KMC [30].

VI. Conclusion:

Based on the findings of this studyit can be concluded that DCC, with practicing kangaroo care help to improvecardiovascular stability for the full term neonates. Whereas, theSpO2 and the heart rate were increased gradually from birth till 15 minutes for all newborns. Furthermore, the mean SpO2is significantly increased with time of cord cutting.

VII. Recommendations

1-Training program should be conducted by the hospitals training centers for obstetricians, and nurse-practitioners to increase their awareness regardingbenefits of DCC for newborns.
2- The curriculum of nursing education should involve skin to skin intervention and its benefits.
3-Kangaroo mother care should be applied for all neonates inside the delivery room for at least 5 minutes.
4- All governmental hospitals should provide policies regarding DCC practice implementation.

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References:

[1]. Wong, D., and Hockenberry, M (2011). Nursing Care of Infants and Children, (8th Ed.) Philadelphia: Mosby
[2]. Rabi Y., Yee W., Chen S., and Singhal A. (2006) OXYGEN SATURATION TRENDS IMMEDIATELY AFTER BIRTH, *J Pediatr 2006;148:590-4*)
[3]. Sandra L. Schutz (2001) Oxygen Saturation Monitoring by Pulse Oximetry, AACN Procedure manual for Critical Care, Fourth Edition; W. B. Saunders)
[4]. Mohammad Y., (2010) CLINICAL USE OF PULSE OXIMETRY POCKET REFERENCE, WONCA, IPCRG, EFA)
[5]. Røsvik A., Øymar K., Kvaløy T. J., Berget M. (2009) Oxygen saturation in healthy newborns; influence of birth weight and mode of delivery J. Perinat. Med. 37: 403–406.
[6]. WHO recommendations on newborn health: guidelines approved by the WHO. Guidelines Review Committee. Geneva: World Health Organization; 2017 (WHO/MCA/17.07). Licence: CC BY-NC-SA 3.0 IGO.
[7]. Smit M., Dawson J., Ganzeboom A., Hooper S., Roosmalen J., Pas A. (2014). Pulse oximetry in newborns with delayed cord clamping and immediate skin-to-skin contact. Arch Dis Child Fetal Neonatal Ed;0:F1–F6. doi:10.1136/archdischild-2013-305484
[8]. Elgzar W., Ibrahim H., and Elkhateeb H. (2017). Effects of Deferred Versus Early Umbilical Cord Clamping on Maternal and Neonatal Outcomes. *American Journal of Nursing Research*, vol.5, no. 4: 115-128. doi: 10.12691/ajnr-5-4-3.
[9]. Campbell-Yeo, M.L., Disher, T.C., Benoit, B.L., Johnston, C.C(2015),Understanding kangaroo care and its benefits to preterm infants, *Pediatric Health, Medicine and Therapeutics* 6;15–32.
[10]. Rao R, Ramji S. Pulse oximetry in asphyxiated newborns in the delivery room. Indian Pediatr 2001;38:762-6)
[11]. Bancalari A., Araneda H., Echeverría P., Alvear M. and Romero L. Arterial oxygen saturation and heart rate after birth in newborns with and without maternal bonding. Pediatrics International (2016) 58, 993–997
[12]. American Academy of Pediatrics. Textbook of Neonatal Resuscitation, 7th ed, Weiner GM (Ed), American Academy of Pediatrics, 2016.
[13]. Ersdal H, Linde J, Dlshtm E, AuestadB&Perlman B. Neonatal Outcome Following Cord Clamping After Onset of Spontaneous Respiration. Pediatrics. 2014 ;(134) 2:265-272.
[14]. World Health Organization .Guideline: Delayed umbilical cord clamping for improved maternal and infant health and nutrition outcomes. 2014.
[15]. KatheriaA,HosonoSH,El-Naggar W. A new wrinkle: Umbilical cord management (how, when, who). Seminars in Fetal and Neonatal Medicine. 2018; available at: https://doi.org/10.1016/j.siny.2018.07.003
[16]. Alenchery A, Thoppil J, Britto C, De Onis J, Fernandez L& Rao S. Barriers and enablers to skin-to-skin contact at birth in healthy neonates - a qualitative study. BMC Pediatrics .2018; 18:48 . available at: https://doi.org/10.1186/s12887-018-1033-y

[17]. Hulsoore R., Shrivastav J., Dwivedi R. (2011) Normal Oxygen Saturation Trend in Healthy Term Newborns within 30 Minutes of Birth. The Indian Journal of Pediatrics Vol. 78 (7) pp 817–820
[18]. Dawson J, Kamlin C, Vento M, Wong C, Cole T, Donath S& Colin D. Defining the Reference Range for Oxygen Saturation for Infants After Birth. Pediatrics. 2010; 125; e1340-e1347.
[19]. Habib H. Oxygen saturation trends in the first hour of life in healthy full-term neonates born at moderate altitude. Pak J Med Sci. 2013; 29(4):903-906.
[20]. Tiwari S, Tiwari S, Nangia S&Saili A. Oxygen Saturation Profile in Healthy Term Neonates in the Immediate Post Natal Period. Int J Clin Pediatr . 2013; 2(1):19-23.
[21]. Zubarioglu U, Uslu S, Can E, bulbul A&Nuhoglu A. Oxygen Saturation Levels during the First Minutes of the Life in Healthy Term Neonates. Tohoku J. Exp. Med. 2011;224:273-279.
[22]. Khriesat W, Amarin1Z, Kassab , Shkour M, & AL-Maghyreh M. Oxygen Saturation Immediately after Birth in Healthy Full-term Neonates Born below Sea Level. Journal of Clinical Neonatology.2016; 5(4):259-261.
[23]. Gautam SH &Agrawal A.Oxygen Saturation Trends In Newborn after Birth.Journal of Evolution of Medical and Dental Sciences. 2015; (4) 63: 11037-11042.
[24]. HutchonD.The normal range of heart rate at birth in a healthy term neonate: a criticalreview of the evidence.CurrPediatr Res. 2016; (20): 1 & 2.
[25]. Uwins CH &Hutchon D. Delayed umbilical cord clamping after childbirth: potential benefits to baby's health.Pediatric Health, Medicine and Therapeutics. 2014;5 :161–171.
[26]. Backes CH,HuangH,CuaCL,GargV,Smith CV, Yin H,Galantowicz M, Bauer JA& Hoffman TM. Early versus delayed umbilical cord clamping in infants with congenital heart disease: a pilot, randomized, controlled trial. J Perinatol. 2015; 35(10): 826–831.
[27]. Raju T&SingalN.Optimal Timing for Clamping the Umbilical Cord after Birth.ClinPerinatol. 2012 ; 39(4):21-29
[28]. Polglase G& Stark M. Cord clamping in term and pre-term infants: how should clinicians proceed? Med J Aust. 2018 ;(7) 208(8):330-331 available at: https://doi.org/10.5694/mja17.01287
[29]. KC A. Singhal N. Gautam J. Rana N & Andersson O. Effect of early versus delayed cord clamping in neonate on heart rate, breathing and oxygen saturation during first 10 minutes of birth – randomized clinical trial.Maternal Health, Neonatology, and Perinatology. 2019; 5:7.
[30]. Boundy E, Dastjerdi R, Spiegelman D, Fawzi W, Missmer S ,Lieberman E, Kajeepeta S, Wall S & Chan G. Kangaroo Mother Care and Neonatal Outcomes: A Meta-analysis.Pediatrics. 2016; (137)1: e20152238.

Dr. Wafaa Elarousy. "Assess Stability of Neonatal Oxygen Saturation (Spo2) with Delay Cord Clamping WhilePracticing Kangaroo Mother Care and Compare it with Defined References Ranges of Oxygen Saturation." IOSR Journal of Nursing and Health Science (IOSR-JNHS), vol. 8, no.06 , 2019, pp. 64-71.