Lateral Versus Supine Position on Breathing Patterns Among Premature Neonates: A comparative Study

Doaa Mahdey Mohamed, Prof. Safy Salah Eldin Ibrahim,* Prof. Haym Rafaat Tantawi,*

Dr. Fatam Mohamed **

Prof. of Pediatric Nursing*, Prof. of Pediatric Nursing*, Lecturer. of Pediatric Nursing**
Faculty of Nursing, Ain Shams University-Cairo-Egypt.

Abstract

Background: Positioning of preterm neonates is basic neonatal nursing care and one of the important aspects of developmental care to keep the preterm infants comfortable. Positioning premature neonates in lateral position and supine with flexion position resulted in higher mean oxygen saturation than in supine extended position.. Premature neonates with assisted ventilation benefit from positioning as it increase oxygen saturation therefore it is recommended that neonatal nurse should arrange position of premature neonates with assisted ventilation and promote flexion side-lying position. ***Aim:*** To compare the effect of lateral versus supine position on breathing pattern among premature neonates. ***Design:*** A descriptive comparative study design. ***Setting:*** At Neonatal Intensive care Units in Children's University Hospital affiliated to Ain Shams University and Saied Galal University Hospital, Al-Azhar University. ***Sample:*** A purposive sample was used to recruit 162 neonates according to certain criteria: Premature babies less than or equal 36 week, Weight between 2000: 2500 gm. ***Tools:*** 1) Pre-designed questionnaire, and 2) Observational checklist. ***Results:*** Findings of the present study showed that more than half of the studied premature neonates suffer from respiratory distress and were small for gestational age (53.1%& 59.9% respectively). Furthermore, nearly three quarters (74.1%) of the studied premature neonates were spending more than ten days in hospital. Finally, there were a highly statistical significance differences for premature neonates heart , respiratory rate and oxygen saturation at supine position at (P< 0.0001respectively). ***Conclusion:*** Supine position was an effective way to improve premature neonates cardiac and respiratory function ***Recommendations:*** 1) Promotes awareness among neonatology nurses about the benefits and importance of positioning preterm neonates in the neonatal intensive care unit to improve cardio-respiratory function of ventilated neonates, 2) Replication of the study on a larger sample and in different geographical areas in Egypt for generalization of findings.

Keywords: Premature Neonates, Lateral Position, Supine Position, Breathing Patterns.

Introduction

Premature neonates are the most common cause of death among newborns worldwide. About 15 million newborns experience preterm birth every year, 5% to 18% of all births. Approximately 0.5% of births are very viable premature births, and these account for the most deaths ***(CDC, 2017)***.

Premature births are more common in women younger than 19 or older than 40, and in those who have had a previous preterm birth. However, any woman may give birth prematurely and many who have no known risk factors ***(Gentle et al., 2018)***. Sometimes this occurs due to the mother's health conditions during pregnancy, such as gestational diabetes, high blood pressure, heart or kidney problems, an infection that particularly involves the fetal membranes, the reproductive or urinary tracts, or bleeding due to the abnormal position of the placenta ***(Hines et al., 2017)***.

A premature neonate is a newborn born before the completion of 37 weeks of pregnancy from the first day of the last menstrual period. A premature neonate is the birth of a newborn before the developing organs are mature enough to allow normal postpartum survival, regardless of the weight of the newborn ***(Banu et al., 2018)***.

Neonates born between 28 and 30 weeks lack the alveoli in the lungs and instead use the primitive alveoli and terminal bronchioles for breathing ***(Caskey et al., 2016)***. Neonates born before 32 weeks lack surfactant, a substance secreted by the lungs that is necessary to keep the alveoli open ***(Finnemore & Groves, 2015)***. The lack of structures and materials causes problems with ventilation, which is defined as the movement of air into the lungs; Ventilation problems can lead to a condition called respiratory distress syndrome ***(Hayes et al., 2019)***.

Posture is of vital importance to maintaining good lung ventilation. The effectiveness of gas exchange is affected by the mechanisms of the respiratory system; The posture has been shown to have an effect on respiratory mechanics in ventilated neonates ***(Santos et al., 2017)***. In premature neonates, positioning is used to improve oxygen transport and gas exchange by improving ventilation / perfusion (V/Q) ratio, increasing lung volumes, reducing respiratory function, reducing cardiac function, and promoting muco-ciliary mucosal clearance. There is not only an effect on the respiratory system, but also nutrition, sleep, energy expenditure, and development ***(Martin et al., 2018)***.

A variety of positions are used as therapeutic interventions for neonates being cared for in the neonatal intensive care unit. The most common are prone (lying on the stomach), supination (lying on the back) and lateral supination (side lying) ***(Roberts et al., 2017)***.

Nurses are on the front line to ensure the position of the neonates for safety of sleep, because they observe the position of the premature neonates regularly, especially during long-term stays in the neonatal intensive care unit ***(Lodha et al., 2015)***. It is important for neonatal nurses to design safe-position practices once the premature neonates is medically stable so that the parents comply with safe-positioning recommendations at home ***(Polit & Beck, 2017)***.

The breathing pattern of the premature neonate requires close follow-up, including appropriate pre-discharge assessment of the neonatal unit, scheduling of follow-up visits and any diagnostic tests, and recommendations on the topic of treatment and prevention ***(Grove & Cipher, 2017)***. Therefore, the present study aims to compare the effect of the lateral versus the supine position on the breathing pattern of premature neonates. This may contribute to a better understanding of the effectiveness of a position that improves a newborn's breathing pattern.

Significance of the study

The position of the premature neonates in the lateral and supine position with the flexion position resulted in a moderately higher oxygen saturation than in the extended supine position. Premature neonates with assisted ventilation benefit from positioning because it increases oxygen saturation, so it is recommended that the neonatal nurse arranges the positions of the preterm neonates with assisted ventilation and promotes the position of flexion and side lying ***(Abman et al., 2017)***.

Breathing problems at birth are common among very premature neonates who have very low birth weight (less than 3 pounds). Because their lungs have not fully developed, premature neonates will likely have difficulty breathing continuously or on their own, a condition known as respiratory failure. Approximately 15 million neonates, or about 1 in 10 newborns, are born prematurely annually worldwide. Across 184 countries, the rate of preterm birth has ranged from 5% to 18% of all live births. Worldwide, prematurity accounts for 75% to 80% of all newborn morbidities and deaths. The incidence of respiratory distress syndrome is 50% in newborns less than 30 weeks old, 37% in gestational age in newborns of 31 to 32 weeks, 12% in newborns of 33 to 34 weeks, and 2% in newborns of age 3 to 32 35 to 36 weeks ***(WHO, 2017)***.

Aim of the study

This study aim is to compare the effect of lateral versus supine position on breathing pattern among premature neonates.

Research question

1. What is the effect of lateral position on breathing patterns among premature neonates?
2. What is the effect of supine position on breathing patterns among premature neonates?
3. What is the different between lateral versus supine position on breathing patterns among premature neonates?

Subjects and Methods

Design:

A descriptive comparative study design was used.

Setting:

The study was conducted at the Neonatal Intensive Care Unit, Children's University Hospital affiliated to Ain Shams University and Saied Galal University Hospital, Al-Azhar University, Egypt.

Sample Type:

A purposive sample was used.

Sample size:

The actual sample size (162) that was chosen from the total number (260) of both hospitals using the sample size equation for estimation of single proportion, with finite population correction ***(Suresh & Chandrashekara, 2012)*** according to certain criteria: Premature babies less than or equal 36 weeks, Weight between 2000: 2500 gm.

Tools of data collection:

Two tools of data collection were used:

I. Pre-designed questionnaire: It consisted of two parts: (1): To assess premature neonates characteristics. (2): To assess the presence of any abnormalities in the breathing pattern of premature neonates.

II. Observational checklist: Based on the protocol of Neonatal Intensive Care Unit of Ain Shams University Hospital and consisted of two parts: (1): Down's score protocol for assessing premature neonates breathing patterns. (2): To assess the effect of different position on premature neonates breathing pattern. The scoring system of the premature newborn was assessed according to the normal ratio of three types: heart rate: normal: 120: 160 b / m, less than 120: bradycardia, over 160: tachycardia. Respiratory rate: normal: 30: 60 / c/m; less than 30: slow breathing; over 60: rapid breathing. Oxygen saturation: normal: 88: 97%, less than 88%: hypoxia, more than 97%: hyperoxia.

Methods of data collection:

The study was conducted according to the following steps:

An official approval letter clarifying the purpose of the present study was issued from the Dean of the Faculty of Nursing at Ain Shams University, to the General Director Saied Galal University Hospital, Children's University Hospital affiliated to Ain Shams University (Neonatal Intensive care Unit), and Scientific Research Ethical Committee in the Faculty of Nursing as an approval to conduct this study. The tool used in the study was developed by the researcher after reviewing the relevant and related literature. The previously mentioned settings were attended by the researchers two days/week (Saturday and Tuesday) from 9.00 a.m. to 12 p.m. This study started from beginning of January 2020, till the end of June 2020, covering six months for data collection.

Firstly, the researchers held the first meeting by interviewing each medical and nursing staff of NICU individually to introduce themselves and briefly explained the nature and the purpose of the study. They were informed that participation in this study was voluntary and they had the right to withdraw at any time without giving any reason. Oral approval of medical and nursing staff of NICU to share in this study was achieved

Secondly, pre-designed questionnaire was distributed to each medical and nursing staff for neonatal and intensive care unit to assess premature neonates socio-demographic characteristics and breathing pattern. The questionnaire took about 10-20 minutes to be completed.

Then the researchers distributed the Observational checklist to assess premature neonates breathing pattern and position. The checklist took about 15-30 minutes to be completed .

However, the researchers used the probing technique. All interviews were recorded. The validity of the tools were done through seeking the opinions of a jury group consisting of five professors of Pediatric Nursing who judged their clarity, comprehensiveness, accuracy, relevance and whether they elicited the type of information sought; thus the tools were face and content- validated. The tools were modified and rephrased based on jury's opinions. This phase took three weeks duration.

Ethical considerations:

All official permissions to carry out the study were secured from pertinent authorities. All medical and nursing staff for neonatal and intensive care unit were informed about the importance and aim of this study. Oral consents were obtained from all the medical and nursing staff for neonatal and intensive care unit. All medical and nursing staff for neonatal and intensive care unit were informed that their participation voluntary and they had the rights to withdraw at any time without giving any reason and confidentiality of the information were assured. As well, the medical and nursing staff for neonatal and intensive care unit were informed that the collected data would be used only for the purpose of the present research, as well as for their benefits.

Pilot study:

A pilot study was carried out on10 % of the studied premature neonates (16) to assess the tool clarity, applicability, and time needed to fill the study tools as well as to find out any problem that may interfere with the process of data collection. No modifications were done. The pilot study was excluded from the main study sample.

Statistical analysis:

Data was collected, coded and entered to a personal computer (P.C) IBM compatible 2.6 GHZ. They were analyzed using Statistical Package for Social Science (SPSS), under windows version 18. The collected data were organized, revised, analyzed, tabulated using number and percent distribution. Proper statistical tests were used to determine whether there were statistically significant differences between variables of the study. The statistical tests used in this study were: mean and SD for qualitative variables, T test to find relations between quantitative data. Statistical insignificant difference was considered when $P>0.05$, while it was a statistical significant difference when $P<0.05$, and statistical highly significant difference was considered when $P<0.001$.

Results:

Table (1): shows that more than one third of the studied premature neonates were in the age group ranged between $15 \leq 21$ days, with a mean age of 17.1 ± 0.4 and more than half of them were females (38.3% & 54.3% respectively).

Table (2): reveals that more than half of the studied premature neonates suffer from respiratory distress and were small for gestational age (53.1% & 59.9% respectively).

Table (3): indicates that less than half (46.3%) of the studied premature neonates their weight ranged between $1500 \leq 2000$gram at birth. Meanwhile, nearly half (50%) of them, their current weight ranged between $2000 \leq 2500$ gram with a mean age of 2700 ± 0.150.

Table (4): shows that nearly three quarters (74.1%) of the studied premature neonates were spending more than ten days in hospital.

Table (5): shows that more than one quarter of the studied premature neonates received oxygen via NC/incubator and continuous positive airway pressure (36.4% & 30.2% respectively). While, more than one third of them connected to oxygen for more than 7 days and an oxygen flow rate of 3L/m (66% & 30.9% respectively) .

Figure (1): presents that more than half of the studied premature neonates' had tachycardia in supine position as compared with 40.5% of them in lateral positions. Concerning heart rate, more than one third of them (37.5%) were in the lateral position as compared to 35% of them were in the supine position.

Figure (2): presents that the majority (80%) of the studied preterm neonates had

tachypnea during the supine position as compared to 72.5% in the lateral positions .

Figure (3): presents that the majority (80%) of the studied preterm neonates their oxygen saturation were ≥ 95 percentage in the supine position as compared to 50.0% of them in the lateral positions.

Table (6): reveals that there were a highly statistical significance differences between lateral and supine position for heart , respiratory rate and oxygen saturation at (P< 0.001 & 0.003 respectively).

Table (1): Distribution of the studied premature neonates according to their characteristics (N=162).

Items	No	%
Age of baby by days		
1-7	23	14.2
8≤ 14	34	21.0
15≤ 21	62	**38.3**
22 ≤ 28	43	26.5
Mean ±SD	**17.1±0.4**	
Gender		
Male	74	45.7
Female	88	**54.3**

Table (2): Distribution of the studied premature neonates according to their diagnosis and gestational age (N= 162).

Items	No	%
Diagnosis		
Low birth weight	54	33.3
Respiratory distress	86	**53.1**
Hyperbilirubinemia	43	26.5
Sepsis	16	9.9
Gestational age		
Small for gestational age	97	**59.9**
Appropriate for gestational age	49	30.2
Large for gestational age	16	9.9
*The number is not exclusive		

Table (3): Distribution of the studied premature neonates according to their weight (N= 162).

Items	No	%
Weight at birth by gm.		
≤ 1000	13	8.0
1000≤ 1500	51	31.5
1500≤ 2000	75	**46.3**
2000≤ 2500	10	6.2
2500≤ 3000	13	8.0
Mean ±SD	**2150 ± 0.220**	
Current neonate weight by gm.		
1000 ≤ 1500	3	1.9
1500 ≤ 2000	26	16.0
2000 ≤ 2500	81	**50.0**
2500 ≤ 3000	52	32.1
Mean ±SD	**2700 ± 0.150**	

Table (4): Distribution of the studied premature neonates according to duration of hospital stay(N= 162).

Items	No	%
Baby environment		
Incubator	162	**100.0**
Duration of Hospital Stay (Days)		
< 3	10	6.2
3 - < 6	15	9.3
6 - <10	17	10.5
≥10	120	**74.1**

Table (5): Distribution of the studied premature neonates according to their characteristics of oxygen therapy (N = 162).

Items	No	%
Type of Oxygen therapy		
Oxygen via NC/Incubator	59	**36.4**
Oxygen hood	27	16.7
Continuous positive airway pressure	49	**30.2**
Mechanical ventilation	27	16.7
Days connected to oxygen		
1-3	7	4.3
3-5	10	6.2
5-7	38	23.5
More than 7 days.	107	**66.0**
Flow rate of oxygen L/m		
1 L/m	26	16.0
2 L/m	40	24.7
3 L/m	50	**30.9**
4 L/m	46	28.4

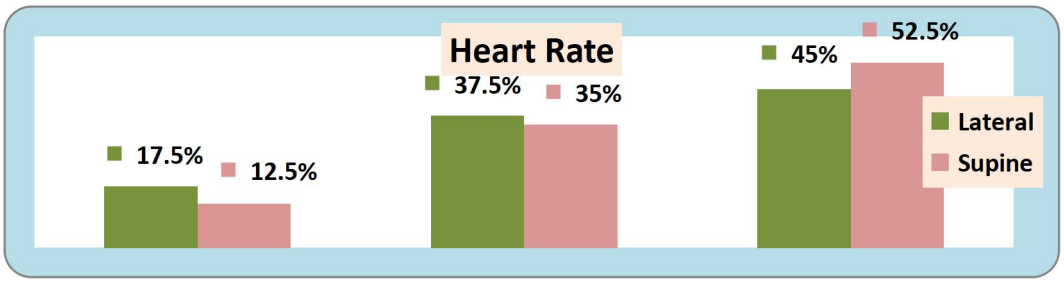

Figure (1): Distribution of the studied premature neonates according to heart rate measures during the lateral and supine position (N = 162).

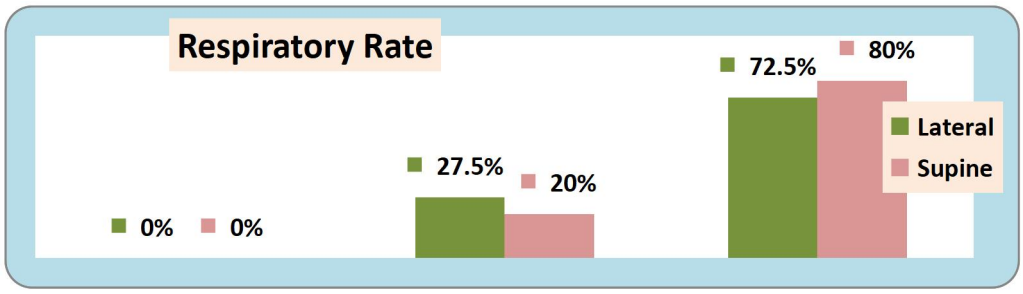

Figure (2): Distribution of the studied premature neonates according to respiratory rate measures during the lateral and supine position(N = 162).

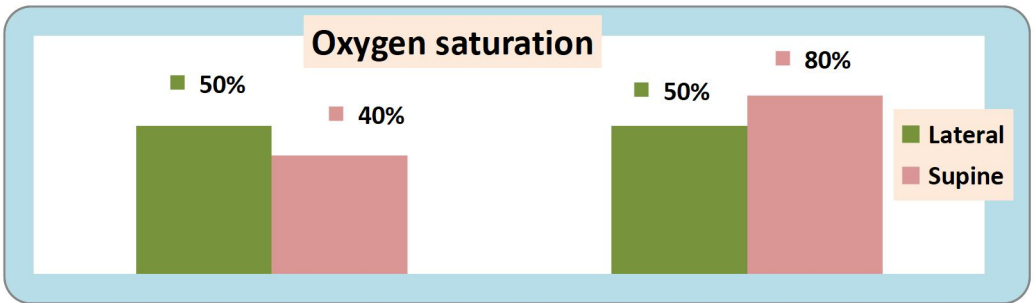

Figure (3): Distribution of the studied premature neonates according to oxygen saturation measures during the lateral and supine position (N = 162).

Table (6): Relations among neonates oxygen saturation, heart rate & respiratory rate in lateral &supine position (N = 162).

Items	Lateral	Supine	P. value
Heart rate	137.4±6.29	141.65±10.06	0.001**
Respiratory rate	53.63±11.38	59.42±11.35	0.001**
O2 Saturation	91.46±2.26	93.38±2.4	0.003**

****Highly statistical significant**

Discussion

The aim of the present study was to compare the effect of lateral versus supine position on breathing pattern among premature neonates. Regarding characteristics of the studied premature neonates, the results of the present study revealed that more than one third of the studied premature neonates were in the age group ranged between 15 ≤ 21 days, with a mean age of 17.1±0.4 and more than half of them were females respectively. These results were in partial agreement with those of ***Elsagh et al. (2019)***, who revealed that the majority of the premature neonates were in the mean age of 2.1±0.75, and more than half of them were females.

Concerning diagnosis and gestational age of the premature neonates, the results of the present study showed that, more than half of the studied premature neonates suffer from respiratory distress followed by low birth weight and were small for gestational age. These results were in partial agreement with that of ***Elsayed et al. (2017)***, who revealed that more than half of the studied premature neonates who were admitted to the neonatal intensive care unit were diagnosed with respiratory distress syndrome followed by hyperbilirubinemia.

Regarding weight of the premature neonates, the finding of the present study indicated that less than half of the studied premature neonates their weight ranged between 1500≤ 2000gram at birth. These results were in line with

those of ***Malagoli et al., (2018)***, who found that slightly less than half of them their birth weight was 1500 ≤ 2000 grams.

Concerning duration of hospital stay for the premature neonates, the finding of the present study revealed that, all the studied premature neonates were in the incubator and nearly three quarters of them were spending more than ten days in hospital. This result was in partial agreement with that of ***El-Nagger*** and ***Bayoumi, (2016)***, who found that slightly more than one-fourth of premature infants in the study group their duration of hospital stay was 3-< 6 days.

Results of the current study presents that, , more than one quarter of the studied premature neonates received oxygen via NC/incubator and continuous positive airway pressure respectively. According to ***Gouna et al.,2013*** and ***El Sayed et al., (2017),*** who pointed out to the left-lateral and prone positions could improve pulmonary function.

Finding of the present study showed that, more than half of the studied premature neonates' had tachycardia in supine position as compared with more than one third of them in lateral positions. This result was argued with ***Babuyeh et al., (2018)***, who found that, no significant differences in heart rate among the studied positions; however, the stroke volume and cardiac output showed significant reductions in the prone position.

These results were in line with those of ***Mohammed & Fathia, (2020)***, who conducted a study on the effect of different body positions on cardiorespiratory parameters of preterm neonates undergoing mechanical ventilation and found that, tachycardia was noticed among more than half of the studied preterm neonates during the supine position, and more than one-third in the right lateral and semi-prone positions respectively with statistically significant differences between the preterm neonates during the three different body positions.

Considering respiratory rate of the premature neonates during the lateral and supine position, the present study showed that, the majority of the studied preterm neonates had tachypnea during the supine position as compared to nearly three quarters of them in the lateral positions. These results were in agreement with the result of ***Yin et al., (2016),*** who conducted a study on the influence of the semi-prone position on respiratory rate variability by using nasal CPAP and mentioned that, the mean respiratory rate was significantly higher in the supine positions than in lateral position.

Regarding to the oxygen saturation of premature neonates during the lateral and supine position, the present study revealed that, the majority of the studied preterm neonates their oxygen saturation were ≥ 95 percentage in the supine position as compared to half of them in the lateral positions. This result was contradicted with that of ***Kayton et al., (2018)***, who indicated that the mean SaO2 was not significantly different among the evaluated positions.

A recent study carried out by ***Prasenjit et al., (2015)***, who mentioned that, the preterm infant's positioning is a basic nursing care in the NICU that includes a head up tilted, supine, side-lying and prone positions.

Finding of the present study showed that, there were highly statistical significance differences between lateral and supine position for heart , respiratory rate and oxygen saturation. This result was consistent with ***Burg et al., (2016)***, who also found that highly statistical significance differences between lateral and supine position for heart and respiratory rate and oxygen saturation .

Conclusion:

Supine position was an effective way to improve premature neonates cardiac and respiratory function. Furthermore,there were a highly statistically significant difference between lateral position and supine position in relation to respiratory, heart rate and oxygen saturation .

Recommendation:

Educational programs to improve the knowledge and practices of NICU nurses about developmental support positions. Promotes

awareness among neonatology nurses about the benefits and importance of positioning preterm neonates in the neonatal intensive care unit to improve cardio-respiratory function of ventilated neonates. Replication of the study on a larger sample and in different geographical areas in Egypt for generalization of findings.

References:

Abman, S. H., Bancalari, E., & Jobe, A. (2017): The evolution of bronchopulmonary dysplasia after 50 years. American Journal of Respiratory and Critical Care Medicine, 195(4), 421-424.

BabuyehT., Farhadi R., Zahed Pasha Y. and Mojaveri M. (2018): The Impacts of Prone Position on The Blood Oxygen Saturations and Heart Rates of Preterm Infants Under Mechanical Ventilation. Caspian J Pediatr.; 4(2): 301-5.

Banu Pasha Asfia, Chen Xiao-Qing And Zhou Guo- Ping, Bronchopulmonary dysplasia. (2018): Pathogenesis and treatment (Review), Experimental And Therapeutic Medicine 16: 4315-4321, 2018

Burg M, Romantsik O, Zappettini S, Ramenghi LA, Calevo MG. (2016): Transcutaneous carbon dioxide monitoring for the prevention of neonatal morbidity and mortality. Cochrane Database Syst Rev. 2016; 2.

Caskey, S., Gough, A., Rowan, S., Gillespie, S., Clarke, J., Riley, M., McGarvey, L. (2016): Structural and functional lung impairment in adult survivors of bronchopulmonary dysplasia. Annals of the American Thoracic Society, 13(8):1262-70.

Center for Disease Control and Prevention. (2017): Preterm birth. Retrieved from https://www.cdc.gov/reproductivehealth/maternalinfanthealth/pretermbirth.htm

El-Nagger, s and Bayoumi. R. (2016): Effect of Applying Nesting Technique as a Developmental Care on Physiological Functioning and Neurobehavioral Organization of Premature Infants. Life Sci J; 13(1s):79-92.

Elsagh A., Lotfi R., Amiri S. and Gooya H. (2019): Comparison of Massage and Prone Position on Heart Rate and Blood Oxygen Saturation Level in Preterm Neonates Hospitalized in Neonatal Intensive Care Unit: A Randomized Controlled Trial. Iran J Nurs Midwifery Res; 24(5): 343-7.

El Sayed, R. Abusaad, E. Nasef, A. (2017): The Effectiveness of Developmentally Supportive Positioning on Preterm Infants' Pain Response at Neonatal Intensive Care Units. American Journal of Nursing Science. 6(1): 63-71.

Finnemore, A., & Groves, A. (2015): Physiology of the fetal and transitional circulation. Seminars in Fetal & Neonatal Medicine, 20(4): 210-216.

Gentle, S. J., Travers, C. P., & Carlo, W. A. (2018): Caffeine controversies. Current Opinion in Pediatrics, 30(2):177-81.

Gouna G, Rakza T, Kuissi E, Pennaforte T, Mur S, Storme L. (2013): Positioning effects on lung function and breathing pattern in premature newborns. J Pediatr.; 162(6):1133-7.

Grove, S. K., & Cipher, D. J. (2017): Statistics for nursing research: A workbook for evidence-based practice (2nd ed.). St. Louis, MO: Elsevier.

Hayes D, Wilson, KC; Krivchenia, K; Hawkins, SMM; Balfour-Lynn. (2019): Home Oxygen Therapy for Children. An Official American Thoracic Society Clinical Practice Guideline". American Journal of Respiratory and Critical Care Medicine. 199 (3): e5–e23.

Hines, D., Modi, N., Lee, S. K., Isayama, T., Sjors, G., Gagliardi, L. (2017): International Network for Evaluating Outcomes (iNeo) of Neonates. Scoping review shows wide variation in the definitions of bronchopulmonary dysplasia in preterm infants and calls for a consensus. Acta Paediatrica, 106(3): 366-374.

Kayton, A., Timoney, P., Vargo, L., & Perez, J. A. (2018): A review of oxygen physiology and appropriate management of oxygen levels in premature neonates. Advances in Neonatal Care. Advance online publication. 18(2):98.

Lodha A, Seshia M, McMillan DD, Barrington K, Yang J, Lee SK, et al. (2015): Association of early caffeine administration and neonatal outcomes in very preterm neonates. JAMA Pediatr 2015; 169:33–8.

Malagoli R., Fagundes F., Santos A., Oliveira E., Cândida M. and Bouzada F. (2018): Influence of Prone Position on Oxygenation, Respiratory Rate and Muscle Strength in Preterm Infants Being Weaned from Mechanical Ventilation; Rev Paul Pediatr; 30(2): 251-6.

Martin, J. A., Hamilton, B. E., & Drake, P. (2018): National vital statistics reports. births: Final data for 2018. (No. 1).

Mohammed. H and Fathia. M . (2020): "Effect of Different Body Positions on Cardiorespiratory Parameters of Preterm Neonates Undergoing Mechanical Ventilation." American Journal of Nursing Research, 8(4): 463-470.

Polit, D. F., & Beck, C. T. (2017): Nursing research: Generating and assessing evidence for nursing practice (10th ed.). Philadelphia, PA: Wolters Kluwer Health.

Prasenjit, H., Debabrata,B., and Arindam, B. (2015): Developmentally Supportive Care In Neonatal Intensive Care Unit (NICU):-A Review, Indian Journal of Medical Research and Pharmaceutical Sciences; 2(2): 34.

Roberts, D., Brown, J., Medley, N., & Dalziel, S. R. (2017): Antenatal corticosteroids for accelerating fetal lung maturation for women at risk of preterm birth. The Cochrane Database of Systematic Reviews, 3, CD004454.

Santos A., Viera C., Bertolini G., Osaku E., Costa C. and Grebinski A. (2017): Physiological and Behavioral Effects of Preterm Infant Positioning in A neonatal Intensive Care Unit. British Journal of Midwifery; 25 (10).

Suresh, K., & Chandrashekara, S. (2012). Sample size estimation and power analysis for clinical research studies. Journal of human reproductive sciences, 5(1), 7.

World Health Organization. (2017): Preterm Birth. Retrieved from http://www.who. int/mediacentre/factsheets/fs363/en/

Yin T, Yuh YS, Liaw JJ, Chen YY, Wang KW. (2016): Semi-prone position can influence variability in respiratory rate of premature neonates using nasal CPAP. J Pediatr Nurs. 2016; 31(2):e167-74.

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