An-Najah National University

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Effectiveness of the Prone Position on Cardio-Respiratory Clinical Outcomes for the Neonates with Acute Respiratory Distress Syndrome

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Dedication

For people who have been with me since the first breath, the first laugh, the first word and the first step in my life for my dear parents.

To the people who gave me all the support, courage and standing by my side no matter what I walk all the way to achieve all my dreams, for my family, brothers and sisters.

To my friends who walked with me all the way, share wonderful moments and had a great time together.

To my professors who taught me in school and university and who have their own clear touches.

Finally, to all of those who sacrificed their lives for their dignity, I dedicate these lines.

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I have no valuable words to express my thanks, but my heart is still full of the favors' received from every person.

الأقرار

انا الموقع ادناه مقدم الرسالة التي تحمل العنوان:

Effectiveness of the Prone Position on Cardio- Respiratory Clinical Outcomes for the Neonates with Acute Respiratory Distress Syndrome

أقر بأن ما اشتملت عليه هذه الرسالة انما هي نتاج جهدي الخاص، باستثناء ما تم االشارة اليه حيثما ورد، وان هذه الرسالة ككل او اي جزء منها لم يقدم لينل اي درجة او لقب علمي او بحثي لدى اي مؤسسة تعليمية او بحثية اخرى

Declaration

The work provided in this thesis, unless otherwise referenced, is the researcher's own work and has not been submitted elsewhere for any other degree or qualification.

Student Name:	اسم الطالب :
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List of Abbreviations

ABG	Arterial Blood Gases
ANOVA	Analysis of variance
ARDS	Acute Respiratory Distress Syndrome
BNP	Brain Natriuretic Peptide
BPM	Breaths Per Minute
Bpm	Beats Per Minute
Cm	Centimetre
COVID-19	Coronavirus disease
CPAP	Continuous Positive Airway Pressure
CVC	Central Venous Catheter
F	Repeated ANOVA measures
FiO_2	Fraction Of Inspired Oxygen
G	GRM
GS	Gaza Strip
HF	Heart Failure
HFOV	High Frequency Oscillatory Ventilator
HP	Heel Prick
HR	Heart Rate
ICU	Intensive Care Unit
IRP	International Research Project
IV	Intravenous
IVF	In Vitro Fertilisation
KG	kilogram
L/min	Litre Per Minute
LBW	Low Birth Weight
LSCS	lower (uterine) segment Caesarean section
mmHg	Millimetre Of Mercury
MOH	Ministry Of Health

N	Number
N-CPAP	Nasal Continuous Positive Airway Pressure
NICU	Neonatal Intensive Care Unit
P	Prone
$Paco_2$	Partial Pressure Of Carbon Dioxide
PaO_2	Partial Pressure Of Oxygen
PEEP	Positive End-Expiratory Pressure
pH	Acidic/Basic Water
RDS	Respiratory Distress Syndrome
RR	Respiratory Rate
SD	Standard Deviation
Spo_2	Oxygen Saturations
SPSS	Statistical Package for the Social Sciences
SSC	Sample Size Calculator
T	t-test
TPN	Total Parenteral Nutrition
USA	United States Of America
UVC	Umbilical Vein Catheter
VS	Versuse
WB	West Bank
WK	Weeks
χ^2	Chi-Square Test

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Abstract

Background: Acute Respiratory Distress Syndrome (ARDS) is a common health concern for health care providers, families of neonate's patients in intensive care units, which is characterized by high mortality. Prone positioning has been increasingly used in the treatment of ARDS neonates over the past few years where this technique is now known as an easy and effective procedure for optimizing oxygenation.

Aim: The study aims to evaluate effectiveness of prone position on cardio respiratory clinical outcomes for neonates with ARDS admitted to NICU.

Method: A Quasi-experimental research design was used in this study. The sample of the study consisted of 100 neonates (50 interventional and 50 control), utilizing simple random sampling method. An observation checklist was used to achieve the study objectives. The data was saved into a computer and analyzed using SPSS V25.0 program.

Results: The study findings showed that 50% (n=50) of participant neonates are males and 50% are female. The gestational age and gender were matched between two groups, the age was 34.1±1.4 days among the interventional group while 34.0±1.4 days among the controls group. As for

type of delivery, 79% of participants had a normal vaginal delivery, while 21% had LSCS. Also, 5-minutes Apgar score for participants were ranged between 5-10; whereas 37% of participants, their Apgar score was 9. There is no statistically significantly different between intervention group and control group regarding chronological age, type of delivery and weight at the time of the study, birth height, the reason of Acute Respiratory Distress Syndrome and name of another position rather than a prone position. The mean of respiratory rate at 2 hours has significantly decreased in the interventional group compared to controls. In contrast, oxygen saturation at 2 hours was statistically significantly elevated in the intervention group compared to control group (96.9±3.3 vs. 94.3±4.9%, respectively), this change was statistically significant (t=3.205, P=0.002). In addition, agitation cry complication resulting from prone positioning of the neonates are statistically significant lowering among intervention groups compared to control group for 0 min, 1 hour and 2 hours while no statistically significantly different in other complications resulting from prone positioning of the neonates.

Conclusion: The chi-square test showed that there is a statistically significant lowering percentage in present lethargic complication at 0 minutes among interventional groups compared to control groups (28.0% vs. 48.0%, respectively, P = 0.039). In contrast, there is no statistically significantly difference among intervention group compared to control group reading other complications). Repeated ANOVA measures pointed out that there is statistically significant different in 0 min, 1 Hour and 2

hours among interventional groups compared to control group regarding respiratory rate (P < 0.001 & effect size = 34.5%); Oxygen saturation (P = 0.001 & effect size = 9.4%) and Pao2 (P = 0.001 & effect size = 39.8%). Also, post hoc test (LSD) demonstrated that it is statistically significantly difference in 0 minutes compared to 1 hour; 0 minute compared to 2 hours &1 hours compared to 2 hours. In contrast, repeated ANOVA measures showed that there is no statistically significant difference among interventional groups compared control group regarding heart rate & Paco2.

Key words: Prone position, cardio, respiratory, clinical outcomes, neonates, NICU, ARDS, Acute Respiratory Distress Syndrome.

Chapter One

Introduction

1. Introduction

This chapter contain an overview and general information about ARDS in neonates and effectiveness of the prone position on cardio- respiratory clinical outcomes; Also, it includes research questions, problem statement & reasons for conducting this study; research significance; objectives; research hypothesis; and research feasibility & cost.

1.1. Research Overview

Every family looks forward to the birth of a healthy newborn. It is an exciting time with so much to enjoy though unforeseen challenges and difficulties occur along the way in some cases. Infant Acute Respiratory Distress Syndrome (ARDS) is a challenging problem and reflects a substantial significant morbidity and mortality rates. Many of ARDS complications are preventable, but it requires early recognition and immediate management. Despite the implementation of supportive treatment interventions, ARDS mortality rates continue to be high, ranging from 30% to 40% (Sharma, Arora, Sarkar, & Puliyel, 2016).

ARDS stands for "Acute Respiratory Distress Syndrome." It is the most common lung disease in premature infants and it occurs because the baby's lungs are not fully developed. The more premature the infant, the more likely it is for the baby to have ARDS. Acute respiratory distress syndrome (ARDS) happens when a baby's lungs are not fully developed and cannot provide enough oxygen, causing breathing difficulties. It usually affects premature babies. It's also known as Acute Respiratory Distress Syndrome, hyaline membrane disease or surfactant deficiency lung disease. fetus's lungs start making surfactant during the third trimester of pregnancy, or weeks 26 through labor and delivery. Surfactant coats the insides of the air sacs, or alveoli, in the lungs. Babies who have ARDS may show these signs: Fast breathing, Retractions (The skin pulls in between the ribs or under the rib cage during fast and hard breathing), Grunting (an "Ugh" sound with each breath), Flaring (widening) of the nostrils with each breath, Baby needs extra oxygen to keep the skin pink (Nationwide Children's Hospital, 2011).

Acute Respiratory Distress Syndrome (ARDS) is characterized by severe hypoxaemia, small volumes of the lung, diminished respiratory compliance, and radiographical diffuse bilateral infiltrates (Pelosi, Brazzi, & Gattinoni, 2002).

The prevalence of ARDS-related clinical disorders varies based on the geographical area, available health- care services and whether they are resource- poor or resource- rich (Matthay, et al., 2019).

In neonatal period, optimal oxygenation plays an important role, since both hypoxia and hyperoxia damage infants, particularly premature ones. Therefore, it is necessary to maintain proper level of oxygen saturation depending on the gestational age.

There are different types of respiratory care for improving and maintaining the optimal oxygenation and heart rate within the optimal range. Therefore, the selection of proper positioning for babies with respiratory distress is a significant factor (Babaei, Pirkashani, & soleimani, 2019).

Positioning of neonates not only has a significant effect on their neurological developments, but may also minimize the long-term prematurity complications (Rad, Mojaveri, Hajiahmadi, Ghanbarpour, & Mirshahi, 2016). Positioning is a significant factor related to ventilation (Eghbalian & Moeinipour, 2008). Although the best method for positioning of newborn babies is unknown, yet some researches, have reported that a supine position has shown as a suitable positioning for low-birth infants since the prone position increases the pressure of the abdominal contents to the diaphragm, and reduces the volume of the lung which lead to worsening oxygenation; whereas in other researches, the prone position is effective in improving oxygenation in infants with very low birth weights. A prone position has several possible beneficial effects including decreased gastro-esophageal reflux, improved oxygenation, improved breathing control, and reduced heart rate variability (Rad, Mojaveri, Hajiahmadi, Ghanbarpour, & Mirshahi, 2016).

Prone positioning was first suggested as a method of improving gas exchange in ARDS in the 1970s (Scholten, Beitler, Prisk, & Malhotra, 2017).

Prone positioning has been increasingly used in the treatment of ARDS patients over the past few years and this technique is now known as an easy and effective procedure for optimizing oxygenation. However, the physiological processes causing respiratory function improvement as well as the real clinical benefit are still not well understood (Pelosi, Brazzi, & Gattinoni, 2002).

Prone positioning is now considered as one of the most effective strategies for severely ARDS patients (Gattinoni, Busana, Giosa, Macrì, & Quintel, 2019).

Present research clearly confirms the beneficial impact of prone positioning on lung safety, respiratory mechanics, gas exchange, and hemodynamics as it redistributes transpulmonary pressure, stress, and strain throughout the lung and unloads the right ventricle (Koulouras, Papathanakos, Papathanasiou, & Nakos, 2016). The factors affecting the time course of alveolar recruitment individually and the oxygenation improvement during prone positioning have not been well characterized. Although the response of patients to prone positioning is very variable and difficult to predict, major randomized trials and recent meta-analysis indicate that prone position in conjunction with a lung-protective strategy will improve survival in patients with ARDS if performed early and in adequate time (Koulouras, Papathanakos, Papathanasiou, & Nakos, 2016). And according to some research, when babies are put in prone position, the frequency of stress behaviors is lower (Sharma, Arora, Sarkar, & Puliyel, 2016).

Therefore, this study aims to evaluate the effectiveness of positioning neonates with ARDS in prone position compared positioning neonates in any other allowed position.

1.2. Research questions

- Is positioning of the neonates admitted to NICU with ARDS in prone position “interventional group” has an effect on cardio respiratory clinical outcomes (heart rate, respiratory rate, spo_2 and arterial blood gases) compared to other ARDS neonates in other positions “control group”?
- What are the results of measuring the heart rate, respiratory rate, spo2 and arterial blood gases for interventional and control groups of neonates?
- What are the demographic characteristics for interventional and control groups of neonates (age, gestational age, birth weight, and gender etc.)?
- Is there any complication resulting from positioning of interventional and control groups?

1.3. Problem Statement

Acute Respiratory Distress Syndrome is a condition associated with heterogeneous underlying pathological processes. It is a common health concern for patients in intensive care unit, which is characterized by high mortality (Koulouras, Papathanakos, Papathanasiou, & Nakos, 2016).

ARDS most often occurs in the cases of severe trauma, aspiration of gastric contents, sepsis, and pneumonia. It found in ~10% of all ICU patient's around the world. Despite some progress, mortality in most researches remains high at 30–40% even with progress in supportive therapies (Matthay, et al., 2019).

It is a significant cause of children or neonate's mortality and morbidity. Mechanical ventilation and intensive care admission are also needed for children with ARDS. Unfortunately, beyond lung protective ventilation, there are limited data to support ARDS management strategies (Orloff, Turner, & Rehder, 2019). And also, there is not any available clear study about the effect of this position on cardio respiratory clinical outcomes.

The positioning of preterm infants is a basic neonatal nursing care, which involves head up tilted, side-lying, prone and supine position. A variety of outcomes affected by various body positioning of preterm infants have been reported in several researches. It has been shown that the prone positioning has many benefits for prematurely born infants. In the prone position, preterm infants spend less waking time and more time quiet and asleep. Prone position is reported that it can facilitate improvement of respiratory status, organize digestive functions, and improve lung and cardiovascular development. Most of caregivers assume that premature and infants with low birth weight are at ease and sleep comfortably in prone position. Some research showed that the cardio-respiratory status of infants is improved in prone position, although some other research found that supine position had better effect. other research reported that there was no significant difference between different positions too. (Ghorbani, Asadollahi, & Valiz, 2013).

Although there is a lack of actual scientific research about the effect of prone position on cardio respiratory clinical outcomes for the neonates admitted to NICU with Acute Respiratory Distress Syndrome in the West

Bank. Therefore, the researcher wanted to focus in this proposed study and shed light on the effects of prone positioning to improve the respiratory function outcomes in NICU neonates aiming at reducing morbidity and mortality of these children. Thus, such research and investigation will help to find out the correct position in managing ARDS where prone position is expected to have the effects on cardio respiratory clinical outcomes.

1.4. Study Significance

In preterm infants, optimum oxygenation is very important, such that both hyperoxia and hypoxia cause damage to infants, including premature ones. Therefore, it is necessary to maintain an adequate oxygen range according to age of the babies and their gestational age in neonatal medicine. There are different methods for enhancing and maintaining the heart rate and optimal oxygenation within suitable ranges including respiratory care and pharmacotherapy. Choosing the correct positioning of the infants on a hospital bed is one of the methods that are important for researchers (Eghbalian & Moeinipour, 2008).

The study will encourage future research in the field of effectiveness of prone positions on ARDS; it will also increase awareness among health caregivers about the importance of not neglecting any symptoms or complications; as well as regarding Acute Respiratory Distress Syndrome positioning.

After searching local studies, it was noted that there are no studies of this type and this study will be the first in Palestine to evaluate of effectiveness of prone position on cardio respiratory clinical outcomes for the neonates who admitted to NICU with Acute Respiratory Distress Syndrome.

1.5. Objectives

The general objective of the study is to evaluate of effectiveness of prone position on cardio respiratory clinical outcomes for the neonates who admitted to NICU with Acute Respiratory Distress Syndrome.

Moreover; this study will measure the following parameters to achieve the study objectives:

- Identify the demographic characteristics of the neonates (age, gestational age, birth weight, and gender, etc.).
- Evaluate heart rate, respiratory rate, spo_2 and arterial blood gases for interventional and control groups of neonates.
- Ascertain whether the positioning of the neonates who admitted to NICU with ARDS in prone position “interventional group” has a different clinical outcome compared to other ARDS neonates in other positions “control group”.
- Assess the neonates for any complication resulting from prone positioning.
- Write recommendations for decision makers and neonatal nurses regarding positioning.

1.6. Research Hypothesis

There is no significance difference at the level ≤ 0.05 in (age, gestational age, birth weight, and gender, etc.) between neonates who admitted to

NICU with ARDS & poisoning on prone position “interventional group” and other ARDS neonates on other positions “control group”.

There is no significance difference at the level ≤0.05 in heart rate between neonates who admitted to NICU with ARDS & poisoning on prone position “interventional group” and other ARDS neonates on other positions “control group”.

There is no significance difference at the level ≤0.05 in respiratory rate between neonates who admitted to NICU with ARDS & poisoning on prone position “interventional group” and other ARDS neonates on other positions “control group”.

There is no significance difference at the level ≤0.05 in SPO_2 between neonates who admitted to NICU with ARDS & poisoning on prone position “interventional group” and other ARDS neonates on other positions “control group”.

There is no significance difference at the level ≤0.05 in arterial blood gases between neonates who admitted to NICU with ARDS & poisoning on prone position “interventional group” and other ARDS neonates on other positions “control group”.

1.7. Feasibility and cost

This study was conducted in NICU ward at Rafedia governmental hospital, in Nablus city, as requirement for the study at medical health department for nursing, faculty of graduate studies, An - Najah National University in order to obtain master degree in specialist of critical medical care. Also, it is supervised by medical health department for nursing at An - Najah National University.

The ideas were discussed and exchanged with high responsible persons, from medical health department, who are specialists either in the nursing, neonates, pulmonology or cardiology field, and with other partners in the same clinical employment; made the implementation of this study more feasible.

This study was self-funded, the researcher responsible for all cost; Also responsible for the credibility of ideas and information within this thesis.

Chapter 2

Theoretical Framework and Literature Review

2. Theoretical framework and literature review

This chapter contain two parts, the first part is theoretical framework which focus on explain and define prone, lateral & supine positions; also, it focus on cardio respiratory clinical outcomes "HR, RR, Spo2, ABG, $Paco_2$ and Pao_2"; definition of neonate, NICU & Acute Respiratory Distress Syndrome; clinical manifestations, pathophysiology, etiologic factors, diagnosis, treatment, and complications of ARDS. While the second part is containing the source of literatures and the summarizations of the literatures.

2.1. Theoretical framework

2.1.1. Positions

Newborns admitted to an intensive care unit often need help breathing (mechanical ventilation). This support is generally provided by a device placed inside the newborn's nose or mouth (which sometimes reaches the trachea), through which different pressures and concentrations of oxygen are sent. The usual practice is to position the newborn in supine (face-up) position during ventilation. However, it is not certain whether other positions, for example, “face-down” (prone position), could be more advantageous for breathing and survival or not (Rivas-Fernandez, Figuls, Diez-Izquierdo, Escribano, & Balaguer, 2016).

- **Prone position:**

It is an anatomical concept where the patient lies on the abdomen. It is used for a wide variety of medical procedures. It keeps the hips in an extended position, stretches the trunk and extremities and provides good bronchioles drainage. Also, it improves arterial oxygenation in critically ill patients with ARDS and others who are mechanically ventilated (Timby, 2009).

Figure (2.1): Prone position. ***Source:*** **(Carey, 2018).**

- **Supine position:**

It also calls horizontal position. An individual is in the supine posture when lying straight on the back in such a way that the body's front and the face are upwards. That is to say, while the body's dorsal side faces downwards, the ventral side facing up (Registered Nurse Team, 2020).

The supine posture is the most widely used posture for the surgery. It is the main position for most abdominal surgery and is often used in thoracic surgery, cosmetic operations, otorhinolaryngologic, ophthalmological, urological and orthopedic (Dybec, Kneedler, Pfister, Devitt, & Adams, 2009).

Figure (2.2): Supine position. ***Source:*** **(Carey, 2018).**

- **Lateral position:**

The term "lateral" means "to the side" and "recumbent" means "to lay back," and can be on either the right or the left. Persons lies on their Rt side, in the position of the right lateral recumbent.

This posture makes it probably see the patient's left side. It is worth noting that the recumbent position on the left side is opposite to the recumbent position on the right side. The person is lying on the left side in this position. This allows access to the right side of a patient easily (Bailey, 2019).

Figure (2.3): Lateral position. ***Source:*** **(Carey, 2018)**

2.1.2. Cardio respiratory clinical outcomes

- **Heart rate (HR):**

One of the most basic life and wellbeing indicators for newborn babies is heart rate or pulse, the heart rate is the physiological measurement that can be readily calculated, the standard range ranges from 110 to 160 beats per minute. It is can counted manually, heard by the stethoscope or by using monitor, (note that a complete 1 minute taken for manual or stethoscope), it is necessary to reflect whether babies complain of heart rate irregularities such as tachycardia or bradycardia (Wilson & Hockenberry, 2010).

- **Respiratory rate (RR):**

One of the most fundamental measures and indicators of life and health for newborn babies is the respiratory rate or breathing rate, the respiratory rate is the physiological parameter that can be easily calculated, and the normal range ranges from 40 to 60 breaths per minute. It may take manual or by using monitor, (note that a complete 1 minute taken for manual) by monitoring abdominal movement, it is important to reflect if babies complain of irregular heart rate such as tachypnea or bradypnea (Wilson & Hockenberry, 2010).

- **Oxygen saturations (Spo2):**

It is a measure of the amount of hemoglobin that is bound to molecular oxygen at a given time point. It is a major and significant parameter for the treatment of patients in a clinical setup (Dutta, 2020).

Saturations of oxygen in infants indicate that 95% of infants maintain SpO2 at or above 93-97% when they breathe naturally, based on their age, the best sites to do the pulse oximeters for babies are around their palm and the foot. The baby pulse oximeter probe, is the best early reflection for babies with hypoxia or need to oxygen support (Wilson & Hockenberry, 2010).

- **Arterial blood gases:**

An arterial blood gas (ABG) test measures the O2&CO2 levels in the blood and the acidity (pH) from an artery. This test is used to assess lungs efficiently in pumping O2 into the blood and extract Co2 from the blood. As blood passes through lungs, O2 flows through the blood, while Co2 flows out of the blood into the lungs. An ABG procedure uses blood collected from an artery where the levels of O_2 and Co_2 can be determined before entering the body's tissues (Alberta Healthwise Staff, 2019).

Blood gases are important to determine the adequacy of respiratory function (ventilation and oxygenation) and the acid-base balance of the baby.

❖ The following sites can be used to take blood gases:

- Arterial sites: Arterial stabs can be obtained from the brachial artery or from the radial artery (provided there is also a palpable ulnar pulse), as an indwelling arterial line or a peripheral arterial stab, as this is in close proximity to the median nerve. To test PO2, arterial specimens are needed. It is often necessary to note the FiO2 (oxygen inspired percentage) when interpreting blood gases.
- Venous sites: (from an intravenous cannula) more accurate from umbilical vein catheter (UVC) or central venous catheter (CVC) than peripheral IV.
- Capillary sites: (heel prick) it is the lowest advantageous specimens, especially if the baby is cold or has reduced perfusion.
- (Safer Care Victoria, 2016).

The study focused on two parts of the arterial blood gases, which are Paco2 and Pao2.

❖ Partial pressure of carbon dioxide (Paco2):

Is the measure of CO_2 within arterial or venous blood. It often serves as a sign of proper alveolar ventilation within the lungs. In general, the value of PCO_2 varies from 35 to 45 mmHg under normal physiologic conditions (Messina & Patrick, 2019). It reflects if baby suffer from respiratory acidosis or alkalosis, A high PCO_2 (>45mmhg) is compatible with a respiratory acidosis and a low PCO_2 (<35mmhg) with a respiratory alkalosis (Wilson & Hockenberry, 2010).

❖ Partial pressure of oxygen (Pao2):

This measures the pressure of oxygen dissolved in the blood and how well oxygen is able to move from the airspace of the lungs into the blood (Alberta Healthwise Staff, 2019). The neonatal PaO2 is around 55 to 75 mm Hg, rarely >80 mm Hg, based on the alveolar gas equation and intra- and extra pulmonary shunts. However, when we give infants FiO2>0.21, it is impossible to predict how high the PaO2 is when the SaO2 is 97 to 100% (Sola, Saldeño, & Favareto, 2008).

2.1.3. Neonates

A newborn infant, or neonate, is an infant under the age of 28 days. The infant is at greater risk of death within these first 28 days of life. The vast majority of newborn deaths occur in developing countries that suffering from limited access to healthcare (WHO, 2015).

2.1.4. NICU

Neonatal Intensive Care Unit: It is a department that containing and fitted with advanced instruments and specialized health team to provide intensive care and treat of premature or critically ill newborn babies.

2.1.5. Acute Respiratory Distress Syndrome

2.1.5.1. Definition of ARDS

Acute Respiratory distress syndrome (ARDS) it is the difficulty in neonate breathing due to surfactant deficiency at birth. ARDS, also known as hyaline membrane disease (HMD), is the dominant clinical problem faced by preterm infants and is directly related to structurally. ARDS is caused by not having enough surfactant in the lungs. Surfactant is normally produced by healthy lungs. It spreads like a thin film over the tiny air sacs in the lungs and helps to keep the air sacs open. The air sacs must be open for proper breathing to allow oxygen to enter the blood from the lungs and carbon dioxide to be released from the blood into the lungs. (Nationwide Children's Hospital, 2011).

2.1.5.2. Clinical manifestations

ARDS begins shortly after birth and is manifested by fast breathing (more than 60 breaths per minute), a fast heart rate, chest wall retractions, expiratory grunting, nasal flaring and blue discoloration of the skin during breathing efforts, pneumothorax. As the disease progresses, the baby may develop ventilator failure (rising carbon dioxide concentrations in the blood) and prolonged cessations of breathing ("apnea") (Nationwide Children's Hospital, 2011).

Initially, ARDS is similarly akin to severe pulmonary hemodynamic edema. Acute phase of ARDS is distinguished by a sudden onset of severe shortness of breath, usually appear after 12 to 48 hours from the event begins. Arterial hypoxemia has a characteristic that does not lead to supplemental oxygen. The findings of chest x-ray are closed to those seen with cardiogenic pulmonary edema and are seen as bilateral infiltrates that worsen rapidly. The acute lung injury then developed to fibrosing alveolitis with persistent, severe hypoxemia. Alveolar dead space (ventilation to alveoli, but poor perfusion) are increased in the patient; and also decreased pulmonary compliance ('stiff lungs' that are difficult to ventilate) (Smeltzer, Hinkle, Bare, & Cheever, 2010).

Clinically, once the lungs become more compliant, the chest x-ray improves and the hypoxemia gradually resolves; the client is assumed to be in the phase of recovery (Smeltzer, Hinkle, Bare, & Cheever, 2010).

2.1.5.3. Pathophysiology

Acute Respiratory distress syndrome (ARDS) is a major cause of neonatal mortality and morbidity, especially in preterm infants. It’s a etiology includes developmental immaturity of the lungs, particularly of the surfactant synthesizing system. Surfactant is produced, stored and recycled by type II pneumocytes and is detectable from about 24 weeks’ gestation. It is a mixture of phospholipids, neutral lipids and proteins and is spread as a film over the alveolar surface to lower surface tension and to prevent alveolar collapse. The resulting clinical correlates of ARDS can be predicted from the immature lung structure and atelectasis which occur due to surfactant deficiency. Various clinical factors are known to irregulated surfactant production and function, leading to the development of ARDS.

Apart from preventing the incidence of prematurity, antenatal steroids and prophylactic surfactant are of proven benefit in reducing the incidence of ARDS (Pickerd & Kotecha, 2009).

2.1.5.4. Etiologic factors related to ARDS

ARDS is most common in babies who are born early, other newborns can get ARDS. Those at greater risk are: white babies, male babies, sibling with ARDS infection, twin or multiple births, C-section delivery, premature delivery, mother has diabetes and infection (Nationwide Children's Hospital, 2011).

2.1.5.5. Diagnosis

A number of tests can be used to diagnose ARDS and rule out other possible causes. These include: (physical examination - blood test to measure the amount of oxygen in the baby's blood and check for an infection - a pulse oximetry test to measure how much oxygen is in the baby's blood using a sensor attached to their fingertip, ear or toe - a chest x-ray to look for the distinctive cloudy appearance of the lungs in ARDS) (Nationwide Children's Hospital, 2011).

2.1.5.6. Treatment

❖ Oxygen: Babies with ARDS need extra oxygen to stay pink. It may be given in several ways:

- Nasal cannula. A small tube with prongs is placed in the nostrils.
- CPAP (Continuous Positive Airway Pressure). This is a machine that gently pushes air or oxygen into the lungs to keep the air sacs open.

- Ventilator for severe ARDS. This is a machine that helps the infant breathe when he or she cannot breathe well enough without help. A breathing tube is put down the infant’s windpipe. This is called intubation (in too BAY shun). The infant is then placed on the ventilator to help him to breathe.

❖ Surfactant: Surfactant can be given into the baby’s lungs to replace what he does not have. This is given directly down the breathing tube that was placed in the windpipe.

❖ IV (intravenous) catheter treatments: A very small tube called a catheter is placed into one or two of the blood vessels in the umbilical cord. This is how the infant gets IV fluids, nutrition and medicines. It is also used to take blood samples.

(Nationwide Children's Hospital, 2011).

2.1.5.7. Complications

The most common complications are: Blood clots, pneumothorax, lung fibrosis, breathing problems for the rest of life (Mayo Clinic Staff, 2020). Furthermore, pulmonary hemorrhage, and cerebral hemorrhage. Moreover, if the brain of the baby is damaged during ARDS, either because of lack of oxygen or bleeding, it may cause long-term developmental disorders, for example, learning disabilities, mobility problems, and impaired vision or hearing (NHS, 2018).

2.2. Literature review

Review of the literature involved reading documents and studies from multiple sources. It included reading and reviewing information that related to Acute Respiratory Distress Syndrome, positions, neonates, and cardio respiratory clinical outcomes.

The researcher obtained the information from:

- Palestinian Ministry of Health.
- Annual reports from the different organizations and institutions.
- Many interviews with several NICU health workers were held.
- Published papers, journal articles, reports, theses, etc. were reviewed and its results were compared with each other.

Many of the previous studies and literatures that focused on the subject of the effect of prone position on cardio respiratory clinical outcomes were reviewed by the researcher.

One of these literatures was done by Prerna Sharma, Smriti Arora, Shilpi Sarkar, and Jacob Puliyel in India at 2016. The purpose of the research is to determine and compare the impact of prone and supine postures on cardiorespiratory outcomes in neonates with ARDS, and to explore any complications or problems during applying the positions. It showed that the applying of prone posture resulted in a progression in cardiovascular clinical outcomes and respiratory distress among neonates with respiratory distress, without complications (Sharma, Arora, Sarkar, & Puliyel, 2016).

Another study was done by Tahereh Babuyeh, Roya Farhadi, Yadollah Zahed Pasha and Mohsen Haghshenas Mojaveri; in Iran. It was performed to assess the impact of prone posture on SpO2 and HR of neonates under mechanical ventilator manifest that neonates had more propitious SpO2 statuses and HR fluctuations in the prone posture than supine posture. For 2 hours respectively, each neonate was placed in control group (supine posture) and experimental group (prone posture). It found that the prone posture compared to the supine posture has a more beneficial impacts of SpO2 and HR fluctuations in neonates (Babuyeh, Farhadi, Pasha, & Mojaveri, 2018).

Also, a study was done by Georgios Nakos, Athanasios Papathanasiou, Georgios Papathanakos and Vasilios Koulouras; in Greece. It highly agrees that prone posture has advantageous impacts on hemodynamics, lung protection, respiratory mechanics and gas exchange because it redistributes strain, stress, and transpulmonary pressure throughout the lung and Rt ventricle unloads. It also clearly promotes the use of prone posture systematically in early treatment of severe ARDS and not as a relief maneuver or a last-ditch effort (Koulouras, Papathanakos, Papathanasiou, & Nakos, 2016).

In addition, there is a study that was done by Fatemeh Ghorbani, MalihehAsadollahi, SousanValizadeh, in Iran. It aimed to compare between the impact of prone and supine positions on HR and RR of neonates with ARDS who were treated using N-CPAP. It found that neonates who were comparable in gestational age and health status and put in two positions had a significant variation in HR and RR. In both groups, the HR and RR of neonates became lower at prone position than supine. So, it concluded that prone position may decrease the HR and RR of neonates, but supine position could increase them (Ghorbani, Asadollahi, & Valiz, 2013).

Furthermore, a study was conducted by HomaBabaei, Leila MohammadiPirkashani, and Behzad Soleimani.The goal was to compare the impact of prone and supine positions on preterm infant physiological parameters under nasal continuous positive airway pressure (N-CPAP). It indicates that the mean heart rate in two positions was significant different. The respiratory rate was slightly lower in the prone position than in the supine position; however, Spo_2 was significantly higher in the prone position than the supine position (Babaei, Pirkashani, & soleimani, 2019).

Finally, a study was done by Eric L. Scholten; Jeremy R. Beitler; G. Kim Prisk; and Atul Malhotra; in USA. Itsgoal was to discusses the clinical evidence, physiological principles and practical application of prone ventilation in ARDS. The study concluded, that prone positioning was first known for its efficiency to enhance oxygenation (Scholten, Beitler, Prisk, & Malhotra, 2017).

Chapter Three

Methodology

3. Methodology

The study methodology is described in the following sections: research design, study population, study setting, study period, sample size, inclusion & exclusion criteria, sampling technique, study tool, validity of checklist, pilot study, reliability of checklist, interventions & protocol for data collection, variables, data entry and analysis, ethical consideration and limitation of the study.

3.1. Research design

A Quasi-experimental research design was used in this study.

Where this design aims to establish a cause-and-effect relationship between an independent and dependent variable. It is a useful tool in situations where true experiments cannot be used for ethical or practical reasons (Thomas, 2021).

3.2. Study Population

The population of the study was all neonates (0-28 days) admitted to NICU department in Rafidia Hospital with ARDS. The total number of these neonates was around 40-45 neonate monthly. Since the data collection period was taken in 3 months according to the study timeline, the total number of populations was between120 – 135.

<u>Intervention group:</u> Neonates who admitted to NICU with ARDS and positioned into a prone position.

Control group: Neonates who admitted to NICU with ARDS and positioned on any another position other than prone position; and were in the same age average as the interventional group.

3.3. Study setting

The researcher selected the study samples from Nablus governorate.

The present study was conducted at NICU department in Rafidia Hospital which considered a government and educational hospital in Nablus city.

3.4. Study period

It was implemented in the period between May 2020 until October 2020 Including checklist design, expert's opinion, pilot study, data collection and analysis.

3.5. Sample size

It included 100 neonates (50 interventional and 50 control) who live in Nablus governorate and admitted to Rafidieh hospital-NICU with ARDS. The sample size was determined by Sample Size Calculator (see annex 2). That helps to identify the exact sample size. A total of 50 interventional and 50 control; in addition, the neonatal who admitted to NICU at the days of the researcher visit and whose parents are voluntary engage in the research were also selected.

3.6. Inclusion & Exclusion Criteria

Inclusion Criteria:

- Neonates that live in the West Bank and are available during the time of study.

- Neonates whose gestational age between 32-36 weeks.
- Neonates with chronological age between 2-28 days.
- Neonates that have a birth weight greater than 1,000 g.
- Neonates who breathe spontaneous respiration and do not have mechanical ventilation.
- Neonates that, when using oxygen in an incubator or hood, have maximum oxygen of 5 L / min.
- Neonates with stable body temperatures .
- Neonates with absence of hematological or congenital disorders.

Exclusion Criteria:

- Neonates with mechanical ventilator support.
- Neonates with any congenital airway malformation.
- Neonates with any CHD.
- Neonates with upper airway obstruction.
- Neonates who suffer from any surgical status in which prone posture is contraindicated.
- Newborns whose parents do not want to take part and participate in this research.

3.7. Sampling technique

The method of sampling was simple random sampling; in which each individual (either interventional group or control group) was chosen randomly and entirely by chance, such that each individual has the same probability of being chosen at any stage during the sampling process.

Each 1 interventional will be match to 1 control. All neonates with ARDS, who admitted to NICU, at the days of the researcher visit the place of study, it was selected as an interventional group; while control group was the next bed, and if it does not comply with the inclusion criteria, the next bed will be selected.

3.8. Study tool

To achieve the study objectives, the checklist was used *(see annex 1)*. It included:

- The first section consisted of demographic information, including diagnosis, gender, gestational age, chronological age, type of delivery, 5-min Apgar score, and weight & height at the birth as well as at the time of study.
- The second part contains of a checklist to enter the value of heart rate, respiratory rate, oxygen saturation, and ABGs.
- The third part consisted of a checklist to detect any complications during and after positioning.

3.9. Validity of checklist

I used the checklist according to:

- **Face validity:**

The researcher double checked the face. The first checked was for persons who provided their advice, judgment, suggestions, and opinion on the checklist's consistency, adequacy, quality and appropriateness. During and after the pilot study, the second checked was performed for the researcher's assistants when the researcher asking them about the clarity of questions, structure, and its form.

- **Content validity:**

It was achieved prior to collection of the data; by submitting the checklist with a cover letter and a paper containing information about the study, objectives, field of the research, and other related information to experts who expertise in this field. They were asked to review and evaluate each components of checklist with respect to clarity, consistency and completeness. Feedback from experts has been obtained; their opinions have also been taken into account. The modification was conducted based on the instructions of the study supervisor. The researcher wrote the checklist in English, then it evaluated by an English language specialist who offered guidance and modifications.

3.10. Pilot study

Since the findings of the pilot study can help to improve and modify the study tools, a pilot study was performed prior to data collection as a pretest to test checklist suitability & validity, to know areas of vagueness, to assess the real time required to fill the checklist, to predict response rate, and to point out any weaknesses in the checklist contents. It involved a total of 10% of interventional and control groups. The pilot study sample was included in the research.

3.11. Reliability of checklist

The checklist reliability was calculated by measuring the Cronbach's Alpha coefficient, where it considered the most effective indicator of measure the reliability. Note that the reliability coefficient higher than 0.7 is deemed to be satisfactory for the most purposes; This was achieved using SPSS program. The total reliability coefficient for all study items are equal 0.810. This range is considered very well; the result ensures the reliability of the checklist.

3.12. Data Collection

Data was collected by using the checklist, which included socio-demographics data and information related to positions, Acute Respiratory Distress Syndrome and cardio respiratory clinical outcomes. Data was collected by the researcher only; and it was done at an appropriate time, and taking all ethical considerations.

Interventions for data collection:

- Based on inclusion and exclusion criteria, the neonates were screened and then enrolled in the study.
- The interview was beginning by providing detailed information, descriptions and explanations about the research and its aims, and the value of participate, to the parents of neonates. The interview was taking all ethical considerations (such as confidentiality and parent's consent).

- The overall sample was divided into neonates that received prone posture (interventional group) and neonates that received another position (control group).
- Collection of demographic data was done before applying of any positions.
- Cardio respiratory clinical outcomes (HR, RR, SaO2 and ABGs) were assessed before applying prone position.
- Prone position was applied to interventional group for 2 hours.
- At first 1 hour, cardio respiratory clinical outcomes and complication checklist were assessed to neonates in prone position.
- After 2 hours, cardio respiratory clinical outcomes and complication checklist were reassessed again to neonates in prone position.
- Likewise, for neonates who receiving another position (control group), cardio respiratory clinical outcomes and complication checklist were assessed before intervention, and at first 1 hour also after 2 hours.
- Comparing between interventional group and control group were done.

Protocol for data collection:

- The researcher was introduced himself to the parents, and establish a rapport with them.
- An appropriate environment was created by providing a separate room for interview and collection of the data.
- Based on inclusion and exclusion criteria, the neonates were screened and then enrolled in the study.
- The aims of the research were illustrated to the parents.

- The parents were presented with a patient information sheet, and consent was received.
- The sample was selected conveniently.
- In this study, total sample size (100 sample) was measured by sample size calculator by raosoft (http://www.raosoft.com/samplesize.html).
- Then the total sample was divided into 2 groups (interventional group and control group), each group was contained 50 sample.
- Collection of demographic data was done for each group.
- In neonates prior of applying the prone posture, cardio respiratory clinical outcomes (HR, RR, SaO2 and ABGs) was assessed, likewise the checklist for complication detection was assessed (agitated cry, apnea, vomiting, and lethargy or another any complication). Than prone posture was applied for 2 hours.
- The prone posture of neonates is to put them on their abdomen with head turned to one side on an even surface.
- At first 1 hour, cardio respiratory clinical outcomes and complication checklist were assessed again to neonates in prone position.
- Also, after 2 hours, cardio respiratory clinical outcomes and complication checklist were assessed one more time to neonates in prone position.
- Neonates, who receiving another position (control group) as a standard treatment was continued, and cardio respiratory clinical outcomes and complication checklist were assessed before intervention, and at first 1 hour also after 2 hours (post intervention).

3.13. Variables

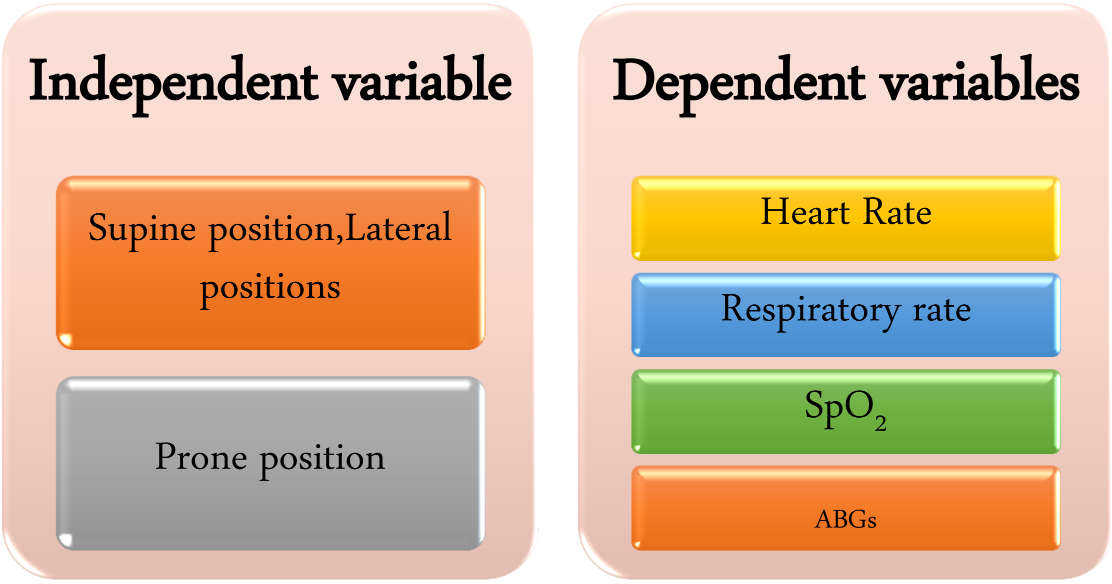

Figure (3.1): Variable of the study.

3.14. Data entry and analysis

- The data was saved into a computer and analyzed using SPSS V25.0 program.
- Microsoft office programs (such as Excel and Word software) and other software can be used for interpretation, processing and analysis the data.

3.15. Ethical Consideration

- The researcher took An-Najah National University approval letter *(see annex 3)*, also another approval letter was taken from the MOH in Palestine *(see annex 4)*; in addition, the researcher took agreement from each parents of the neonates.
- The researcher maintained a voluntary and confidential participation in the study.
- The researcher was keeping all information confidential for the persons .

- Choose the right and safe place to apply the study; and not subjecting the participants to any physical or moral danger.
- Credibility in writing search results.

3.16. Limitation of the study

- Limited resource like, books, literature etc.
- Insufficient or inappropriate data.
- Lack of local previous literatures related to the study.
- Inadequacy of time.
- Political condition in the region which restricts the movements and cause challenges and obstacles to scientific studies (such as security checkpoints).
- Transportation challenges.
- Data collection took a long time (more than expected) due to the application of preventive measures to prevent the spread of COVID-19.

Chapter Four

Results and Discussions

4. Results and discussions

This chapter presents the analysis of the data which was collected. Statistical procedure allowed the researcher to realize, summarize, interpret, organize, evaluate, and communicate the numeric information. Analysis is a technique of interpreting quantitative information intelligible and meaningful. The purpose of data analysis is to afford answers to the hypothesis or research questions. The plan for data analysis derives exactly from the question, the design, and the level of measurement of the data and the method of data collection. In this chapter the data collected were edited, tabulated, analyzed and interpreted.

4.1 General characteristics of the study population

The present study is an experimental study included 100 subjects (50 interventional group as cases and 50 controls). General characteristics of the study population are illustrated in Table 4.1. The gestational age and gender were matched between interventional and controls, the age was 34.1±1.4 days among the interventional group while 34.0±1.4 days among the controls group ($P>0.05$). Regarding the gender, the study findings showed that 50% (n=50) of participants are male as well as 50% are female. Both groups' interventional and controls were equal numbers of males (25 (50%) and female (25 (50%)) and not statistically significantly different ($P>0.05$).

Regarding to gestational age, the results showed that 19% of participants their gestational age is 32 weeks, 18% of participants their gestational age is 33 weeks, 20% of participants their gestational age is 34 weeks, 21% of participants their gestational age is 35 weeks and 22% of participants their gestational age is 36 weeks.

Likewise, regarding to chronological age, the results showed that 47% of participants their chronological age is from 0-7 days, 16% of participants their chronological age is from 8-14 days, 15% of participants their chronological age is from 15-21 days and 22% of participants their chronological age is from 22-28 days.

As for type of delivery, 79% of participants had a normal vagainal delivery, while 21% had LSCS.

Concerning the participants weigh (Kg), the researcher recorded the weight of the participants at the birth time and at the time of conducting the study. As for birth weight, the results showed that 29% of participants their birth weight was from 1 to 1.5 Kg; 47% of participants their birth weight was from 1.51 to 2.5 Kg; 16% of participants their birth weight was from 2.51 to 3.5 Kg; and 8% of participants their birth weight was more than 3.5 Kg. likewise as for weight at the time of the study, the results showed that 31% of participants their weight at the time of the study was from 1 to 1.5 Kg; 38% of participants their weight at the time of the study was from 1.51 to 2.5 Kg; 27% of participants their weight at the time of the study was from 2.51 to 3.5 Kg; and 4% of participants their weight at the time of the study was more than 3.5 Kg.

Also, concerning the participants' height (cm), the researcher recorded the height of the participants at the birth time and at the time of application of the study. As for birth height, the results showed that 27% of participants their birth height was from 31 to 35 cm; 38% of participants their birth height was from 36 to 40 cm; 31% of participants their birth height was from 41 to 45 cm; 3% of participants their birth height was from 46 to 50 cm; and 1% of participants their birth height was from 51 to 55 cm. likewise as for height at the time of the study, the results showed that 24% of participants their height at the time of the study was from 31 to 35 cm; 33% of participants their height at the time of the study was from 36 to 40 cm; 35% of participants their height at the time of the study was from 41 to 45 cm; 7% of participants their height at the time of the study was from 46 to 50 cm; and 1% of participants their height at the time of the study was from 51 to 55 cm.

The study findings listed the reasons of Acute Respiratory Distress Syndrome for participants, it showed that 21% was due to lack of surfactant; 21% was due to premature delivery; 2% was due to problems with baby's lung development; 6% was due to stress during baby's delivery; 12% was due to infections; 9% was due to premature rapture of membranes; 3% was due to congenital deformities; 11% was due to meconium aspiration; 7% was due to cold environment; and 8% was due to infant of diabetic mother.

Moreover, the researcher was recording the duration of hospitalization (days) for each participant; the results showed that 24% of participants their duration was less than 1 day; 13% of participants their duration was ranged from 1-3 days; 10% of participants their duration was ranged from 4-7 days; and 53% of participants their duration was more than 7 days.

The table showed that there is no statistically significantly different between interventional group and controls group regarding chronological age (days), type of delivery, weight at the time of the study (kg), birth height, the reason of Acute Respiratory Distress Syndrome and name of another position rather than a prone position (P>0.05).

Table (4.1): The relation between demographic characteristics (age, gestational age, birth weight, and gender, etc.) and study groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

	Groups (n=100) n (%)			Statistical analysis	
	Total	Control (n=50)	Interventional (n=50)	χ^2	P-value
2) Gender:					
Male	50 (50.0)	25 (50.0)	25 (50.0)	0.000	1.000
Female	50 (50.0)	25 (50.0)	25 (50.0)		
4) Chronological age (days)					
0-7	47 (47.0)	19 (38.0)	28 (56.0)	3.913	0.141
8-14	16 (16.0)	8 (16.0)	8 (16.0)		
15-21	15 (15.0)	11 (22.0)	4 (8.0)		
22-28	22 (22.0)	12 (24.0)	10 (20.0)		
5) Type of delivery:					
LSCS.	79 (79.0)	38 (76.0)	41 (82.0)	0.542	0.461
Normal vaginal delivery.	21 (21.0)	12 (24.0)	9 (18.0)		
Weight at the time of the study (kg).					
1 to 1.5	31 (31.0)	18 (36.0)	13 (26.0)	1.245	0.742
1.51 to 2.5	38 (38.0)	18 (36.0)	20 (40.0)		
2.51 to 3.5	27 (27.0)	12 (24.0)	15 (30.0)		

More than 3.5	4 (4.0)	2 (4.0)	2 (4.0)		
Birth Height (cm).					
31 to 35	27 (27.0)	14 (28.0)	13 (26.0)	5.583	0.233
36 to 40	38 (38.0)	14 (28.0)	24 (48.0)		
41 to 45	31 (31.0)	19 (38.0)	12 (24.0)		
46 to 50	3 (3.0)	2 (4.0)	1 (2.0)		
51 to 55	1 (1.0)	1 (2.0)	0 (0.0)		
Reason of ARDS:"					
Lack of surfactant	21 (21.0)	9 (18.0)	12 (24.0)	9.083	0.430
Premature delivery	21 (21.0)	14 (28.0)	7 (14.0)		
Problems with baby's lung development	2 (2.0)	2 (4.0)	0 (.0)		
Stress during baby's delivery	6 (6.0)	4 (8.0)	2 (4.0)		
Infections	12 (12.0)	4 (8.0)	8 (16.0)		
Premature rapture of membranes	9 (9.0)	5 (10.0)	4 (8.0)		
Congenital deformities	3 (3.0)	1 (2.0)	2 (4.0)		
Meconium aspiration	11 (11.0)	6 (12.0)	5 (10.0)		
Cold environment	7 (7.0)	2 (4.0)	5 (10.0)		
Infant of diabetic mother	8 (8.0)	3 (6.0)	5 (10.0)		
If the patient on another position rather than prone position; please specify:					
Supine	50 (50.0)	25 (50.0)	-		
Lateral	50 (50.0)	25 (50.0)	-		

	Groups (n=100) Mean±SD			Statistical analysis	
	Total	**Control (n=50)**	**Interventional (n=50)**	**T**	**P-value**
Gestational age (weeks):	34.1±1.4 (32-36)	34.1±1.4 (32-36)	34.0±1.4 (32-36)	0.348	0.728
5-min Apgar score:	8.3±1.2 (5-10)	8.3±1.3 (5-10)	8.2±1 (6-10)	0.605	0.547

Significant at P≤0.05; P>0 05: Not significant; **n:** number of subjects; **SD:** standard deviation;**t**: independent t-test &χ^2**:** chi-square test**.**

Also, the study results showed that the 5-minutes Apgar score for participants were ranged between 5-10; whereas the majority of participants, their Apgar score was 9 which represent 37% from total study participants.

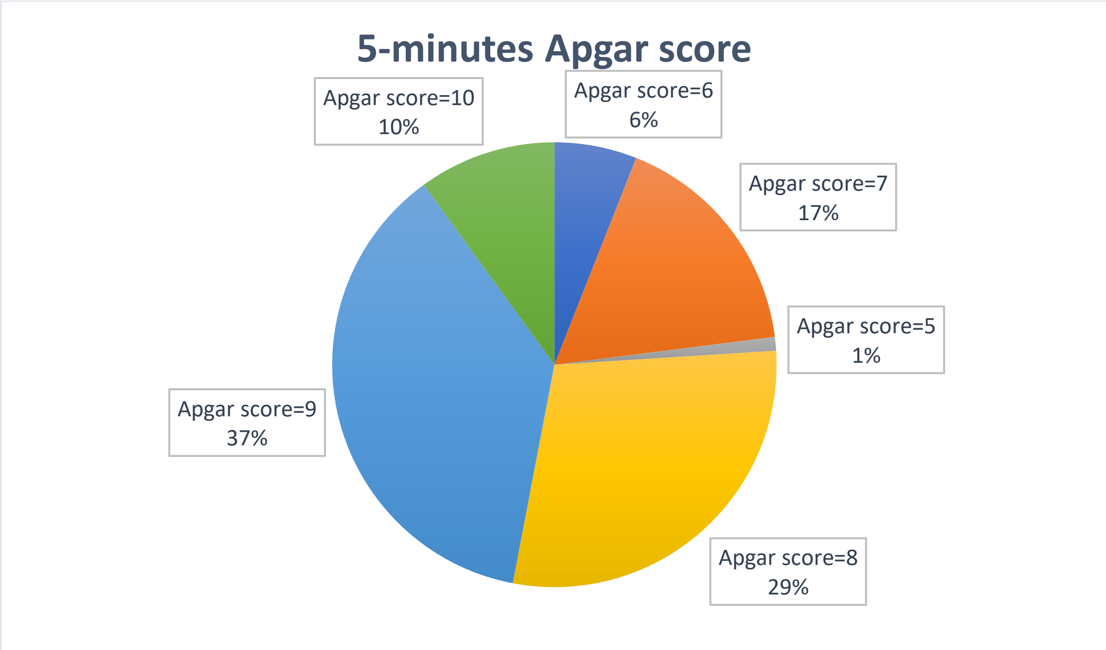

Figure (4.1): 5-minutes Apgar score.

4.2 The relation between parameters studied (Heart rate (bpm), Respiratory rate (BPM), Oxygen saturation (%), $Paco_2$ (mmHg) & Pao_2 (mmHg)) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

Concerning the participants' heart rate, respiratory rate, oxygen saturation and ABGs ($Paco_2$& Pao_2), the researcher recorded these values for the total participants three times, first at 0 minute, second at 1 hour and third at 2 hours.

As for heart rate, the results showed that the participants' heart rate at 0 minute ranged between 80-189 beats per minute, while at 1 hour it ranged between 97-180 bpm, and at 2 hours it ranged between 70-181 bpm.

Also, for respiratory rate, the results showed that the participants respiratory rate at 0 minute ranged between 29-70 breaths per minute, while at 1 hour it ranged between 24-66 BPM, and at 2 hours it ranged between 26-60 BPM.

While, for oxygen saturation, the results showed that the participants oxygen saturation at 0 minute ranged between 70-99%, while at 1 hour it ranged between 77-100%, and at 2 hours it ranged between 75-100%.

Likewise, for $Paco_2$, the results showed that the participants Paco2 at 0 minute ranged between 16-63 mmHg, while at 1 hour it ranged between 24-59 mmHg, and at 2 hours it ranged between 20-63 mmHg.

Furthermore, for Pao_2, the results showed that the participants Pao2 at 0 minute ranged between 50-100mmHg, while at 1 hour it ranged between 51-112 mmHg, and at 2 hours it ranged between 56-132 mmHg.

Table 4.2 points out that the mean of respiratory rate (BPM) At 2 hours was significantly decreased in the interventional group compared to controls (42.2±7.0 vs. 47±7.1 breaths per minute (BPM), t= -3.368 & $P=0.001$, respectively; Figure 4.1). In contrast, oxygen saturation (%) at 2 hours was statistically significantly elevated in the interventional group compared to controls (96.9±3.3 vs. 94.3±4.9 %, respectively; Figure 4.2). This change was statistically significant ($t=3.205$, $P=0.002$). On the other hand, the table illustrated that there are no statistically significant differences between interventional and controls groups regarding other parameters studied ($P>0.05$).

Table (4.2): The relation between parameters studied (Heart rate (bpm), Respiratory rate (BPM), Oxygen saturation (%), Paco2 (mmHg) & Pao2 (mmHg)) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome.

	Groups (n=100) Mean±SD			**Statistical analysis**	
	Total	**Control (n=50)**	**Interventional (n=50)**	**t**	**P-value**
Heart rate (bpm) At 0 minute	149.0±23.8 (80-189)	150.2±19.8 (96-180)	147.8±27.4 (80-189)	-0.494	0.622
Heart rate (bpm) at 1 hour	147.5±20.7 (97-180)	148.2±19.3 (97-178)	146.8±22.3 (99-180)	-0.341	0.734
Heart rate (bpm) at 2 hours	147.5±17.9 (70-181)	147.1±19.3 (70-177)	148.0±16.5 (112-181)	0.262	0.794
Respiratory rate (BPM) At 0 minute	49.6±8.1 (29-70)	49.4±8.3 (29-68)	49.8±8 (34-70)	0.257	0.797
Respiratory rate (BPM) At 1 hour	46.6±7.8 (24-66)	47.1±8.9 (24-66)	46.1±6.6 (30-60)	-0.612	0.542
Respiratory rate (BPM) At 2 hours	44.6±7.4 (26-60)	47±7.1 (32-60)	42.2±7.0 (26-60)	-3.368	**0.001***
Oxygen saturation (%) At 0 minute	93.8±4.9 (70-99)	94.4±4 (86-99)	93.3±5.6 (70-99)	-1.145	0.255
Oxygen saturation (%) At 1 hour	94.8±4.4 (77-100)	94.3±4.5 (77-100)	95.2±4.3 (82-100)	1.018	0.311
Oxygen saturation (%) At 2 hours	95.6±4.3 (75-100)	94.3±4.9 (75-100)	96.9±3.3 (86-100)	3.205	**0.002***
Paco2 (mmHg) At 0 minute	39.2±8.2 (16-63)	39.5±7.5 (20-63)	38.9±8.8 (16-60)	-0.342	0.733

Paco2 (mmHg) At 1 hour	39±6.5 (24-59)	39±5.7 (24-55)	39±7.2 (29-59)	0.000	1.000
Paco2 (mmHg) At 2 hours	39±6.8 (20-63)	39.3±5.7 (26-55)	38.6±7.9 (20-63)	-0.538	0.591
Pao2 (mmHg) At 0 minute	85.7±9.4 (50-100)	87.2±9.6 (57-100)	84.1±8.9 (50-93)	-1.705	0.091
Pao2 (mmHg) At 1 hour	90.1±9.4 (51-112)	89.8±10.2 (58-112)	90.4±8.6 (51-111)	0.297	0.767
Pao2 (mmHg) At 2 hours	94.7±13 (56-132)	92.7±12.6 (60-124)	96.7±13.3 (56-132)	1.525	0.130

Significant at $P \leq 0.05$; P>0 05: Not significant; **n:** number of subjects; **SD:** standard deviation &**t**: independent t-test.

4.3 Complication resulting from prone positioning of the neonates among studied groups of the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

Regarding to complications that may occur (e.g. agitation cry, apnea, lethargic, vomiting and any other complications), the researcher recorded these complications for the total participants three times, first at 0 minute, second at 1 hour and third at 2 hours.

For agitation cry, the results showed that the agitation cry present at 0 minute for 67% of participants, while it presents at 1 hour for 39% of participants, and it present at 2 hours for 23% of participants.

Also, for apnea, the results showed that the apnea present at 0 minute for 9% of participants, while it presents at 1 hour for 2% of participants, and it present at 2 hours for 15% of participants.

While, for lethargic, the results showed that the lethargic present at 0 minute for 38% of participants, while it presents at 1 hour for 37% of participants, and it present at 2 hours for 43% of participants.

Likewise, for vomiting, the results showed that the vomiting did not present neither at 0 minute nor at 1 hour for any participants, while it present at 2 hours for 6% of participants.

Furthermore, for the results showed that at 2 hours, 3% of participants were developed to severe ARDS and they had connected to mechanical ventilator.

Table 4.3 shows the distribution of complication resulting from prone positioning of the neonates among studied groups of the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome. The chi-square test showed that there is a statistically significant lowering percentage in present lethargic complication at 0 minutes among interventional groups compared to control groups (28.0% vs. 48.0%, respectively, P = 0.039). In contrast, the table showed that no statistically significantly difference among interventional groups compared to controls reading to others complications).

Table (4.3): The relation between complications and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

	Groups (n=100) n (%)			Statistical analysis	
	Total	Control (n=50)	Interventional (n=50)	χ^2	P-value
Agitation cry at 0 minute					
Present	67 (67.0)	30 (60.0)	37 (74.0)	2.216	0.137
Absent	33 (33.0)	20 (40.0)	13 (26.0)		
Agitation cry at 1 hour					
Present	39 (39.0)	21 (42.0)	18 (36.0)	0.378	0.539
Absent	61 (61.0)	29 (58.0)	32 (64.0)		
Agitation cry at 2 hours					
Present	23 (23.0)	19 (38.0)	4 (8.0)	12.705	0.001
Absent	77 (77.0)	31 (62.0)	46 (92.0)		
Apnea at 0 minute					
Present	9 (9.0)	5 (10.0)	4 (8.0)	0.122	0.727
Absent	91 (91.0)	45 (90.0)	46 (92.0)		
Apnea at 1 hour					
Present	2 (2.0)	0 (.0)	2 (4.0)	2.041	0.153
Absent	98 (98.0)	50 (100.0)	48 (96.0)		
Apnea at 2 hours					
Present	15 (15.0)	8 (16.0)	7 (14.0)	0.078	0.779
Absent	85 (85.0)	42 (84.0)	43 (86.0)		
Lethargic at 0 minute					
Present	38 (38.0)	24 (48.0)	14 (28.0)	4.244	**0.039***
Absent	62 (62.0)	26 (52.0)	36 (72.0)		
Lethargic at 1 hour					
Present	37 (37.0)	23 (46.0)	14 (28.0)	3.475	0.062
Absent	63 (63.0)	27 (54.0)	36 (72.0)		
Lethargic at 2 hours					
Present	43 (43.0)	29 (58.0)	14 (28.0)	9.180	0.002
Absent	57 (57.0)	21 (42.0)	36 (72.0)		
Vomiting at 0 minute					
Present	0 (0.0)	0 (0.0)	0 (0.0)	0.000	1.000
Absent	100 (100.0)	50 (100.0)	50 (100.0)		
Vomiting at 1 hour					
Present	0 (0.0)	0 (0.0)	0 (0.0)	0.000	1.000
Absent	100 (100.0)	50 (100.0)	50 (100.0)		
Vomiting at 2 hours					
Present	6 (6.0)	1 (2.0)	5 (10.0)	2.837	0.092
Absent	94 (94.0)	49 (98.0)	45 (90.0)		

Another complication at 0 minute					
Present	-	-	-	0.000	1.000
Absent	100 (100.0)	50 (100.0)	50 (100.0)		
Another complication at 2 hours					
Present	-	-	-	0.000	1.000
Absent	100 (100.0)	50 (100.0)	50 (100.0)		
Another complication at 2 hours (Baby developed to severe ARDS and he connected to mechanical ventilator)					
Present	3 (3.0)	2 (4.0)	1 (2.0)	0.344	0.558
Absent	97 (97.0)	48 (96.0)	49 (98.0)		

Significant at $P \leq 0.05$; P>0 05: Not significant; **n:** number of subjects; &χ^2**:** chi-square test

4.4 Effectiveness of prone position on cardiorespiratory clinical outcomes for the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome

Table 4.4 showed the effectiveness of prone position on cardiorespiratory clinical outcomes for the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome compare to controls. Repeated ANOVA measures pointed out that there is statistically significant different in 0 min, 1 Hour and 2 hours among interventional groups compared controls group regarding to respiratory rate ($P < 0.000$ & effect size = 34.5%; Figure 4.2); Oxygen saturation ($P = 0.002$ & effect size = 9.4%; Figure 4.3) and Pao_2 ($P = 0.000$ & effect size = 39.8%; Figure 4.5). Also, post hoc test (LSD) demonstrated that it is statistically significantly different in 0 minutes compared to 1 hour; 0 minute compared to 2 hours &1 hours compared to 2 hours ($P < 0.05$). In contrast, Repeated ANOVA measures showed that there is no statistically significant difference among interventional groups compared control group regarding heart rate & $Paco_2$ (Figure 4.1 & 4.4; respectively; P > 0.05).

The study is corresponding with the study made by Prerna Sharma et.al in 2016; which showed revealed that the introduction of prone position leads to an improvement in RR, SpO2, and RD among infants with RD. Also, the current study differs with Sharma P., study regarding to heart rate where the current study shows that there is no effect of prone position on heart rate, while the Sharma P., study showed that the introduction of prone position leads to an improvement in heart rate among infants with RD.

Also, this study is corresponding with the study conducted by Zahra Akbarian Rad et.al in 2016; which indicated that in preterm newborns, the prone position made more desirable oxygenation and HR variability.

As well as it corresponding with the study performed by Tahereh Babuyeh et.al in 2018; which found that the prone posture has a beneficial impact of SpO2 fluctuations in neonates. Also, the present study differs with it regarding to HR fluctuations; where the current study found that there is no effect of prone position on heart rate, while the Babuyeh T., study found that the prone posture has a beneficial impact on HR fluctuations in neonates.

Table (4.4): Effectiveness of prone position on cardiorespiratory clinical outcomes for the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

	Groups (n=100) Mean±SD			Statistical analysis			
	Control (n=50)	Interventional (n=50)	Mean Different	F	P-value	Post hock	Effect size
Heart rate (bpm) At							
0 minute	150.2±19.8	147.8±27.4	1.47 [a]	0.798	0.416	0.135 [a]	0.008
1 hour	148.2±19.3	146.8±22.3	1.47 [b]			0.387 [b]	
2 hours	147.1±19.3	148±16.5	0.00 [c]			1.000 [c]	
Respiratory rate (BPM) At							
0 minute	49.4±8.3	49.8±8	2.97 [a]	35.094	0.000*	0.000 [a*]	0.345
1 hour	47.1±8.9	46.1±6.6	4.95 [b]			0.000 [b*]	
2 hours	47.0±7.1	42.2±7.0	1.98 [c]			0.000 [c*]	
Oxygen saturation (%) At							
0 minute	94.4±4	93.3±5.6	-.930 [a]	7.948	0.002*	0.020 [a*]	0.094
1 hour	94.3±4.5	95.2±4.3	-1.75 [b]			0.002 [b*]	
2 hours	94.3±4.9	96.9±3.3	-.82 [c]			0.022 [c*]	
Paco2 (mmHg) At							
0 minute	39.5±7.5	38.9±8.8	0.16 [a]	0.094	0.862	0.744 [a]	0.001
1 hour	39.0±5.7	39.0±7.2	0.23 [b]			0.734 [b]	
2 hours	39.3±5.7	38.6±7.9	0.07 [c]			0.874 [c]	
Pao2 (mmHg) At							
0 minute	87.2±9.6	84.1±8.9	-4.42 [a]	57.709	0.000*	0.000 [a*]	0.398
1 hour	89.8±10.2	90.4±8.6	-9.05 [b]			0.000 [b*]	
2 hours	92.7±12.6	96.7±13.3	-4.63 [c]			0.000 [c*]	

Significant at P≤0.05; P>0 05: Not significant; **n:** number of subjects; **SD:** standard deviation; **F:**repeated ANOVA measures; χ^2**:** chi-square test**;** Post hoc(LSD)**[a]** **:** 0 minute *vs.* 1 hour: [b]: 0 minute *vs.* 2 hours; [c]: 1 hour *vs.* 2 hours & Effect Size calculated by Partial Eta Squared.

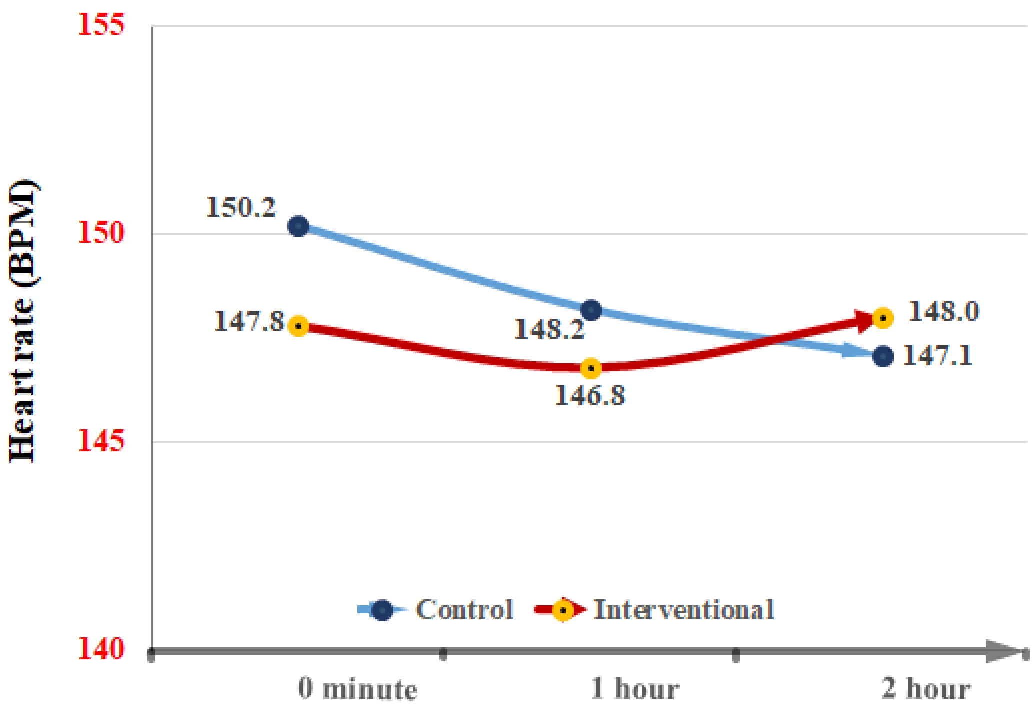

Figure (4.2): The relation between Heart rate (BPM) and studied groups among the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome.

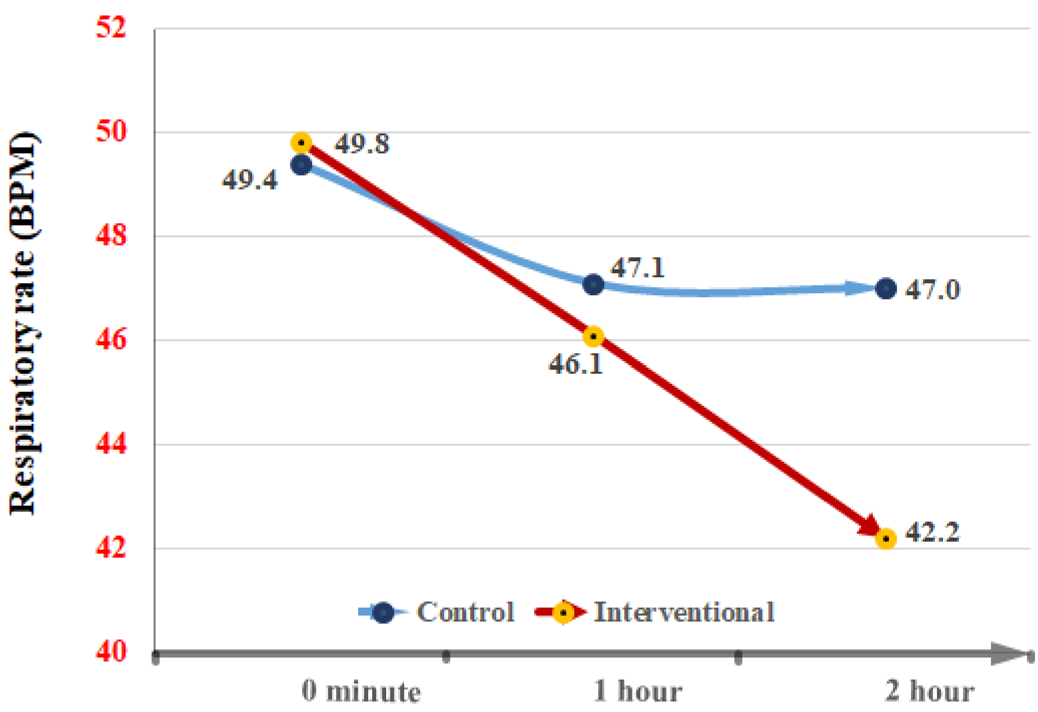

Figure (4.3): The relation between respiratory rate (BPM) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

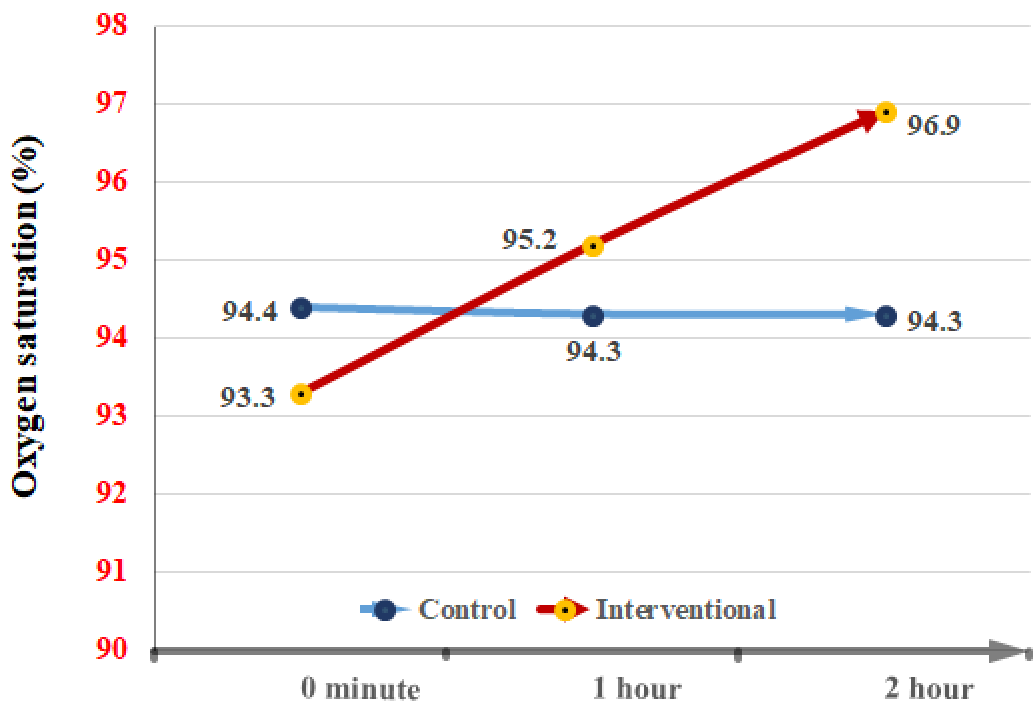

Figure (4.4): The relation between Oxygen saturation (%) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

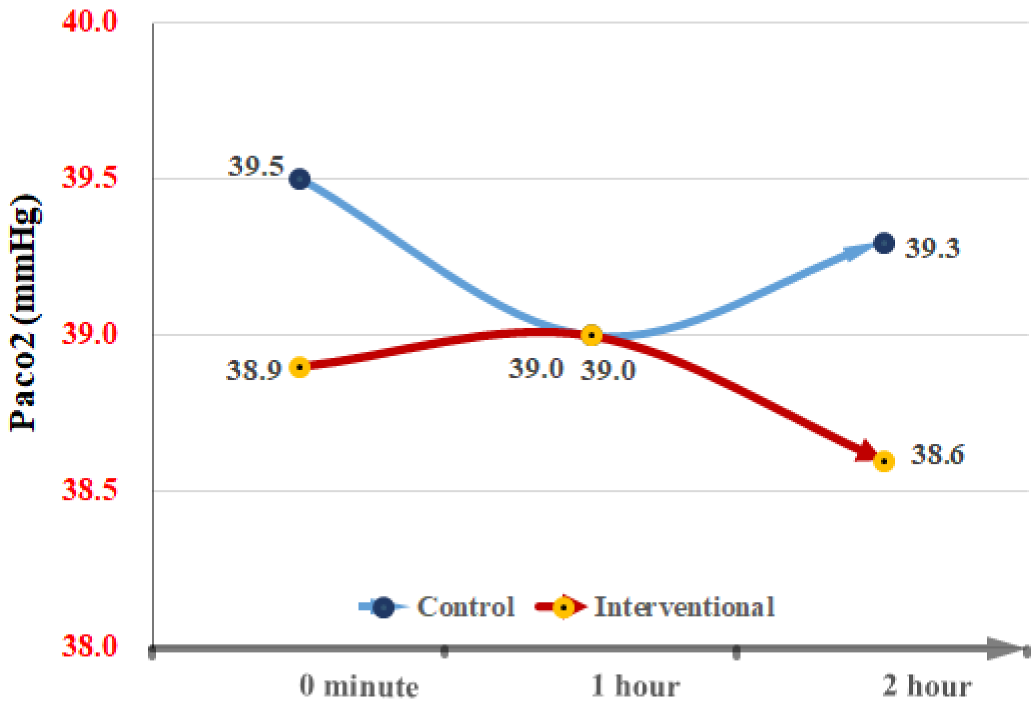

Figure (4.5): The relation between Paco2 (mmHg) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome

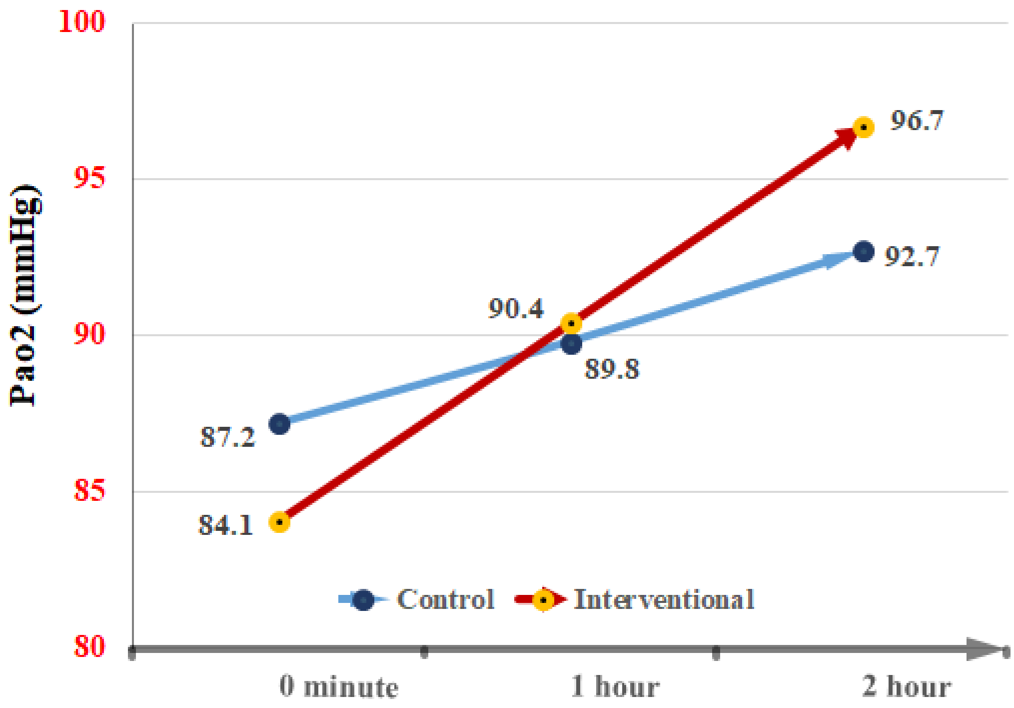

Figure (4.6): The relation between Pao_2 (mmHg) and studied groups among the neonates who admitted to NICU with Acute Respiratory Distress Syndrome.

4.5 The relation between complications and studied groups among the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome

The relation between complications and studied groups among the neonates who were admitted to NICU with Acute Respiratory Distress Syndrome illustrate in Table 4.5. The results showed that agitation cry complication resulting from prone positioning of the neonates are statistically significant lowering among interventional groups compared controls group for 0 min, 1 hour and 2 hours ($P<0.05$) while no statistically significantly different in others complication resulting from prone positioning of the neonates ($P > 0.05$).

Table (4.5): The relation between complications and studied groups among the neonates who admitted to NICU with Respiratory Distress Syndrome

	Control n (%) (n=50)				P-value	Interventional (n=50)				P-value
	1 hour		2 hours			1 hour		2 hours		
	Present	Absent	Present	Absent		Present	Absent	Present	Absent	
Agitation cry At										
0 minute										
Present	19 (38.0)	11 (22.0)	15 (30.0)	15 (30.0)	0.022 [a]	18 (36.0)	19 (38.0)	3 (6.0)	34 (68.0)	0.000 [a]
Absent	2 (4.0)	18 (36.0)	4 (8.0)	16 (32.0)	0.019 [b]	0 (0.0)	13 (26.0)	1 (2.0)	12 (24.0)	0.000 [b]
1 hour					0.791 [c]					0.001 [c]
Present			13 (26.0)	8 (16.0)				3 (6.0)	15 (30.0)	
Absent			6 (12.0)	23 (46.0)				1 (2.0)	31 (62.0)	
Apnea At										
0 minute										
Present	-	5 (10.0)	3 (6.0)	2 (4.0)	-	0 (0.0)	4 (8.0)	1 (2.0)	3 (6.0)	0.687 [a]
Absent	-	45 (50.0)	5 (10.0)	40 (80.0)	0.453 [b]	2 (4.0)	44 (88.0)	6 (12.0)	40 (80.0)	0.508 [b]
1 hour					-					0.180 [c]
Present			-	-				0 (0.0)	2 (4.0)	
Absent			8 (16.0)	42 (84.0)				7 (14.0)	41 (82.0)	
Lethargic At										
0 minute										
Present	18 (36.0)	6 (12.0)	16 (32.0)	8 (16.0)	1.000 [a]	11 (22.0)	3 (6.0)	7 (14.0)	7 (14.0)	1.000 [a]
Absent	5 (10.0)	21 (42.0)	13 (26.0)	13 (26.0)	0.383 [b]	3 (6.0)	33 (66.0)	7 (14.0)	29 (58.0)	1.000 [b]
1 hour					0.180 [c]					1.000 [c]
Present			19 (38.0)	4 (8.0)				9 (18.0)	5 (10.0)	
Absent			10 (20.0)	17 (34.0)				5 (10.0)	31 (62.0)	

Vomiting At										
0 minute										
Present	-	-	-	-	-	-	-	-	-	-
Absent	-	50 (100.0)	1 (2.0)	49 (98.0)	-	50 (100.0)	-	5 (10.0)	45 (90.0)	-
1 hour					-					-
Present			-	-				-	-	
Absent			1 (2.0)	49 (98.0)				5 (10.0)	45 (90.0)	
Another complication At										
0 minute										
Present	-	-	-	-	-	-	-	-	-	-
Absent	-	50 (100.0)	2 (4.0)	4 (96.0)	-	-	50 (100.0)	1 (2.0)	2 (98.0)	-
1 hour					-					-
Present			-	-				-	-	
Absent			2 (4.0)	4 (96.0)				1 (2.0)	2 (98.0)	

Significant at P≤0.05; P>0 05: Not significant (McNemar test); **n:** number of subjects; **SD:** standard deviation;[a] **:** 0 minute *vs.* 1 hour: [b]: 0 minute *vs.* 2 hours&[c]: 1 hour *vs.* 2 hours.

Chapter Five

Conclusion and Recommendations

5. Conclusion and Recommendations

5.1. Conclusion

A Quasi-experimental research design was conducted between May 2020 until October 2020 to evaluate of effectiveness of prone position on cardio respiratory clinical outcomes for the neonates who admitted to NICU with ARDS. It conducted in Rafedia governmental hospital, NICU department at Nablus city.

The findings showed that there is no statistically significantly different between interventional group and controls group regarding chronological age (days), type of delivery, weight at the time of the study (kg), birth height, the reason of acute respiratory distress syndrome and name of another position rather than a prone position ($P>0.05$).

There is a statistically significant lowering percentage in present lethargic complication at 0 minutes among interventional groups compared to control groups. While there is no statistically significantly difference among interventional groups compared to controls reading to others complications). Also, the agitation cry complication resulting from prone positioning of the neonates are statistically significant lowering among interventional groups compared controls group for 0 min, 1 hour and 2 hours ($P<0.05$) while no statistically significantly different in others complication resulting from prone positioning of the neonates ($P > 0.05$).

There is statistically significant different in 0 min, 1 Hour and 2 hours among interventional groups compared controls group regarding to respiratory rate, Oxygen saturation. While there is no statistically significant difference among interventional groups compared control group regarding heart rate & Paco2.

The findings showed that there is no statistically significantly different between interventional group and controls group regarding chronological age (days), type of delivery, weight at the time of the study (kg), birth height, the reason of Acute Respiratory Distress Syndrome and name of another position rather than a prone position ($P>0.05$).

5.2. Recommendations

Keeping in view of the findings of the present study, the researcher proposes the following recommendations:

- The study recommends using of prone position in the treatment of ARDS, taking into account the correct applying of the position, especially correct position of patients' face.
- Avoid putting the baby in the prone position immediately after feeding to avoid vomiting.
- Increasing awareness of the medical staff, especially specialists in the field of neonates, and increasing their knowledge about the importance of non-drug treatment, such as changing the position of the infant, etc., and highlighting the importance and effectiveness of prone position in early treatment of neonates with ARDS and its importance in improving cardio respiratory clinical outcomes.

- The number of nurses, neonatologists and other health staff should be increased within the NICU departments.
- Provide more training about ARDS to nurses, pediatricians, neonatologists and resident doctors who are working in neonatal care units and Establish an elaborate national neonatal treatment protocol, including non-drug treatment (e.g. body positioning). And increase the knowledge of health staff about the complications of ARDS in neonates.
- Conduct studies with a different duration to determine the ideal duration of applying prone position to neonates with ARDS.
- Developing hospitals and improve facilities in neonatal care departments and increase the number of neonatal cots, to meet the required standard, taking into account the geographical areas and the number of births. However, an increase in the number of cots in a unit would require improvements to infrastructure.
- It is necessary to have incubators with mechanical ventilators capable of multiple ventilation modes to provide comprehensive respiratory treatment, a blood gas analyzer system, C-PAP machines, a portable x-ray, and a humidifier for any hospital that cares for neonates. Providing essential medications such as TPN, caffeine, and surfactants is also necessary.

5.3. Strengths and weakness points

Strengths points:

- A specific group of patients was selected based on specific criteria.
- The study was implemented in a governmental, central, and educational hospital, which receives large numbers of patients, and is considered a reference for private hospitals.
- There was help with controlling the sample.
- There is wide experience of the researcher within the department in which the study was applied.

Weakness points:

- The study was applied in a limited period of time.
- Only one hospital was selected and the remaining hospitals were excluded.
- The sample size is limited.
- There are not enough monitors for all patients.
- Some of the hospital's policies have delayed data collection.
- Difficulty accessing some patient data.

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Annexes

Annex 1:

An-Najah National University

Faculty of Graduate Studies

Master of Intensive Care Nursing

Checklist about:

Evaluate the effectiveness of Prone position on cardio respiratory clinical outcomes for the neonates who admitted to NICU with Respiratory Distress Syndrome.

Prepared by:

Anas Badwan

Supervised by:

Dr. Eman Alshawish

Section one

1) Patient name: ……………………………….

2) Gender:

- ☐ Male.
- ☐ Female.

3) Gestational age (weeks):

- ☐ 32 weeks.
- ☐ 33 weeks.
- ☐ 34 weeks.
- ☐ 35 weeks.
- ☐ 36 weeks.

4) Chronological age (days):

- ☐ From 0-7 days.
- ☐ From 8-14 days.
- ☐ From 15-21 days.
- ☐ From 22-28 days.

5) Type of delivery:

- ☐ Normal vaginal delivery.
- ☐ LSCS.

6) 5-min Apgar score: ……………………………………..

7) Weight and Height:

Weight (kg).	
Birth Weight (kg).	**Weight at the time of study (kg).**
□ **Less than 1 kg.** □ **From 1 to 1.5 Kg.** □ **From 1.51 to 2.5 Kg.** □ **From 2.51 to 3.5 Kg.** □ **More than 3.5 kg.**	□ Less than 1 kg. □ From 1 to 1.5 Kg. □ From 1.51 to 2.5 Kg. □ From 2.51 to 3.5 Kg. □ More than 3.5 kg.
Height (cm).	
Birth Height (cm).	**Height at the time of study(cm).**
□ **Less than 30 cm.** □ **From 31 to 35 cm.** □ **From 36 to 40 cm.** □ **From 41 to 45 cm.** □ **From 46 to 50 cm.** □ **From 51 to 55 cm.** □ **More than 55 cm.**	□ Less than 30 cm. □ From 31 to 35 cm. □ From 36 to 40 cm. □ From 41 to 45 cm. □ From 46 to 50 cm. □ From 51 to 55 cm. □ More than 55 cm.

8) Reason of Acute Respiratory Distress Syndrome:

□ Lack of surfactant.

□ Premature delivery.

□ Problems with baby's lung development.

□ Stress during baby's delivery.

□ Lose a lot of blood.

□ Infections.

□ Premature rapture of membranes.

□ Congenital deformities.

□ Meconium aspiration.

□ Cold environment.

□ Infant of diabetic mother.

9) Duration of hospitalization (days):

- ☐ Less than 1 day.
- ☐ From 1-3 days.
- ☐ From 4-7 days.
- ☐ More than 7 days.
- ☐

Section two

10) Patient:

- ☐ Interventional group (on prone position).
- ☐ Control group (on another position rather than prone position).

If the patient on another position rather than prone position; please specify: ……………………………………….

11) Checklist for recording the value of heart rate, respiratory rate, oxygen saturation and ABGs.

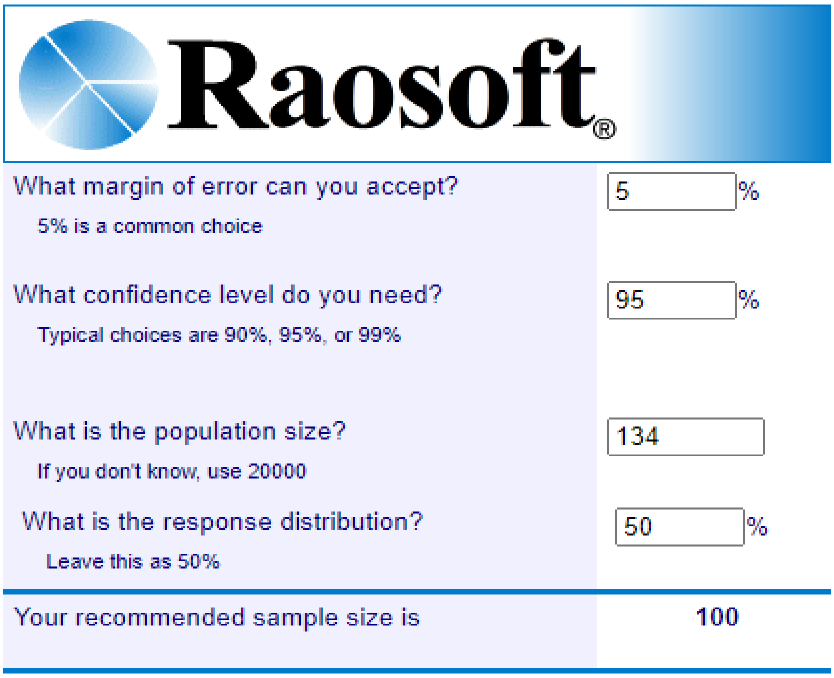
Thevalue	At 0 minute	At 1 hour	At 2 hours
Heart rate			
Respiratory rate			
Oxygen saturation			
$Paco_2$			
Pao_2			

Section three

12) Complications before, during and after positioning:

Complications	At 0 minute	At 1 hour	At 2 hours
Agitation cry.			
Present			
Absent			
Apnea			
Present			
Absent			
Lethargic			
Present			
Absent			
Vomiting			
Present			
Absent			
Another complication: ………………………..			
Present			
Absent			

Annex 2:



Source: sample size calculator by Raosoft (Raosoft, 2020).

Annex 3:

An-Najah
National University
Health Faculty of medicine&
Sciences
IRB

جامعة النجاح
الوطنية
كلية الطب وعلوم الصحة
لجنة اخلاقيات البحث العلمي

Ref: Mas. August /2020/6

IRB Approval Letter

Study Title:
"The effectiveness of Prone position on cardio respiratory clinical outcomes for the neonates who admitted to Neonatal Intensive Care Units with acute respiratory distress syndrome."

Submitted by:
Anas Badwan

Supervisor:
Eman Alshawish

Date Approved:
13th August 2020

Your Study Title "**The effectiveness of Prone position on cardio respiratory clinical outcomes for the neonates who admitted to Neonatal Intensive Care Units with acute respiratory distress syndrome.**" was reviewed by An-Najah National University IRB committee and was approved on 13th August 2020.

Hasan Fitian, MD

IRB

IRB Committee Chairman
An-Najah National University

Annex 4:

State of Palestine
Ministry of Health - Nablus
General Directorate of Education in Health

دولة فلسطين
وزارة الصحة- نابلس
الإدارة العامة للتعليم الصحي

Ref.: ....
Date:.................

الرقـــم: ٢٢٢/١٠٦/٢٠٢٢
التـاريخ: ١٠/٩/٢٠٢٢

الاخ مدير عام الادارة العامة للمستشفيات المحترم ،،،

تحية واحتـرام،،،

الموضــوع: تسهيل مهمة بحث

لاحقاً لموافقة معالي وزيرة الصحة، يرجى تسهيل مهمة الطالب: أنس بدوان، ماجستير تمريض التخدير، جامعة النجاح، لاجراء بحث رسالة الماجستير بعنوان:

"Evaluate the effectiveness of Prone and Supine position on cardio respiratory clinical outcomes for the neonates who admitted to NICU with acute respiratory distress syndrome"

حيث سيقوم الطالب بجمع المعلومات من قسم الحضانة عن طريق المشاهدة فقط، وذلك في:

- مستشفى رفيديا (قسم الحضانة)

حيث سيتم الالتزام باساليب واخلاقيات البحث العلمي.

مشرفة الدراسة: د. ايمان الشاويش.

وتقبلوا فائق الاحتـرام،،،

د. أمل ابو عوض
مدير عام التعليم الصحي

دولة فلسطين وزارة الصحة
الإدارة العامة للتعليم الصحي

P.O .Box: 14
Tel.:09-2333901

ص.ب. 14
تلفون: 09-2333901

Annex 5:

Article Matrix

TITLE	Year	Authors	Variable	Methodology	Result	Positive /negative
1-A randomized clinical trial to assess the effectiveness of prone position on cardiorespiratory outcomes among infants with respiratory distress.	2016	(Prerna Sharma, Arora, Sarkar, &Puliyel ,2016)	HR, RR, RD, SPO2	Before the administration of prone position, pre-intervention of physiological parameters, namely, HR, RR, SpO2, RD, complication detecting checklist was assessed for parameters like agitated cry, lethargy, vomiting, and apnea. Those randomized to receive, prone position was given for 2 h. Before the administration of prone position, pre-intervention of physiological parameters, namely, HR, RR, SpO2, RD, complication detecting checklist was assessed for parameters like agitated cry, lethargy, vomiting, and apnea Those randomized to receive, prone position was given for 2 h.	Prone position leads to an improvement in cardio respiratory clinical outcomes, and RD among infants with RD, without any complications.	**POSITIVE**
2-The impacts of prone position on the blood oxygen saturations and heart rates of preterm	2002	(Pelosi, Brazzi, & Gattinoni , 2002)	Spo2, HR	Each infant was positioned in a supine (control group) and prone (experimental group group) positions for 2hours.	The prone position compared to the supine position has a more favorable effect of SpO2	**POSITIVE**

infants under the mechanical ventilation.					and heart rate	
3-Efficacy of prone position in acute respiratory distress syndrome patients: A pathophysiology-based review.	2016	(Sharma, Arora, Sarkar, & Puliyel, 2016).	RR, HR, SPO2, PAO2, PACO2, gas exchange, respiratory mechanics, lung protection and hemodynamics as it redistributes transpulmonary pressure, stress and strain	Short prone positioning session of no more than 10, prone positioning seems to act beneficially in most pathophysiological disorders of ARDS improving hemodynamics, gas exchange and respiratory mechanics. Moreover, prone positioning seems to exert an additional beneficial effect against ventilator-induced lung injury. The mechanisms by which prone positioning improves with survival, are likely related to its physiologic effects.	It strongly supports that PP has beneficial effects on gas exchange, respiratory mechanics, lung protection and hemodynamics as it redistributes transpulmonary pressure, stress and strain throughout the lung and unloads the right ventricle.	**POSITIVE**
4-Comparison the effect of Sleep Positioning on Cardiorespiratory Rate in Noninvasive Ventilated Premature Infants.	2019	(Orloff, Turner, & Rehder, 2019).	HR, RR	Infants were randomly assigned into two groups, and the first group was placed in prone at first and then in supine, and the position of second group was at first supine and then prone. Infants' Heart Rate (HR) and Respiratory Rate (RR) were assessed three times in each position for 30	Prone position could decrease infants heart rate and respiratory rate, but supine position might increase them	**POSITIVE**

				minutes.		
5-Comparison of the effect of supine and prone positions on physiological parameters of preterm infants under nasal continuous positive airway pressure (N-CPAP): a cross over clinical trial	2016	(Rad, Mojaveri, Hajiahmadi, Ghanbarpour, & Mirshahi, 2016)	SPO2, HR, RR, arterial oxygen saturation	Neonates were placed in supine position at first for 180 minutes and then their position was changed into prone position for another 180minutes. During this period, heart rate (HR), respiratory rate (RR) and arterial oxygen saturation (Spo2) were assessed once every 15 minutes in two positions	The respiratory rate in the prone position was significantly lower than that in the supine position; however, the Spo_2 in the prone position was significantly higher than the supine position	**POSITIVE**
6-Treatment of ARDS With Prone Positioning.	2019	(Babaei, Pirkashani, & soleimani, 2019).	SPO2	Place newborn baby for 2 hrs. in prone position that shown improvement in oxygen saturation.	Prone positioning was first recognized for its ability to improve oxygenation.	**POSITIVE**
7- Does prone positioning improve oxygenation and reduce mortality in patients with acute respiratory distress syndrome?	2019	(Scholten, Beitler, Prisk, & Malhotra, 2017).	Mortality rate and spo2	Place patient for 10-18 hrs. in prone position that shown improvement in oxygen saturation and decrease mortality rate.	Prone positioning benefits oxygenation and improves mortality potentially through the mitigation of abnormal lung tissue strain and VALI.	**POSITIVE**
8- Influence of prone positioning on premature newborn infant stress assessed by means of salivary cortisol	2019	(Gattinoni, Busana, Giosa, Macrì, & Quintel, 2019)	salivary cortisol level, RR, and Brazelton sleep score	Saliva samples were collected from newborn infants at two different times: the first (corresponding to the baseline) after a period of 40 minutes during which the infants were not	Prone positioning significantly reduced the salivary cortisol level, respiratory rate, and Brazelton sleep score,	**POSITIVE**

measurement: pilot study				subjected to any manipulation and were placed in the lateral or supine position, and the second 30 minutes after placement in the prone position. Variables including heart rate, respiratory rate, peripheral oxygen saturation, and the Brazelton sleep score were recorded before, during, and at the end of the period in the prone position	suggesting a correlation between prone positioning and reduction of stress in preterm infants.	
9- Prone versus supine position in mechanically ventilated children: A pilot study.	2016	(Koulouras, Papathanakos, Papathanasiou, & Nakos, 2016).	ABG	Receive initial ventilation for 4hours prone or supine by drawing lots.	Mechanically ventilated patients in the PP have improved oxygenation compared with those supine, Prone position in the first few hours of ventilation significantly improve gas exchange and oxygenation, reduces the mean airway pressures required to ventilate children.	**POSITIVE**
10- Comparison the effect of Sleep Positioning on Cardiorespiratory Rate in Noninvasive	2019	(Matthay, et al., 2019).	RR, HR.	Infants were randomly assigned into two groups, and the first group was placed in prone at first and then in supine, and the position of second	Premature infants' HR and RR became lower at prone position than supine in both groups	**POSITIVE**

Ventilated Premature Infants				group was at first supine and then prone. Infants' Heart Rate (HR) and Respiratory Rate (RR) were assessed three times in each position for 30 minutes		
11- Positioning for acute respiratory distress in hospitalized infants and children	2013	(Ghorbani, Asadollahi, & Valiz, 2013).	SPO2	Randomized controlled trials (RCTs) or pseudo-RCTs comparing two or more positions in the management of infants and children hospitalized with acute respiratory distress, placing infant for 2hrs and child for 4 to 5hrs.	Prone positioning was significantly more beneficial than supine positioning in terms of oxygen saturation	
12- Effects of prone and supine positions on sleep state and stress responses in mechanically ventilated preterm infants during the first postnatal week.	2011	(Kabisch, Ruckes, Seibert-Grafe, & Blettner, 2011).		randomly assigned to supine/prone or prone/supine position sequence. Infants were placed in each position for 2 hours. A stabilization period of 10 minutes before observation of each position was allowed	Prone positioning improves the quality of sleep and decreases stress for ventilated preterm infants during the first week post birth	**POSITIVE**

جامعة النجاح الوطنية

كلية الدراسات العليا

فعالية وضعية الانبطاح على النتائج السريرية للقلب والجهاز التنفسي للأطفال حديثي الولادة المصابين بمتلازمة الضائقة التنفسية الحادة

اعداد

أنــس بــدوان

اشراف

د. ايمان الشاويش

قدمت هذه الأطروحة استكمالا لمتطلبات الحصول على درجة الماجستير في تمريض العناية المكثفة بكلية الدراسات العليا في جامعة النجاح الوطنية، نابلس – فلسطين.

2021

فعالية وضعية الانبطاح على النتائج السريرية للقلب والجهاز التنفسي للأطفال حديثي الولادة المصابين بمتلازمة الضائقة التنفسية الحادة

إعداد

أنس بدوان

إشراف

د. ايمان الشاويس

الملخص

الخلفية: متلازمة الضائقة التنفسية الحادة هي مصدر قلق صحي شائع للمرضى في وحدات العناية المركزة، والتي تتميز بارتفاع معدل الوفيات. تم استخدام وضعية الانبطاح بشكل متزايد في علاج مرضى متلازمة الضائقة التنفسية الحادة على مدى السنوات القليلة الماضية. تهدف الدراسة إلى تقييم فعالية وضعية الانبطاح على النتائج السريرية للقلب والجهاز التنفسي للولدان الذين دخلوا وحدة العناية المكثفة للأطفال الخدج مع متلازمة الضائقة التنفسية الحادة.

المنهجية: تم استخدام تصميم بحث تجريبي عشوائي محكم في هذه الدراسة. تكونت عينة الدراسة من 100 مولود (50 تداخلي و50 ضابطة). تم اختيار المشاركين بطريقة العينات العشوائية البسيطة. وتم استخدام الاستبيان لتحقيق أهداف الدراسة. حيث كان معدل الاستجابة 100٪.

النتائج: أظهر نتائج الدراسة أن 50٪ (العدد = 50) من المشاركين هم من الذكور بالإضافة إلى 50٪ من الإناث. كلتا المجموعتين التداخلية والضابطة كان بأعداد متساوية من الذكور (25 (50٪) والإناث (25 (50٪)) تمت مطابقة عمر الحمل والجنس بين المجوعتين التداخلية والضابطة، وكان العمر 34.1 ± 1.4 يوم للمجموعة التداخلية بينما 34.0 ± 1.4 يوم للمجموعة الضابطة. أما بالنسبة لنوع الولادة، 79٪ من المشاركات كان لديهن ولادة مهبلية طبيعية، بينما 21٪ كان لديهن ولادة قيصرية. كما أظهرت النتائج أن نتيجة مقياس أبغار للمشاركين تراوحت بين 5-10، حيث أن 37% من المشاركين كانت لديهم نتيجة مقياس أبغار هي 9.

الخلاصة: أظهرت النتائج أن متوسط معدل التنفس (نفس بالدقيقة) عند ساعتين انخفض بشكل ملحوظ في المجموعة التداخلية مقارنة بمجموعة التحكم (42.2 ± 7.0 مقابل 42.2 ± 7 نفسا في الدقيقة، (P=0.001 & 3.368−=t على التوالي) في المقابل، ارتفع تشبع الأكسجين (100٪) عند ساعتين بشكل ملحوظ إحصائيًا في المجموعة التداخلية مقارنةً بمجموعة التحكم (96.9 ± 3.3 مقابل 94.3 ± 4.9٪، على التوالي). كان هذا التغيير ذا دلالة إحصائية (t=3.205, P=0.002). أيضا، هناك فروق ذات دلالة إحصائية في 0 دقيقة، 1 ساعة وساعتين بين المجموعات التداخلية مقارنة مجموعة الضوابط فيما يتعلق بمعدل التنفس، أيضًا، أظهرت اختباراتpost hoc أنه يختلف اختلافًا كبيرًا من الناحية الإحصائية في 0 دقيقة مقارنة بساعة واحدة؛ 0 دقيقة مقارنة بساعتين و1ساعة مقارنة بساعتين (P <0.05). في المقابل، أظهرت مقاييسANOVA المتكررة أنه لا يوجد فرق مع تدبه إحصائيًا بين المجموعات التداخلية مقارنة بالمجموعات الضابطة فيما يتعلق بمعدل ضربات القلب وتشبع ثاني أكسيد الكربون بالدم (P > 0.05).

الكلمات المفتاحية: وضعية الانبطاح، القلب، الجهاز التنفسي، النتائج السريرية، الخُدج، وحدة العناية المركز للأطفال حديثي الولادة، متلازمة الضائقة التنفسية الحادة.