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Master Program in Neonatal Nursing

Outcomes of Surfactant Administration for Premature Infants (28-34weeks) At Al-Istishari Arab Hospital – West Bank

Rawd Ahmad Mohamed Shwawrah

202112978

Supervision Committee:
Dr.Najwa Subuh
Dr.Faeda Eqtait
Dr.Ibtesam Swekat

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This thesis was defended successfully on August 24, 2024 and approved by:

Thesis Committee Member:

Name	Title	Signature
1- Dr.Najwa Subuh	Main Supervisor	
2- Dr.Faeda Eqtait	Members of Supervision Committee	
3- Dr.Ibtesam Swekat	Members of Supervision Committee	

Palestine, August / 2024

Declaration

I declare that, except where explicit reference is made to the contribution of others, this thesis is substantially my own work and has not been submitted for any other degree at the Arab American University or any other institution.

Student Name: Rawd Ahmad Mohamed Shwawrah

Student ID: 202112978

Signature: Rawd

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Dedication

To the person who gave me giving, strength and pride... my dear father.

To the person who gave me love, tenderness, tenderness and loyalty .... my dear mother .

To my bond, my consolation, my joy and my honor... my dear brothers and sisters.

To all my friends and relatives, I dedicate to you my scientific research in .

I hope, in the end, from God to make happy for everyone and for this country to live in safety and peace and for these wars and massacres to end.

Amen……!

Rawd Ahmad Mohamed Shwawrah

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Abstract

Introduction: Premature infants are babies who are born alive before the full 37 weeks of pregnancy; Premature births can occur due to spontaneous preterm labor or medical indications for an early cesarean delivery or labor induction. Aim of study: To assess the relationships between maternal, fetal factors and the outcomes of surfactant administration in premature infants born in Al-Istishari Arab Hospital. Method: the study employed a retrospective descriptive design involving 94 premature infants diagnosed with respiratory distress syndrome who received surfactant treatment. It specifically examined premature infants in the Neonatal Intensive Care Unit at Al-Istishari Arab Hospital during 2023. Data were gathered through a review of medical records, and analysis was conducted using IBM SPSS, utilizing descriptive statistics and ANOVA. Results: All 94 premature infants received surfactant therapy, administered exclusively via the endotracheal tube method. The average duration of mechanical ventilation prior to surfactant administration was 1.7 days, while the mean length of stay in the NICU was 58.3 days. Approximately 87% of the infants survived, while 13% did not. There was a significant association between the presence of sepsis and survival outcomes within the first 24 hours post-birth, as well as between clinical signs and symptoms and survival status in the same timeframe. However, no significant difference was observed in the length of stay before and after surfactant administration concerning premature outcomes. Conclusion: Surfactant therapy has significantly improved the treatment of Neonatal Respiratory Distress Syndrome in newborns. The surfactant administration did not significantly change overall length of stay at NICU, it reduced length of stay on non-invasive ventilation. Recommendation: The recommendation is to implement rigorous post-surfactant monitoring protocols, develop guidelines for early detection and treatment of sepsis and pulmonary hemorrhage, create personalized care plans, educate parents on complications, and conduct larger multi-center studies to confirm findings.

Keywords: Premature, Surfactant Administration, Respiratory Distress Syndrome, surfactant therapy.

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List of Definitions of Abbreviations

Abbreviations	Title
BPD	Bronchopulmonary Dysplasia
BMI	Body Mass Index
CI	Confidence Interval
CS	Cesarean Section
CPAP	Continuous Positive Airway Pressure
ETT	Endotracheal Tube
FIO2	Fraction Of Inspired Oxygen
GA	Gestational Age
INSURE	Intubation, Surfactant Administration, And Extubation
IVH	Intraventricular Hemorrhage
LISA	Less Invasive Surfactant Administration
LOS	Length of Stay
LMP	The Last Menstrual Period
LMIC	Low- And Middle-Income Countries
MIST	Minimally Invasive Surfactant Therapy
NVD	Normal Vaginal Delivery
MAP	Mean Arterial Pressure
NEC	Necrotizing Enterocolitis
NEXT	Neonatal Expert Taskforce
NICU	Neonatal Intensive Care Unit
NNP	Neonatal Nurse Practitioner
NIV	Non-Invasive Ventilation
PDA	Patent Ductus Arteriosus
RDS	Respiratory Distress Syndrome
RR	Relative Risk
SRT	Surfactant Replacement Therapy
UK	United Kingdom
WHO	World Health Organization
NVD	Normal Vaginal Delivery

Chapter One: Introduction

1.1 Background

World Health Organization (WHO) in 2023 define Premature infants are babies who are born alive before the full 37 weeks of pregnancy, Premature births can occur due to spontaneous preterm labor or medical indications for an early cesarean delivery or labor induction. In 2020, an estimated 13.4 million infants were delivered prematurely. That is greater than one baby out of ten. in 2019 will see almost 900 000 children lose their lives due to complications from preterm birth. A lifetime of difficulties, such as vision and hearing impairments and learning disorders, await many survivors.

As WHO reports in 2023, prematurity is the primary cause of death for children under five worldwide. There are significant disparities in survival rates between countries. In lowincome settings, the lack of practical, affordable care such as warming, breastfeeding support, and basic treatment for infections and breathing difficulties causes the death of half of babies born at or below 32 weeks, or two months early. In wealthy nations, nearly all of these infants make it through. Premature infants that survive the neonatal period have a higher burden of disability due to suboptimal use of technology in middle-class settings (WHO, 2023). Among the 15 million yearly premature infants who are born worldwide, 1 million of them die before the age of 5 years old. In fact, preterm birth accounts for 18% of the deaths under the age of 5 years old, and 35% of deaths among newborns, i.e., younger than 28 days (Walani, 2020).

In developing countries 5% to 18% of premature infant mortality and morbidity are evident causes include infection, endometriosis, uterine hyperdilation, progesterone deficiency, stress on mother and baby, allograft reaction, allergic events etc. Interactions between the decidua and uterine follicles can mistakenly trigger the normal processes of uterine ripening, follicle rupture, and unplanned labor. Factors such as being Black, having dental disease, a low body mass index (BMI), and a history of premature term delivery can contribute to this risk (Khandre et al., 2022).

Focusing on the very premature births, studies have shown multiple associated outcomes and morbidities, including death, sepsis and necrotizing enterocolitis (NEC), as well as secondary outcomes of various weight and nutritional changes, more infection susceptibility and antibiotics administration, and prolonged length of stay (LOS) in hospitals (Mitha et al., 2022).

Respiratory Distress Syndrome (RDS), also known as" Hyaline Membrane Disease, is a condition primarily seen in preterm infants. It is characterized by insufficient surfactant production in the lungs, leading to alveolar collapse, impaired gas exchange, and respiratory failure" (WHO, 2023).

Respiratory distress syndrome (RDS) is a common complication of preterm birth, with more than half of those with a birth weight of 501 g to 1500 g showing signs of RDS. It has been shown that exogenous surfactant reduces mortality and pulmonary embolism in infants with RDS by approximately 30% and 50%, respectively. In human subjects, premature delivery may be unexpected and it is possible to steroids to induce rapid surfactant synthesis in the lungs. In unexpected cases, synthetic or natural surfactants may be administered to induce respiratory depression in the infant. A surface exchanger can prevent the airway from sticking together, when a baby usually needs oxygen or other air to help breathe (Steenhoo et al., 2022).

Several protocols have been developed around proper surfactant administration to premature infants with RDS, including the United Kingdom (UK) national consensus, which included several key recommendations. Such recommendations include that all neonatal units should agree on a specific policy related to surfactant administration, especially on a national level. Also, it is recommended to use surfactant as an early rescuer (within the first 2 hours of birth, while late is when surfactant is administered 2 hours after birth or later (Bhandari et al., 2023) rather than a prophylactic measurement, which includes the administration of surfactant in the delivery units. Moreover, surfactant dose is based on the baby's body weight, with a recommended dosage of 200 mg/kg, which has shown significant decrease in infant mortality and redosing need when compared to the dosage of 100 mg/kg. Lastly, less invasive surfactant administration (LISA) is the preferred approach compared to INSURE approach, especially for babies who are breathing spontaneously kept on non-invasive ventilation (NIV), which is based on the placement of soft-tipped semi-rigid fine bore catheter that is placed under laryngoscopy, taken consideration that a fraction of inspired oxygen (FiO2) of 30% or more after 2 hours of continuous positive airway pressure (CPAP) may be predictive of CPAP failure and should indicate surfactant replacement therapy (Banerjee et al., 2019).

In Palestine, a study showed that 17.9% of the premature births are (28 – 32 weeks of gestation), with a prevalence of RDS that reached 33.3%, with two thirds of the RDS occurred among infants with ≤ 34 weeks of gestation, compared to 6.7% among infants older than 34 weeks of gestation. Also, the study showed that surfactant is administered

to 75.9% of the premature infants, with 20% of them developed complications, mainly pulmonary hemorrhage (7.4%), followed by NEC, bronchopulmonary dysplasia (BPD) and pneumothorax (1.9% each), as well as the cited complications that include cerebral palsy, mental retardation, visual and hearing impairments, poor health growth, and often having long term difficulties such as behavioral and social emotional problems and learning difficulties (Ali et al., 2020) .

However, health care in Palestine still suffers from countless obstacles, the ongoing occupation, the inefficiency of the health care system, the lack of funding and the shortage of specialists in many fields, especially newborns, which suffer from a large medical staff. Also, health care as an institutional system remains unstable and uneven in Palestine. In addition, almost one generation has passed, and most attempts to improve effectiveness and efficiency to create a fair system have proven unachievable (WHO, 2023) .

The study aims to assess the relationships between maternal, fetal factors and the outcomes of surfactant administration in premature infants born in Al-Istishari Arab Hospital.

1.2 Problem Statement

Premature birth is one of the leading causes of preterm mortality and morbidity. It considered a dangerous health problem among neonates because the baby is born too early, before 37 weeks of gestation and it is more serious when a baby is born less than 28 weeks of gestation. Studies have shown that 60% of the preterm births occur in the low- and middle-income countries (LMIC), which clarifies the message related to the importance of focusing the efforts on understanding the burden of such phenomenon in related countries (Barfield, 2018). The main critical health problem among the premature infants is the development of RDS. Consequently, RDS and other health related issues will increase the infant's length of stay (LOS) in the hospitals, and will cause adverse outcome on infant's health, which may result in the increased rate of mortality and morbidity of these infants (Onger et al., 2023).

Administration of surfactant therapy is one of the effective measures to decrease the risk RDS and the long stay at hospital as well as death. Unfortunately, there is a lack of research on the value of using surfactant which provided to premature infants with RDS in the West- Bank. In present study base line data on the situations and outcomes of premature infants under treatment with surfactant in West Bank.

1.3 Significance of the Study

This study was described the outcomes of surfactant administration to premature infants. It will particularly consider the premature infants with respiratory distress syndrome (RDS). Also, it is expected to help in understanding the differences in the characteristics and health outcomes of the two groups of neonates as those with early and late administration of surfactant.

Premature infants with RDS faces numerous challenges in arrange to survive within the extra uterine environment; for that there's an awesome require for the expertise and extraordinary refinement of nursing practice and knowledge for neonatal intensive care unit (NICU), to guarantee that the holistic nursing care needs of the newborn child are met) Madeline et al., 2017) .

The study's findings can serve as a platform for future research aiming at better understanding the effect of surfactant on lung maturity. While there is research on using of surfactant with the first 4 hours or after 24 hours in diverse groups, there may be minimal evidence available for the Palestinian setting.

The therapeutic use of surfactant can be divided, according to the moment of treatment, into early (up to two hours after birth) or late (later than 24 hours after birth). There is evidence in the international literature that early treatment reduces the incidence of air leak syndrome and premature infants' mortality when compared to late use; however, there are no national data that associate the timing of treatment with exogenous surfactant and response to this treatment. Therefore, the aim of this study was to have local data regarding the timing of exogenous surfactant treatment and the main variables associated with RDS or prematurity (Sweet et al., 2023).

Moreover, this study seeks to provide recommendations to the officials and decision makers in the hospitals in question about the outcomes of surfactant administration in premature infants 28 – 32 weeks, in order to be able to establish related guidelines and protocols to enhance the outcomes of surfactant use to the optimal level. Also, it deals with one of the important health related problems of premature infants, i.e., surfactant-related outcomes.

1.4 Objectives of the Study

1.4.1 General Objective

To assess the relationships between maternal, fetal factors and the outcomes of surfactant administration in premature infants born at Al-Istishari Arab Hospital.

1.4.2 Specific Objectives

1.Determine the percentage and timeframe of surfactant use among premature infants in AlIstishari Arab Hospital.

2.Determine surfactant's administration outcomes among premature infants in Al-Istishari Arab Hospital (death versus alive and complications).

3.Investigate the difference in surfactant administration outcomes according to neonatal factors, like delivery type, antenatal morbidities, conception type, … etc.

4.Investigate the difference in surfactant outcomes according to maternal factors, like comorbidities, pregnancy type, age, … etc.

5. Assess the difference in neonatal outcomes after surfactant administration according to technical factors, like surfactant administration method, timing (early within first 2 hours vs late after 2hours of birth

1.5 Study Hypotheses:

1 .H0: There is no statistically significant difference in neonatal outcomes after surfactant administration according to neonatal factors, like delivery type, antenatal morbidities, conception type, … etc., at a significance level of 0.05.

2 .H0: There is no statistically significant difference in neonatal outcomes after surfactant administration according to maternal factors, like comorbidities, pregnancy type, age, … etc., at a significance level of 0.05.

3.H0: There is no statistically significant difference in neonatal outcomes after surfactant administration according to technical factors, like surfactant administration method, timing (early within first 2 hours vs late after 2hours of birth), … etc., at a significance level of 0.05.

1.6 Theoretical Definition

Gestational Age: the length of pregnancy after the first day of the last menstrual period (LMP) and is usually expressed in weeks and days. The fetus's gestational age is not the same as its embryologic age (Schlaudecker et al., 2017).

Premature infants: It is defined as neonates born alive before 37 weeks of gestation by the (WHO,2023). According to gestational age preterm is classified as extremely preterm for babies who are less than 28 weeks, very preterm for babies between 28-32 weeks, and moderate - late for babies between 32-37 weeks (WHO, 2023).

Respiratory Distress Syndrome (RDS): impaired or delayed surfactant synthesis and secretion in the immature lung. Between 24 to 28 weeks of gestation, type II alveolar epithelial cells begin production of surfactant (Ekhaguere et al., 2022).

Surfactant: is a complex mixture of lipids and specific proteins found in the alveoli and its main role is to reduce the surface tension of the alveolar air/water interface, thereby preventing lung collapse (Robichaud et al., 2019).

Neonatal Outcomes: the" occurrence of Low Birth Weight (LBW), preterm delivery, low Apgar score at first and fifth minutes after birth, early or late neonatal death, small for gestational age, and severe neonatal conditions" (Workinehet al., 2022).

Maternal characteristics: the behavioral and psychological characteristics that are possessed by a mother and are likely to have a direct impact on the health of the child or the child's' development. These characteristics include a number of variables such as; maternal age this is of importance as both early and late maternal age is hazardous to the lives of both mother and child (Jagtap et al., 2023).

Fetal factors: are relative to the constitutional or the inherent embryonic factors that affect its development and well-being during pregnancy. Others are race, genomics, fetal sex, and whether or not there have been any abnormalities at birth. Genetic factors are very important when it comes to the determination of fetal development not only as regards to physical characteristics, but also in cases of health risks (Andrawus et al., 2022).

1.7 Study Variables

1.7.1 Dependent variable

The outcomes of the baby with surfactant treatment therapy (alive, death, complication).

1.7.2 Independent variables:

1. Demographic data of the mother such as maternal age, education, occupational status and residency the place of follow-up & the premature infants .
2. Maternal & neonatal factors. like gestational age, delivery type, presence of previous preterm deliveries .

1.8 Summary

Surfactant replacement therapy has been the cornerstone of medical management for premature infants. A majority of premature infants in this gestational age (GA) group receive surfactant therapy to treat or prevent respiratory distress syndrome (RDS).

The practice of surfactant treatment has evolved over years from administration. It started to be used after a premature infant exceeded a certain cut-off for respiratory support, then changed to prophylactic administration irrespective of clinical status immediately after birth, early vs delayed administration, followed by the use of continuous positive airway pressure (CPAP) to establish functional residual capacity and give surfactant only if needed, and more recently, to either immediate extubating after surfactant.

Chapter Two: Literature Review

2.1 Search Strategy and key words

PUMBED and google Scholar are all databases that were used to research in last 5 month the body of literature on the topic from (2016-2024) and write literature review. The key words used in the research were: Surfactant, premature infants, outcomes .

2.2 Literature Review

2.2.1 Surfactant Definition, Surfactant Administration and its Importance

The word surfactant means a surface acting agent that lowers surface tension. Pulmonary surfactant is a thin liquid film synthesized by type II pneumocytes of the alveolar lining. It decreases surface tension at the gas-liquid interface of alveoli and also maintains the stability of the alveolar lattice apart from also preventing transudation of interstitial fluid into the alveoli (Nanda et al., 2020).

Surfactant is a substance consisting mainly of phospholipids by (75%) and proteins by (10%). The main components of the surfactant are dipalmitoyl phosphatidylcholine (lecithin), phosphatidylglycerol (surface proteins A, B, C and D), and cholesterol. These surface-active agents are released into the alveoli, where they reduce surface tension, and help maintain alveolar stability by preventing collapse of the small air spaces at the end of exhalation. Direct effects of surfactant therapy include improved oxygenation, reduced ventilator support, increased pulmonary compliance, and improved chest x-ray appearance (Taylor et al., 2019).

The administration of surfactant as a treatment has evolved over years. It started to be used after a premature infants exceeded a certain cut-off for respiratory support, then changed to prophylactic administration irrespective of clinical status immediately after birth, early vs delayed administration, followed by the use of continuous positive airway pressure (CPAP) to establish functional residual capacity and give surfactant only if needed, and more recently, to either immediate extubating after surfactant or administration of surfactant via endotracheatl tube (Coshal et al., 2021).

Nowadays it is known that exogenous surfactant therapy increases the mere size rapidly and improves pulmonary gas exchange until endogenous surfactant is released and surfactant replacement therapy is a well-established treatment strategy in respiratory distress of newborn infants. It reduces both neonatal mortality and pulmonary air leaks by about 50% (Dhar & Paul, 2020).

Surfactant replacement therapy (SRT) plays an essential role in the management of neonates with respiratory distress syndrome (RDS) because it improves survival and reduces respiratory morbidities. With the increasing use of noninvasive ventilation as the primary mode of respiratory support for preterm infants at delivery, prophylactic surfactant is no longer beneficial. For infants with worsening RDS, early rescue surfactant should be provided. While the strategy to intubate, give surfactant, and extubate (INSURE) has been widely accepted in clinical practice, newer methods of noninvasive surfactant administration, using thin catheter, laryngeal mask airway, or nebulization, are being adopted or investigated (Sweet et al., 2019).

Eras of clinical trials by (Bhattacharya et al., 019), and systematic reviews by (Minocchieri et al., 2019) , have established the unequivocal benefits of surfactant replacement therapy (SRT) for premature infants with respiratory distress syndrome (RDS). Irrespective of the strategy or product used, surfactant has been shown to decrease the need for ventilation support, risk of pulmonary air leak, mortality, and the combined outcome of death or bronchopulmonary dysplasia (BPD) at 28 days, without increasing adverse neurodevelopmental outcomes.

Studies for more than 3 decades has convincingly established surfactant replacement therapy (SRT) as highly effective treatment for premature infants with respiratory distress syndrome (RDS). The lung physiology dynamically changes after SRT, historically performed via endotracheal tube in mechanically ventilated infants, with rapid improvements in pulmonary gas exchange, reduced work of breathing, and decreased risk of interstitial pulmonary edema, pneumothorax and mortality (Humberg et al., 2020).

Surfactant Replacement Therapy (SRT) has changed the nature of RDS-associated longterm pulmonary morbidities such as bronchopulmonary dysplasia (BPD), while the incidence of BPD remains high, that is, up to 50% babies <29 weeks' gestation. Current approaches to prevent the lifetime burden of BPD are limited by its multifactorial etiology and the biological heterogeneity of affected newborn (Herting et al., 2020).

Surfactant replacement therapy has been known as the basic medical management for preterm neonates with RDS (Barkhuff & Soll, 2019). Its administration is a two-person procedure, which should be performed by at least one medical practitioner or a neonatal nurse practitioner (NNP) who administers the surfactant and one registered nurse as the assistant, mainly using the intubation-surfactant-extubating (INSURE) method, in which an endotracheal tube (ETT) is placed to the baby, followed by brief

ventilation and timely extubating within 60 minutes, then noninvasive ventilation (NIV) resuming (Sweet et al., 2019).

Further, it reduces the symptoms of RDS and consequently reduces ventilation and prolonged oxygen therapy. Surfactant administration has been shown to improve the clinical outcome of infants at risk for respiratory distress syndrome. In clinical trials, animal derived surfactant preparations reduce the risk of pneumothorax and mortality (Ng & Shah, 2021). Neonates who often respond to one dose of surfactant are either extubated or stabilized using lower oxygen requirements and lower mean airway pressure support (Coshal et al., 2021). However, the respiratory condition might worsen in some neonates after a few hours to the surfactant administration and they might require additional doses of surfactant (Barkhuff & Soll, 2019).

2.2.2 Surfactant Administration Methods, its Effectiveness and Complications

Strategies in surfactant administration have been based on manufacturer guidelines for individual surfactants. The dose of surfactant, frequency of administration, and treatment procedures have been modeled after research protocols. Furthermore, repeated doses of surfactants given at intervals for predetermined indications have decreased mortality and morbidity compared with placebo or single surfactant doses. However, given the long halflife for surfactant in preterm infants with RDS, redosing should not be needed more often than every 12 hours, unless surfactant is being inactivated by an infectious process, meconium, or blood. Dosing intervals shorter than 12 hours recommended by some manufacturers are not based on human pharmacokinetic data (Jackson et al., 2022).

The Respiratory distress syndrome -Neonatal Expert Taskforce (RDS-NExT) initiative aims to enhance clinical practice guidelines for surfactant use in premature infants with respiratory distress syndrome (RDS). An expert panel of healthcare providers conducted a survey questionnaire and virtual workshops to gather consensus on topics related to surfactant use in neonatal RDS. After discussion and voting, 20 consensus statements were reached, providing practical guidance for surfactant administration in preterm neonates with RDS, aiming to improve neonatal care and address knowledge gaps (Bhandari et al., 2023).

(Sabzehei et al.,2022) have a study on surfactant administration is carried out in two methods. In Intubation, Surfactant administration, and Extubating (INSURE), which is the most common method, the baby is first intubated and then extubated after surfactant

administration. However, sometimes tracheal intubation fails and causes hypoxia, bradycardia, increased intracranial pressure, and respiratory system injury. Moreover, mechanical ventilation can cause barotrauma and lung injuries making the infant susceptible to chronic lung disease. In minimally invasive surfactant therapy (MIST), surfactant is injected into trachea using a thin catheter with using forceps in direct laryngoscopy .

Another study by (Gupta et al.,2020) concluded that using the new and less invasive strategy of MIST in surfactant administration is increasingly growing and studies, carried out mostly in developed countries, have shown the advantages and feasibility of MIST in treating premature infants with RDS. Given that recent studies have shown that MIST could result in higher recovery rate without bronchopulmonary dysplasia (BPD) and reduce other complications associated with premature birth such as severe intraventricular hemorrhage (IVH).

A study comparing surfactant administration using invasive and non-invasive techniques on 175 very premature infants found that the SURE group had significantly better outcomes than the INSURE group. The SURE group experienced less mechanical ventilation need, fewer CPAP and supplemental oxygen needs, and fewer incidences of NEC stage 2 or more. The INSURE group had a shorter median neonatal intensive care unit stay and a lower incidence of BPD. Both groups showed no significant differences in gestational age, birth weight, gender, Apgar scores, or respiratory distress scores (Jena et al., 2019).

Procedures of surfactant administration may be complicated by transient airway obstruction, oxygen desaturation, bradycardia, and alterations in cerebral blood flow and brain electrical activity (Sood et al., 2019). The delivery of surfactant can also result in rapid improvement in lung volume, functional residual capacity, and compliance. Thus, expeditious changes in mechanical ventilator settings may be necessary to minimize the risks of lung injury and air leak. Clinicians with expertise in these procedures should be responsible for surfactant administration whenever surfactant is given (Taylor et al., 2019).

In many surfactants clinical trials have included premature infants born between 23- and 34-weeks' gestation and/or with birth weight between 500 and 2000 g. The results of subgroup analyses from such studies indicated that surfactant therapy decreased mortality rates most effectively in premature Infants born at less than 30 weeks' gestation or with birth weight <1250gm (Challis et al., 2021, Bugiera et al., 2020, Navikiene et al.,

2021). In addition, surfactant replacement reduced the incidence of pneumothorax, pulmonary interstitial emphysema, and the combined outcome of death or BPD, compared with no surfactant replacement, these findings suggest that lung injury is mitigated after surfactant replacement. The incidence of other medical morbidities, such as BPD, intraventricular hemorrhage, necrotizing enterocolitis, health care–associated infections, retinopathy of prematurity, and patent ductus arteriosus, has not changed with surfactant replacement, but this may be attributable, in part, to the large reduction in mortality with surfactant replacement therapy. The onset of clinical signs of patent ductus arteriosus may occur earlier, and the incidence of pulmonary hemorrhage, especially in infants born at less than 27 weeks' gestation, may be increased with surfactant therapy. Surfactant replacement is effective for larger and more mature premature infants with established RDS (Canpolat et al., 2020).

When CPAP fails to achieve desired respiratory outcomes in high-risk newborn with respiratory disorders (RDS), surfactant deficiency must be considered. Surfactant administration is performed using two techniques: INSURE and LISA, LISA aims to provide surfactant without exposing the infant to positive pressure ventilation by maintaining spontaneous breathing and glottis. This approach reduces the use of sedation, analgesia, intubation, and post-surfactant positive pressure ventilation. It also reduces short- term and long-term complications, such as intracerebral hemorrhage and bronchopulmonary dysplasia, although it still includes the use of a laryngoscope (Herting et al., 2019).

Respiratory distress syndrome (RDS) is the most common cause of respiratory failure among premature infants. The most important choice for the treatment of RDS is still exogenous surfactant replacement therapy and respiratory support. Today, there are some different surfactants applying techniques. A study by Silahli & Tekin (2020) aimed to evaluate the effects of the surfactant administration techniques in premature infants less than 33 weeks of gestational age. The medical data were collected retrospectively from the medical records. The patient divided into two subgroups as Less Invasive Surfactant Administration (LISA) group (n: 35) and Intubation- Surfactant administration and rapid Extubation (INSURE) group (n: 30).

In the previous discussed study two surfactant administration techniques were evaluated on the neonatal morbidities and mortality among premature infants. Results: There were no significant differences in maternal and neonatal characteristics between the two groups. Duration on the nasal continues positive airway pressure (nCPAP) is

significantly higher in the LISA group as compared with the INSURE group ($p< 0.001$). Concluded that the technique of the surfactant administration has no effect on the postnatal morbidities. LISA method is safe and effective as much as INSURE method, which is still a good alternative in centers with lack of experience about LISA.

A study comparing LISA and INSURE approaches on premature infants found a homogeneous sample with no significant differences in gestational age, birth weight, Apgar scores, gender, or use of antenatal maternal steroids. The INSURE group had a higher percentage of CS (93.5%) than the LISA group (52%). However, no significant differences were found in respiratory outcomes such as 48 hours post-surfactant intubation, second surfactant dose, pneumothorax, pulmonary hemorrhage, mechanical ventilation days, CPAP days, or oxygen supplementation days between the two groups. Insignificant differences were observed in BPD and intraventricular hemorrhage grades, patent ductus arteriosus, NEC, or death rates (Kaniewska & Gulczyńska, 2019).

In a study by Balazs et al (2022) about incidence and predictors of success and outcome of LISA in very preterm infants draw a conclusion that to have an optimal effect on lung function and gas exchange, the endotracheal administered surfactant should have a homogeneous distribution across the surfactant deficient lungs. In addition, the surfactant that reaches the alveolar or saccular space should not be inactivated by local conditions. Both these factors are in play when considering the effect of timing in surfactant treatment.

In utero, the fetal lungs are fluid filled to promote lung growth and differentiation. At birth, most of the fluid is still present in the lungs and is cleared by postnatal breathing during the first minutes to hours of life. Animal studies have shown that the homogeneity of exogenous surfactant distribution is improved if surfactant is administered in large volumes to the lungs. It is therefore hypothesized by (Ferri, et al ,2020) that administering surfactant in a still fluid-filled lung shortly after birth will enhance homogeneous distribution of surfactant and thereby its efficacy to improve lung function and gas exchange. A study in preterm lambs provided some support for this hypothesis as pretreatment with surfactant resulted in more homogeneous aeration following a sustained inflation after birth than administering the surfactant after the sustained inflation.

For premature infants intubated for RDS the timing of surfactant administration was examined in one systematic review by (Goncalves-Ferri et al.,2020) that compared early (within the first 2 hours of age) to late surfactant administration (delayed until RDS was established, usually 2 hours or beyond). It showed that early surfactant was associated

with a significant decrease in mortality, BPD at 36 weeks, BPD or death at 36 weeks, and reduction in the risk of air leak, with no increase in the risk for pulmonary hemorrhage or severe intraventricular hemorrhage .

Similar findings by (Hanke et al., 2020) was noted in two trials of more premature infants (<30 weeks GA) infants, showing the benefits of early surfactant in reducing mortality and BPD or death at 36 weeks. A few studies comparing early to late surfactant, as defined by oxygen requirement thresholds, suggest that low (FiO2 0.30 to 0.50) versus high (FiO2>0.55) thresholds incur more benefit by providing surfactant earlier—before the development of more severe RDS—without increasing the rate of intubation significantly. This finding held especially in premature infants born to mothers who received two doses of antenatal corticosteroids .

In one systematic review by Ambulkar et al published in 2021, analysis based on oxygen requirement criteria showed that a lower threshold (FiO2≤0.45) for intubation and surfactant administration was associated with less air leak and BPD compared with an FiO2 threshold >0.45. Further, two large, randomized trials that did not allow premature infants initially managed with CPAP to receive surfactant until an FiO2 threshold of 0.6 was reached demonstrated higher rates of pneumothorax compared with those who were intubated and given surfactant early.

In a study conducted by (Dhale,et al, 2022), they concluded that early rescue group there is significant reduction in mortality and lessen the need of mechanical ventilation with p value <0.05. Conclusion: Early routine surfactant administration within 2 hrs. of life as compared to late selective administration significantly reduced the need mechanical ventilation within 7th day of life and mortality among preterm with respiratory distress syndrome.

In administering surfactant very early (<30 min) after birth might enhance its efficacy by a more optimal distribution in a (partly) fluid filled lung and less inactivation by proteins in the alveolar space. This strategy is often referred to as ―prophylactic‖ surfactant treatment because it requires administration to all infants before the presence or absence of RDS becomes clinically apparent (Capasso et al., 2023).

A trials study by (Abdel-Latif, et al, 2021) compared prophylactic surfactant treatment with placebo, showing a significant reduction in mortality (relative risk (RR) 0.60, 95 % confidence interval (CI) 0.47–0.77) and air leaks (RR 0.40, 95%CI 0.29–0.54) in favor of the surfactant group. The rate of other neonatal morbidities was similar in both groups. Next, other trials by (Dargaville, et al, 2021) compared prophylactic surfactant

treatment to so-called selective treatment, i.e. targeting only preterm infants who show clinical signs of RDS. All infants included in these trials were intubated at the time of birth and surfactant was administered via an endotracheal tube. Furthermore, in most infants assigned to selective treatment, surfactant was administered after 2 h of life. Meta-analysis of nine trials including a total of 2789 infants clearly showed a decrease in neonatal mortality (RR 0.69, 95%CI 0.56–0.85) and air leaks (RR 0.79, 95%CI 0.63–0.98) in favor of the prophylactic treatment. There were no differences between the groups in other neonatal morbidities.

A study by (Ng & Shah ,2021) concluded that prophylactic use of surfactant refers to a strategy of providing exogenous surfactant at birth to infants at risk for RDS, with the aim of preventing severe RDS from developing. Selective use of surfactant refers to a strategy of providing exogenous surfactant to infants with established RDS. Both strategies have been shown to be effective, but with increasing use of continuous positive airway pressure (CPAP) in the delivery room stabilization of preterm infants, the benefit of prophylactic surfactant is being questioned.

A prophylactic, or preventive, surfactant strategy is defined as intubation and surfactant administration to infants at high risk of developing RDS for the primary purpose of preventing worsening RDS rather than treatment of established RDS; this has been operationalized in clinical studies as surfactant administration in the delivery room before initial resuscitation efforts or the onset of respiratory distress or, most commonly, after initial resuscitation but within 10 to 30 minutes after birth. This contrasts with a rescue or treatment surfactant strategy, in which surfactant is given only to preterm infants with established RDS. Rescue surfactant is most often administered within the first 12 hours after birth, when specified threshold criteria of severity of RDS are met (Lee et al., 2020, Bel et al., 2017).

Another study by (Cucereaet al., 2024) aimed to determine if early surfactant administration affects the status of ductus arteriosus in preterm infants ≤ 32 weeks of gestational age within 24 hours of birth. A prospective study was conducted from March 2022 to December 2023, involving 88 in-born infants. Results showed that 76% of premature infants who received surfactant therapy had an increase in Kindler score at 24 hours of life. Surfactant administration was significantly associated with decreased preductal diastolic pressure, post-ductal diastolic pressure, pre-ductal MAP, and post-ductal MAP. No significant changes in ductus arteriosus parameters were observed at 24 hours of life.

Some more large observational cohort studies also assessed the impact of timing when surfactant is administered selectively via an endotracheal tube to premature infants with RDS started on CPAP. (Canpolatet al., 2020) in a study about late administration of surfactant may increase the risk of patent ductus arteriosus included 593 premature infants with a gestational age (GA) < 30 weeks, who received treatment with surfactant when the FiO2 exceeded 0.40. Late surfactant (>2h of age) was associated with higher odds for Patent Ductus Arteriosus (PDA) but no other differences in short term outcomes were found. This shortage of a clear benefit following earlier administration may be explained by the fact that the timing of surfactant treatment is impacted by RDS severity, i.e. more premature infants with more severe RDS reach the clinical treatment threshold (FiO2) earlier and consequently receive surfactant earlier, while having a higher risk for adverse outcomes. Indeed, a large population cohort study from Sweden by (Challis et al., 2021) in a study about association of adherence to surfactant best practice uses with clinical outcomes among premature infants in Sweden showed that infants with lower GA more often received surfactant within 2h after birth. In this study, 38.9 % of premature infants received surfactant >2hours of life.

On the contrary, in Sweed study at 2019 about European consensus guidelines on the management of respiratory distress syndrome – 2019 Update aimed to evaluate the use of surfactant therapy for respiratory distress syndrome (RDS) in premature infants and its associations with outcomes, particularly among very preterm infants (GA <32 weeks). The study involved 97,377 premature infants born in Sweden between 2009 and 2018, who did not have malformations and were admitted for neonatal care. The main outcome measures included in-hospital survival, pneumothorax, intraventricular hemorrhage grade 3 to 4, duration of mechanical ventilation, use of postnatal systemic corticosteroids for lung disease, treatment with supplemental oxygen at 28 days' postnatal age and at 36 weeks' postmenstrual age. The results showed that 18.8% of premature infants (18.8%) received off-label use. In 1364 of 3508 premature infants (38.9%) with GA of 22 to 31 weeks, the first administration of surfactant was given more than 2 hours after birth, which was associated with higher odds of pneumothorax, intraventricular hemorrhage grades 3 to 4, receipt of postnatal corticosteroids, and longer duration of assisted ventilation but also higher survival than among infants treated within 2 hours of birth. In 146 premature infants (2.8%), the recommended maximum of 3 surfactant administrations was exceeded without associated improvements in outcome, (Sweet et al., 2019).

In Iraq, a study aimed to assess the effectiveness of surfactant therapy using the INSURE method in managing respiratory distress syndrome (RDS) in premature infants. The study involved 50 neonates diagnosed with RDS, with 54% being male and 46% female. The INSURE method saved 62% of the neonates' lives, with the failure group having significantly lower birth weights. The study also found that the INSURE method was successful in 72% of premature infants with gestational age ≥ 30 weeks, while only 28% succeeded in those under 30 weeks. The severity of RDS was significantly increased in the failure group. Tachycardia, bradycardia, and de saturation were the main complications during surfactant therapy. The study concluded that the INSURE method is effective in managing RDS, with decreased need for mechanical ventilation and decreased neonatal mortality rates. However, premature infants with lower birth weight, gestational age, lower Apgar score at 5 minutes, severe RDS, and prolonged administration have an increased risk for INSURE method failure. Adequate NICU beds and appropriate nursing care can improve outcomes for preterm patients. Surfactant echocardiograms are essential for predicting PDA risk (Hashim et al., 2021).

Although in a study by (Ng & Shah ,2021), they concluded that there are no statistically significant benefits to prophylactic use of surfactant when compared with prophylactic CPAP, several studies have investigated whether administration of surfactant early in the course of respiratory insufficiency improves clinical outcomes. Early rescue is defined as surfactant treatment within 1 to 2 hours of birth, and late rescue is defined as surfactant treatment 2 or more hours after birth. A recent meta-analysis of early (within 2 hours) versus delayed surfactant treatment concluded that the risks of mortality (RR 0.84; 95% CI

0.74–0.95), air leak (RR 0.61; 95% CI 0.48–0.78), chronic lung disease (RR 0.69; 95% CI 0.55–0.86), and chronic lung disease or death (RR 0.83; 95% CI 0.75–0.91) were significantly decreased. There were no differences in other complications of prematurity

In China, a study by (Duanet al., 2022) aimed investigate the therapeutic effect of surfactant replacement therapy (SRT) on respiratory distress syndrome (RDS) in premature infants in the Qinghai-Tibet Plateau. The study involved 337 premature infants with RDS from 10 hospitals in the Qinghai-Tibet Plateau from 2015 to 2017. The results showed that SRT significantly lowers the mortality rate of children with RDS compared to non-SRT groups. The effect of SRT on high-altitude infants with RDS was better than that in ultrahigh-altitude infants, with death rates of 34.34 and 49.71%, respectively. The improvement of PaO2/FiO2 and pH in children at high altitude was also better after SRT.

The study concludes that SRT plays a significant role in curing RDS in both high- and ultra-highaltitude regions, with better effects at high altitudes.

2.3 Summary

Surfactant replacement, given as prophylaxis or rescue treatment, reduces the incidence of RDS, air leaks, and mortality in premature infants with RDS. Early rescue surfactant treatment (<2 hours of age) in premature infants with RDS decreases the risk of mortality, air leak, and chronic lung disease in premature infants.

Premature infants and term infants who are receiving surfactant should be managed by nursery and transport personnel with the technical and clinical expertise to administer surfactant safely and deal with multisystem illness. Therefore, pediatric providers who are without expertise, or who are inexperienced or uncomfortable with surfactant administration or managing premature infants who has received surfactant should wait for the transport team to arrive.

Chapter Three: Methodology

3.1 Introduction

The goal of the study is to assess the relationships between maternal, fetal characteristics and the outcomes of surfactant administration in premature born at Al-Istishari Arab. In this section, research crossed the details and analysis of the research methodology, study design, study location, study participants, sample selection criteria, survey instruments, data analysis techniques, and ethical considerations.

3.2 Design of study

This study is a retrospective, cross-sectional design to describe the relationship between early administration of surfactant for premature infants and the effects on the premature infants admitted to the NICU in Al-Istishari Arab Hospital.

3.3 Study Population, Setting and Duration of the Study

The study population included all premature infants born with RDS and receive surfactant treatment. This study was conducted at Al-Istishari Arab Hospital (IAH) in Ramallah, Palestine.

The duration of study was from June 2023 to July 2024.

Al-Istishari Arab Hospital (IAH) is one of the largest private hospitals in Palestine. The prematurity and neonatal unit at Al-Istishari Arab Hospital consists of 26 incubators and it considers one of the best equipped units in the region. It is equipped with the latest technology, medical devices including 10 ventilator and 4 CPAP, and facilities designated for premature infants and their families, such as waiting areas for families of children and breastfeeding rooms. premature babies staying in the hospital are followed up by a qualified medical team of neonatologists and 26 nurses who hold distinguished academic degrees, such as a master's degree and bachelor's degree in nursing and in the field of care for premature infants.

3.4 Sample & Sampling and Sample Size

The sampling method employed in this study is convenience sampling as defined a nonprobability sampling technique where participants are selected based on their easy availability and proximity to the researcher. This method is often used in social science research due to its simplicity and cost-effectiveness, but it can lead to bias because the

sample may not be representative of the larger population, with specific inclusion criteria guiding the selection of premature infants for the study. Sample size was 102 premature infants (28-34 weeks) , 94 premature infants is a full data in the files, 8 premature infants doesn't have full information, so this file in IAH was excluded from the sample.

3.5 Inclusion Criteria & Exclusion Criteria

3.5.1 Inclusion Criteria:

1. Premature infants diagnosed with NRDS (28-34weeks)
2. Premature infants received surfactant.
3. All files of premature infants between (January 2023 – December 2023).

3.5.2 Exclusion criteria:

1. Premature infants file with incomplete information, or missing data
2. Diagnosed with other problem except RDS (of newborn, congenital pneumonia, meconium aspiration, diaphragmatic hernia, congenital heart disease, birth asphyxia).
3. The presence of congenital anomalies incompatible with life beyond the neonatal period

3.6 The Study Instrument and Data Collection

The researcher utilized an instrument adapted from previous studies (Ali et al., 2020; Greiner et al., 2021; Coshal et al., 2021), as well as insights gained from clinical experience and expert opinions in the field of neonatology and nursing. This checklist includes various sections that cover demographic information, neonatal characteristics, maternal and neonatal factors, surfactant administration, specific complications, Apgar scores, mechanical ventilation parameters, duration of oxygen therapy, length of hospital stay, and outcomes for premature infants.

The data sheet consisted of four parts

First Part was concerned with the demographic data of the mother and the premature infants, including maternal age, education, occupational status and residency, as well as the place of follow-up.

Second Part was concerned with selected maternal and neonatal factors (independent factors) that would affect the outcomes of the baby, like gestational age, delivery type, presence of previous preterm deliveries and others.

Third Part contains questions related to surfactant administration (that are filled for babies who received surfactant only), like dosage, type, and method of administration, while the Fourth Part is concerned with specific outcomes, like whether the baby developed any of a certain set of complications, Apgar scores, mechanical ventilator-related readings, length of stay on oxygenation therapy and in hospital and the outcome of the premature infants.

3.7 Data Collection

Data were collected from June 2023 to December 2023 after having permission from the Arab American university and IAH , the researcher reviewed each file and find the information based on the checklist as appendix One.

3.8 Ethical Consideration

This study was approved by the faculty of higher studies at Arab American University research ethical committee. In addition, permission for data collection was obtained from the Al-Istishari Arab Hospital, the researcher did not have approval from family of premature because the access of family is very difficult, and this study utilized data from premature infants, which was collected from patient files after obtaining approval from the hospital.

All collected information were treated as confidential, and the researcher committed not to disclose any data from the records.

The consent form provided information about the study's purpose, assured hospitals of the absence of any risks or threats associated with premature infant participation, briefly explained the study's objectives and outlined the procedures for maintaining the confidentiality of their data .

3.9 Pilot Study

A pilot study was conducted to test the clarity and applicability of the study tools, which were initially developed by Dr. Iyad Ali and later adapted for this research. The pilot included 10% of the total study population, involving 20 premature infants, to assess the content validity and reliability of the tools. Based on the findings, minor modifications, such as rephrasing, were made to enhance the study tools.

3.10 Reliability

Cronbach's Alpha was calculated for the checklist, yielding a value of 0.65.

3.11 Data Analysis

After completing the data collection, statistical analysis was carried out to meet the study's objectives. The data was collected by using the checklist model and was processed using IBM-Statistical Package for the Social Sciences (SPSS) SPSS (version 23.0, SPSS Inc., Chicago, IL, 2016), and the results were subsequently presented, descriptive statistics were used to analyze the collected data. Analysis of variance (ANOVA) (confidence interval 95%) was used.

Chapter Four: Results

4.1 Introduction

This chapter presents the findings and analysis of the study and compares the outcome of surfactant administration in the premature unit during the 1st 24 hours of life versus after 72 hours. The analysis data used descriptive and summarized critical features of data, including means, middle standard deviation, and the frequency of variables like gestational age and birth weight. The chi-square test of independence was used to compare category variables such as delivery time, antenatal morbidity between the early and late surfactant administration group. The third independent sample T-test compares continuous variables such as birth weight and gestational age between the two groups' forces. Lastly, logistic regression is used to assist the impact of various factors on one care outcome and identify significant periodicity among immunity and maternal characteristics.

4.2 Descriptive Analysis:

4.2.1 Demographic characteristics of the mothers:

Table 4.1: Socio-Demographic Characteristics of the Mothers (n = 94) :

Variables	N	(%)
Residency:		
Ramallah	71	75.5%
Jericho	15	16.0%
Salfit	4	4.3%
Hebron	4	4.3%
Educational level:		
High school	5	5.3%
College or university	20	21.3%
Other	69	73.4%
Occupation:		
Worker	11	11.7%
Housewife	21	22.3%
Others	62	66.0%
Antenatal Care Provider		

Private	36	38.3%
Governmental	58	61.7%

Table (4.1) showed the distribution of socio-demographic characteristics of the mothers', residency as follows: 75.3% (N= 71) of the mothers are from Ramallah, 15.9% (N= 15) are from Jericho, (N= 4) are from Salfit, and 4.2% (N= 4) are from Hebron. The distribution of mothers' antenatal care providers: 61.7% (N= 58) of the mothers received care from private sector providers, while 38.3% (N= 36) received care from governmental providers. This led to 73.4% (N=69) of the sample having an unknown educational level, while 21.3% (N=20) had a bachelor's degree, and 5.3% (N=5) had a high school education (Tawjehi). lastly, present that maternal occupational status was not mentioned in the hospital records during the review of the medical files. This led to 66% (N=62) of the sample having an unknown educational level, while 11.7% (N=11) were worker women and 22.3% (N=21) were homemakers.

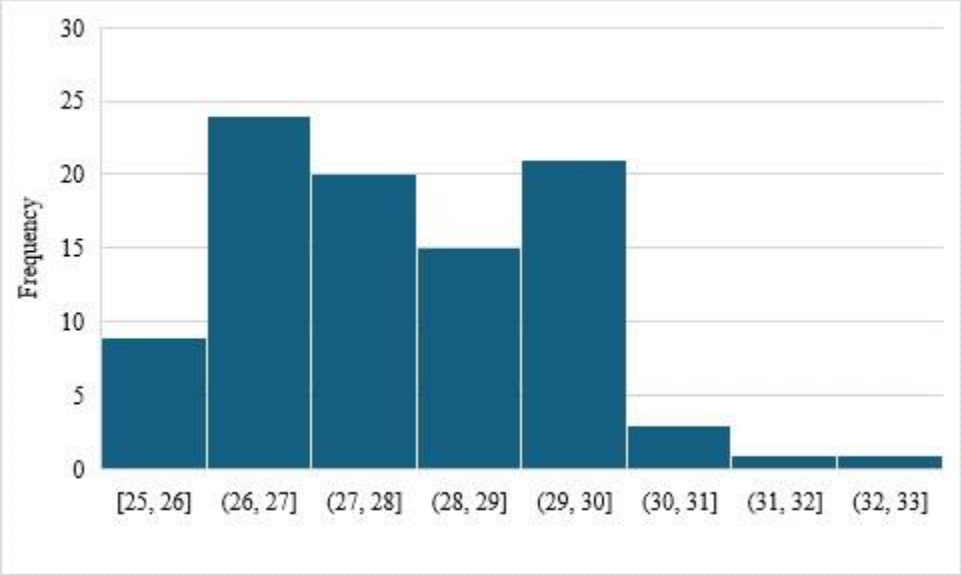

Figure 4.1: Gestational Age.

Figure (1) showed a histogram of the distribution of gestational age of the premature babies. The mean gestational age is 28.3 weeks, with a median of 28 weeks. The minimum age is 25 weeks, and the maximum is 33 weeks. The highest number of deliveries occurred at 27 weeks of pregnancy, accounting for 25.5% (N = 24) of deliveries. This was followed by deliveries at 28 weeks (21.3%, N = 20), 29 weeks (12.8%, N = 12), and 30 weeks (17%, N = 16).

4.2.2 The Obstetric Characteristics of the Mothers

In table 4.2, descriptive statistics for various factors related to pregnancies and deliveries. For the number of previous pregnancies, the mean is 2 and the median is 1, with a minimum of 0 and a maximum of 10. 49% of the mothers were pregnant at least once, 17% were pregnant twice, 16% three times, and 15% four times. Also, number of living children, the mean is 1.85 and the median is 1. 49% of the mothers had at least one living child, 17% had two, 21% had three, and 9% had four living children. When it comes to the number of abortions, the mean is 0.14 and the median is 1. 90% of the mothers had no abortions, 9% had one, and 1% had five abortions. For the number of deliveries, the mean is 1.85 and the median is 1. 47% of mothers had at least one delivery, 23% had two, 14% had three, 19% had four, and 3% had none. The data also shows that 85% of mothers had no history of multiple gestations, while 15% did. Regarding the type of delivery, 3% had a Cesarean Section (CS) and 92% had Normal Vaginal Delivery (NVD). In terms of smoking status, 97% were non-smokers, and 3% were smokers or ex-smokers.

Finally, 90% of the mothers received Dexamethasone during antenatal care as per protocols, while 9% did not.

Table 4.2: Maternal Factors (n=94)

Variables		
Previous pregnancies	**n**	**(%)**
No previous pregnancy	2	2.10%
1 previous pregnancy	46	48.90%
2 previous pregnancies	16	17.00%
3 previous pregnancies	15	16.00%
4 previous pregnancies	14	14.90%
>Four pregnancies	1	1.10%
	94	100%
Lived Children	**n**	**(%)**
No lived children	3	3.20%
1 lived child	46	48.90%
2 lived children	16	17.00%
3 lived children	20	21.30%
4 lived children	9	9.60%

No of deliveries	**n**	**(%)**
0 deliveries	2	2%
1 delivery	46	49%
2 deliveries	16	17%
3 deliveries	15	16%
4 deliveries	14	15%
5 deliveries	1	1%
	94	100.00%
No of abortion	**n**	**(%)**
0	85	90.40%
1	8	8.50%
More than one	1	1.10%
	94	100%
Multiple pregnancies	**n**	**(%)**
No	80	85.10%
Yes	14	14.90%
	94	100%
Type of delivery	**n**	**(%)**
Vaginal	80	85.10%
Cesarean delivery	14	14.90%
Maternal Smoker Status	**n**	**(%)**
Nonsmoker	92	97.90%
Smoker	2	2.10%
Received Dexamethasone	**n**	**(%)**
No	9	9.60%
Yes	85	90.40%
	94	100%

Table 4.3 shows the mother's comorbidities. Gestational hypertension is present at 44%, followed by a premature rupture of the membrane at 27% and 5% for diabetics. There are no cases of pre-eclampsia or diabetes, and the rest of the sample presents with no comorbidities.

Table 4.3: Comorbidities for the Mothers

		Responses	
		N	(%)
	Gestational hypertension	44	61.1%
	Gestational diabetes	1	1.4%
	Preeclampsia	0	0%
	Diabetes	0	0%
	Premature rupture of membrane	27	37.5%
	None	22	23.4%

4.2.3 Premature Related Factors and Surfactant Administration Factors:

The length of stay (LOS) Mean was 58.3 days, with a Standard Deviation of 45.56. The 25th percentile (Q1), also known as the first quartile, was 31.6 days, the 50th percentile (Q2), also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, and was 53.6 days. The 75 percentiles (Q3), also known as the third quartile, represent the value below which 75% of the data falls, with a mean of 75.25 days.

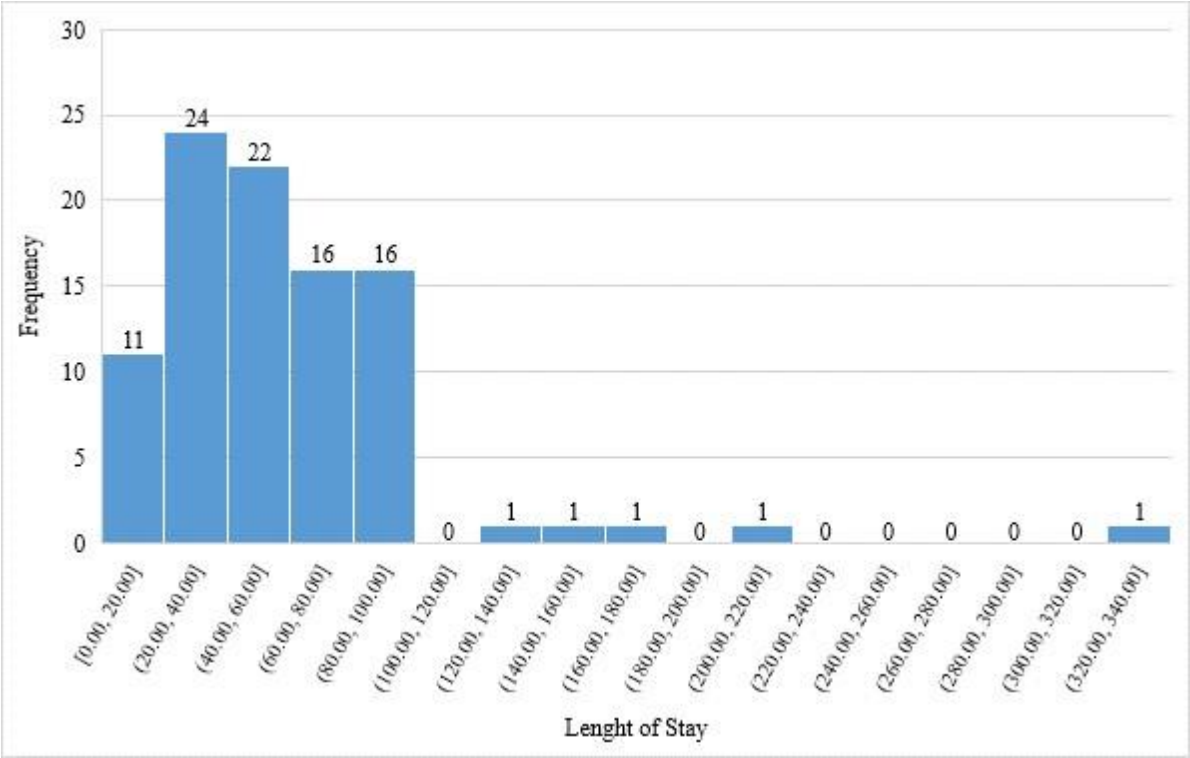

Figure 4.2: Length of Stay (LOS) for Premature Deliveries in the NICU During 2023.

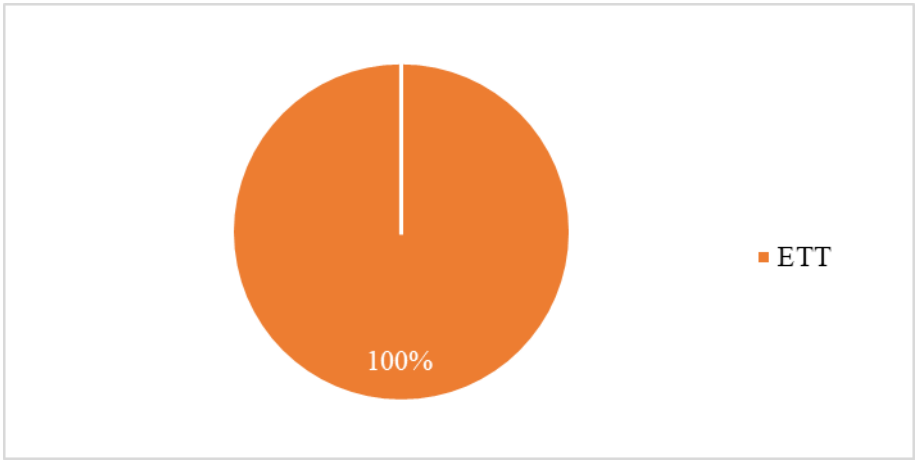

Figure 4.3: Surfactant Administration Method

Figure (4.3) illustrates the Surfactant Administration Method, which is 100% using the Endotracheal tube method.

Table 4.4: Length of Stay Before Surfactant Administration:

Variables	Frequency	Percent
Less than 24 hours	2	2.1
1 day	91	96.8
2 days	1	1.1

Table (4.4) illustrates the Length of Stay Before Surfactant Administration for premature deliveries in the NICU during 2023. The LOS Mean was 1days.

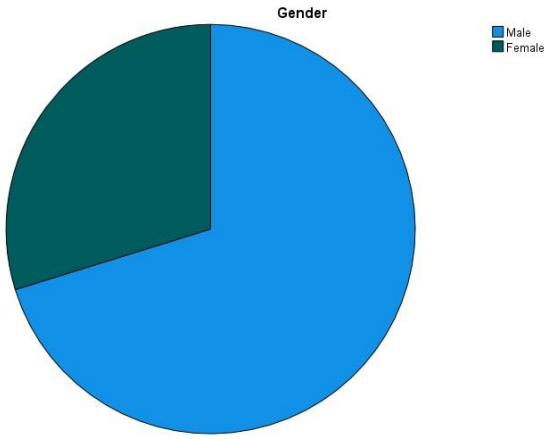

Figure 4.4: The Gender of the Premature.

Figure (4.4) presents the gender distribution in the sample. The male group consisted of 70.2% (N=66), and the female group consisted of 29.8% (N=28) of the total sample, n=94 in the NICU.

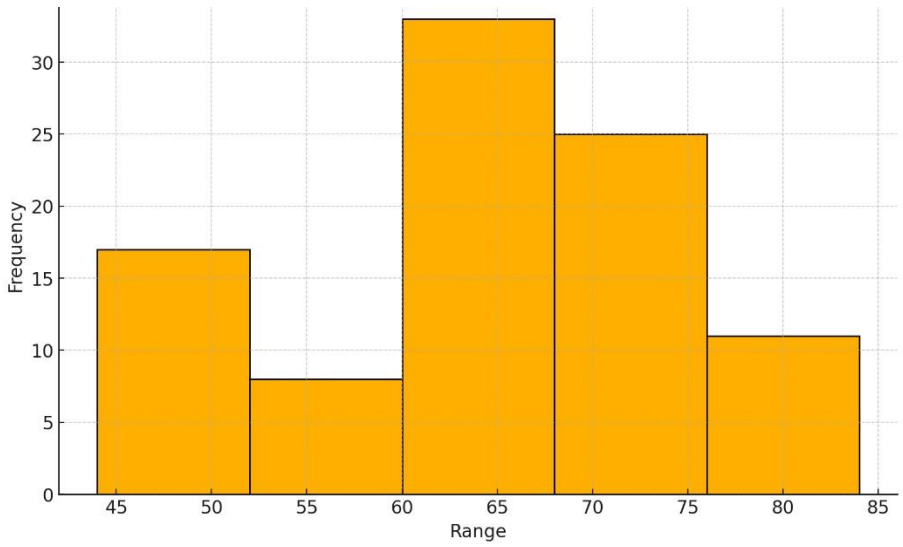

Figure 4.5: Respiratory Rate Before the Surfactant

Figure (4.5) showed illustrates the Respiratory rate of the premature before administering the dose of the surfactant. The data distribution Mean 63; on average, premature babies in the study had a respiratory rate of 63 breaths per minute. Stander deviation 10.6 suggests that there was a spread of respiratory rates around the average. Some babies likely had respiratory rates significantly higher or lower than 63 breaths per minute. On the other hand, the 25th percentile (Q1), also known as the first quartile, was 55 breath/min, and the 50th percentile (Q2), also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, which was 65 breath/min. However, the 75 percentiles (Q3), also known as the third quartile, represent the value below which 75% of the data falls, with a mean of 75 breath/min.

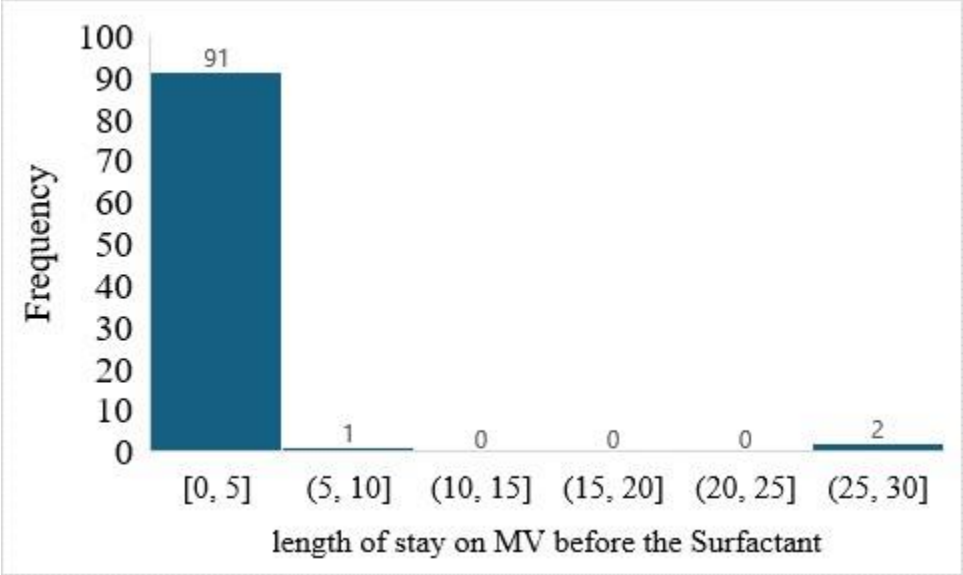

Figure 4.6: Length of Stay on MV Before the Surfactant Administration

Figure (4.6) illustrates the Length of Stay on MV before administering the dose of the surfactant. The data distribution Mean 1.7 days; on average, premature babies in the study had a respiratory rate of 1.7 days. Standard deviation 1 This indicates that the Length of stay (LOS) on MV for most babies was very close to the average of 1.7 days. There wasn't much variation in how long babies needed to be on ventilation. On the other hand, the 25th percentile (Q1), also known as the first quartile, was one day, and the 50th percentile (Q2), also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, which was one day. However, the 75 percentiles (Q3), also known as the third quartile, represents the value below which 75% of the data falls, with a mean of 1 day.

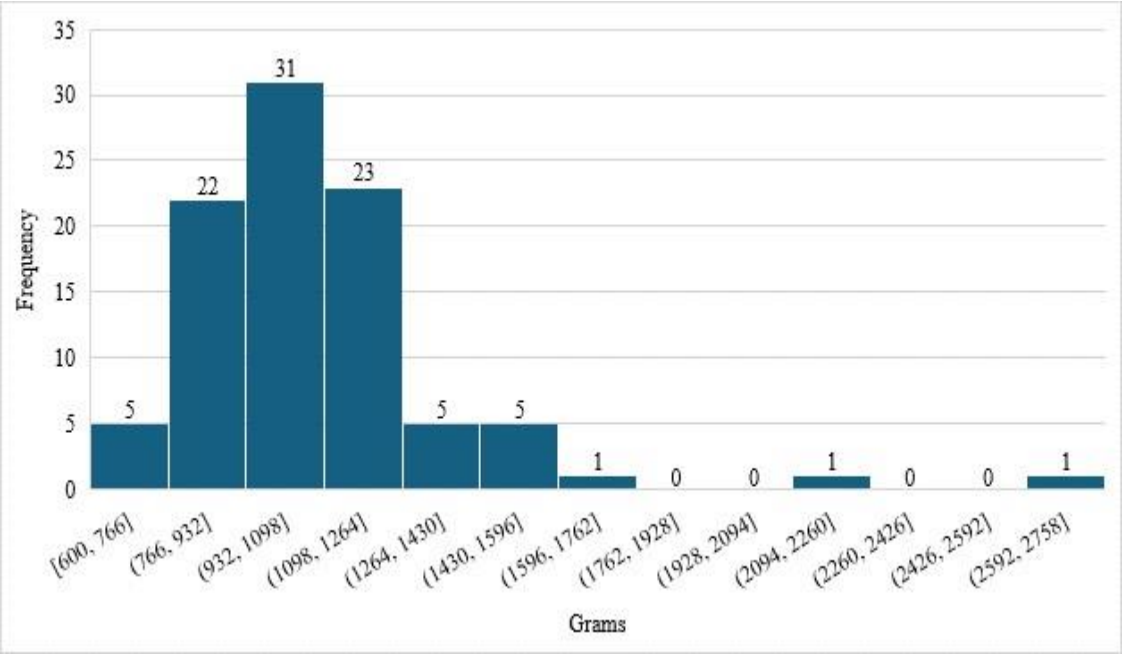

Figure 4.7: Birth Weight

Figure (4.7) illustrates the premature birth weight.

The mean of premature birth weight was 1079 Grams; the lower weight was 600 Grams 2.1%(N=2), and the heaviest was 2700 Grams 1% (N=1).

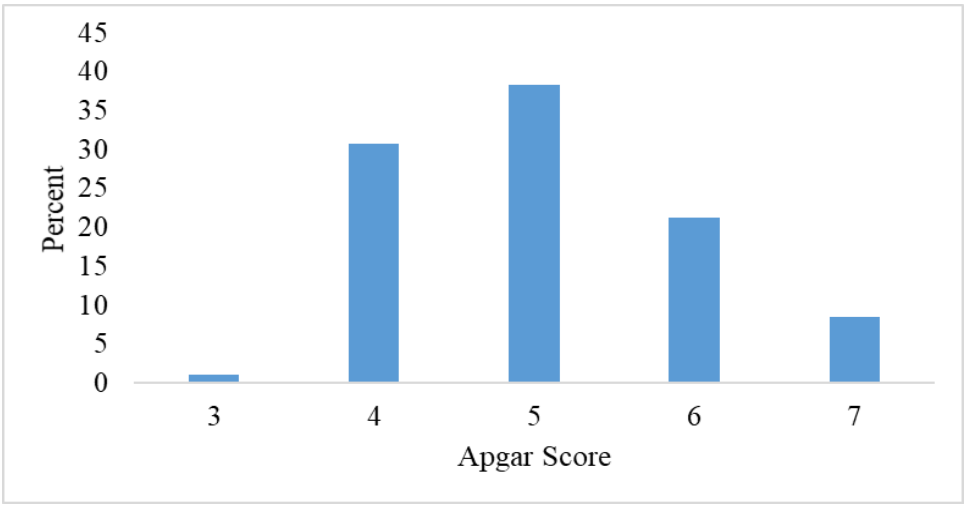

Figure 4.8: Apgar Score

Figure (4.8) showed the babies' APGAR scores after they were delivered. The result for score 3 was 1% (N=1); for score 4, the percentage was 31% (N=29); for score 5, the rate was 38% (N=36); for score 6, the percentage was 21% (N=20); and for score 7, the percentage was 9% (N=8).

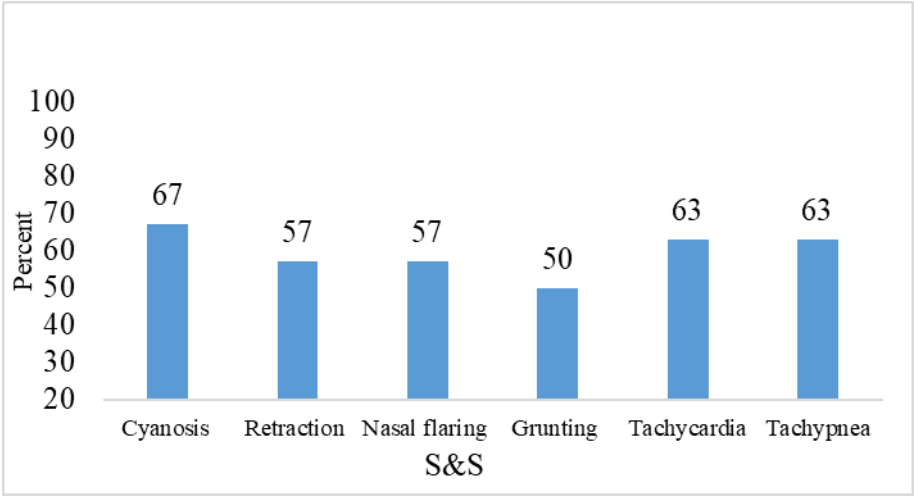

Figure 4.9: Signs and Symptoms Before Surfactant

Figure (4.9) showed the signs and symptoms before the surfactant administration for premature babies. The percentage of noise was 67%, followed by Tachycardia and tachypnea at 63%, nasally flaring at 57%, retraction at 57%, and granting at 50% of the total premature babies.

4.2.4 The Premature Babies After the Administration of Surfactant

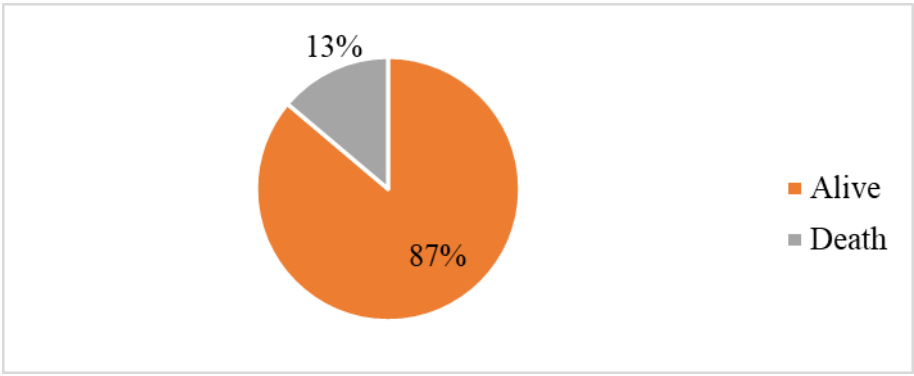

Figure 4.10: Discharge Status of premature

Figure (4.10) illustrates the discharge status of premature infants, 87% of the premature babies were alive, while 13%, unfortunately, died.

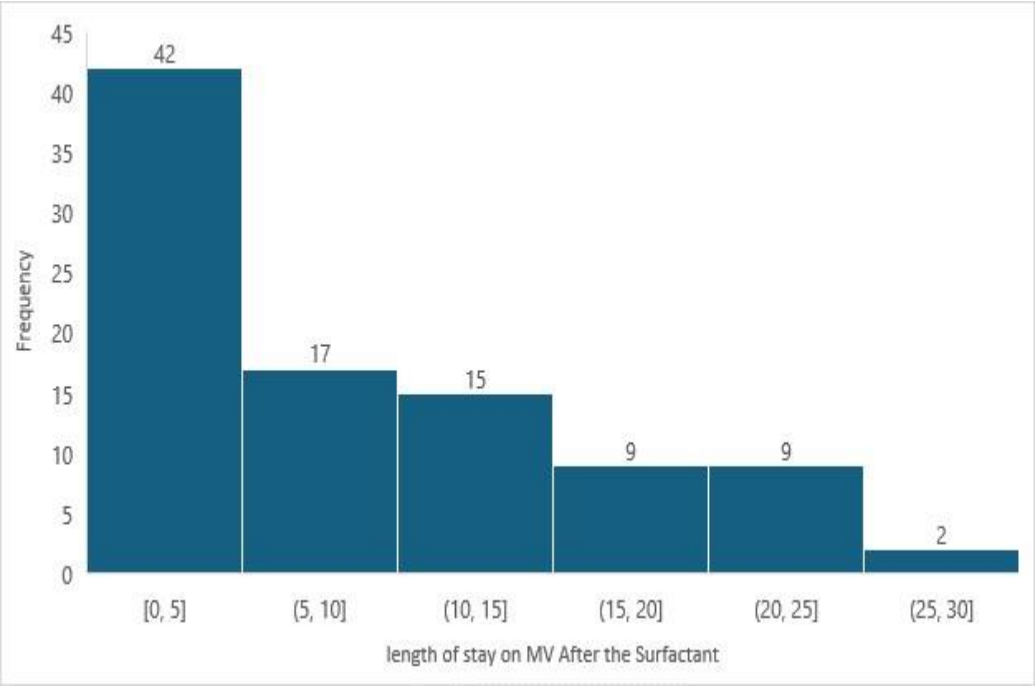

Figure 4.11: Length of stay on MV After the Surfactant Administration

Figure (4.11) illustrates the Length of Stay on the Mechanical Ventilator (MV) after administering the dose of the surfactant. The data distribution mean was 9.1 days; on average, premature babies in the study had a respiratory rate of 9.1 days. Standard deviation 7.6 This indicates that the LOS on MV for most babies was very close to the average of 1.7 days. There wasn't much variation in how long babies needed to be on ventilation. On the other hand, the 25th percentile (Q1), also known as the first quartile, was 3 days, and the 50th percentile (Q2), also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, which was 6 days. However, the 75 percentiles (Q3), also known as the third quartile, represents the value below which 75% of the data falls, with a mean of 15 days.

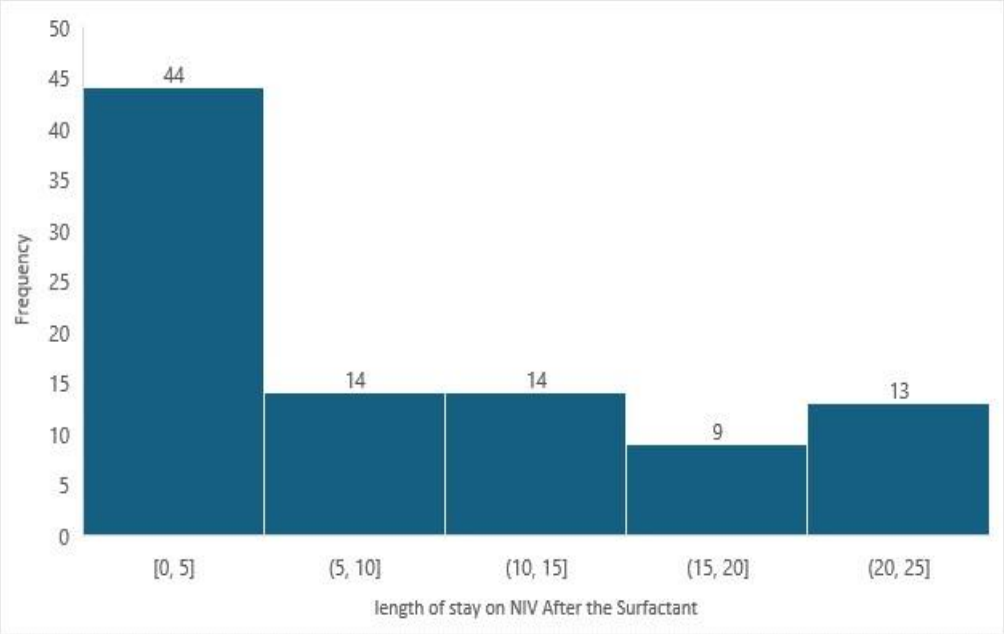

Figure 4.12: Length of stay on Noninvasive Ventilation (NIV) After the Surfactant

Figure (4.12) illustrates the length of stay on Noninvasive ventilation (NIV) after administrative surfactant. The data distribution man 9.3 days. Standard deviation 7.6 This indicates that the LOS on MV for most babies was very close to the average of 9.3 days. On the other hand, the 25th percentile (Q1), also known as the first quartile, was 2.7 days, and the 50th percentile (Q2), also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, which was 7 days. However, the 75 percentiles (Q3), also known as the third quartile, represents the value below which 75% of the data falls, with a mean of 15 days

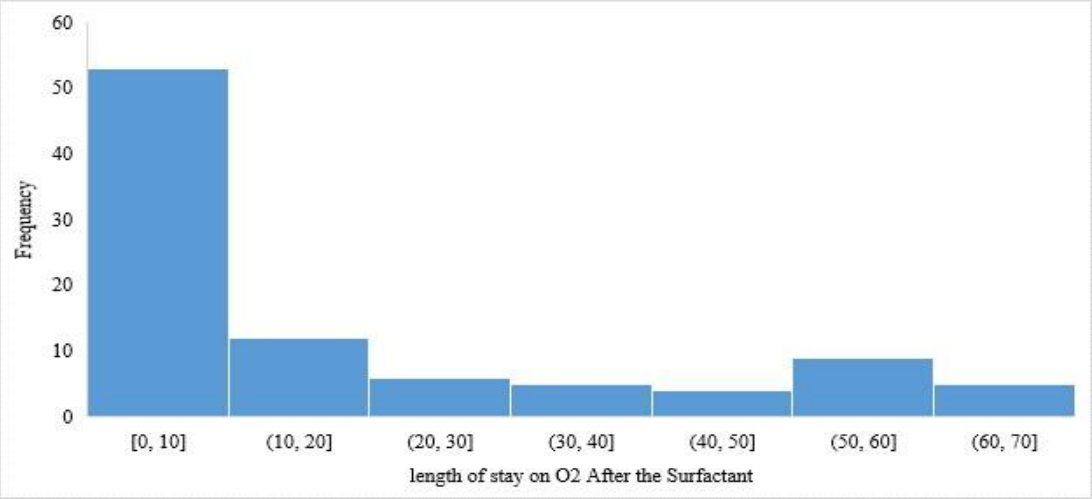

Figure 4.13: Length of stay on O2 After the Surfactant Administration

Figure (4.13) illustrates the Length of Stay on oxygen after administering the dose of the surfactant. The data distribution means 17 days. This indicates that the LOS on MV for most babies was very close to the average of 17 days. On the other hand, the 25th percentile (Q1), also known as the first quartile, was 0 days, and the 50th percentile Q2, also known as the median, represents the middle value in the data set, with the data ordered from least to greatest, which was 5 days. However, the 75 percentile Q3, also known as the third quartile, represents the value below which 75% of the data falls, with a mean of 29 days.

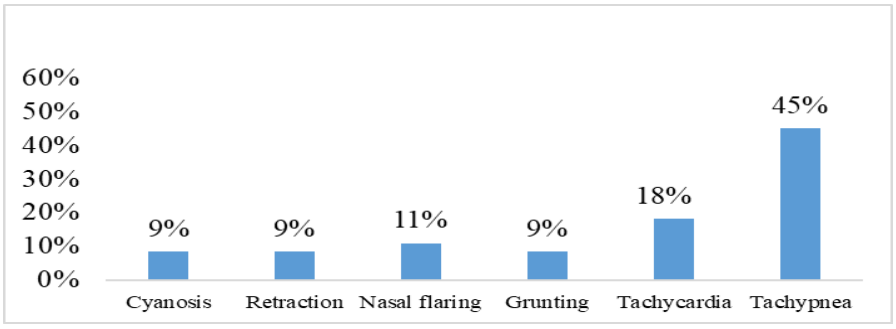

Figure 4.14: Signs & Symptoms of respiratory distress after surfactant administration:

Figure (4.14) illustrates the administration of surfactant, several signs and symptoms were observed in newborns, with tachypnea being the most common, affecting 45% of the cases. Tachycardia was noted in 18% of the infants, while nasal flaring was present in 11%. Other symptoms such as cyanosis, retraction, and grunting were reported in 9% of the cases.

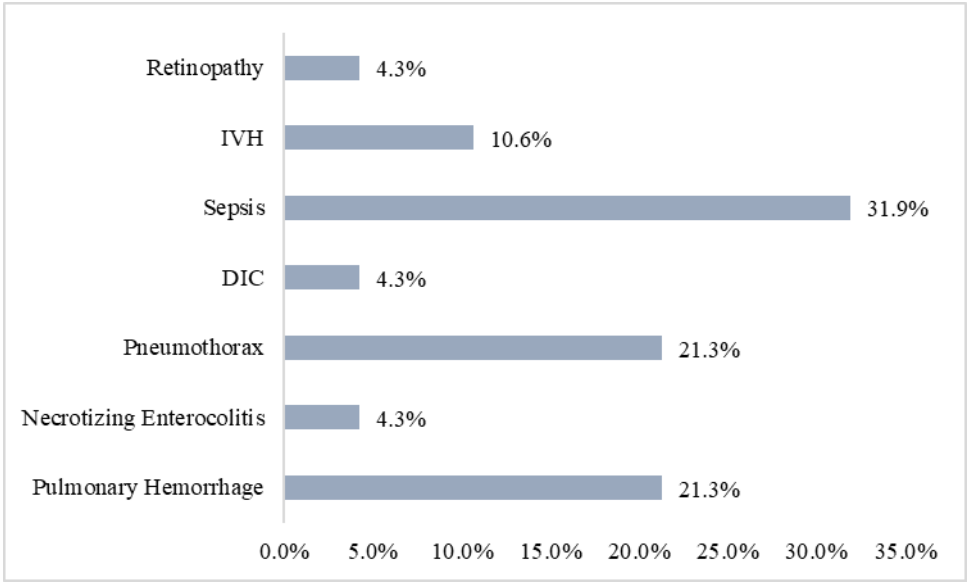

Figure 4.15: Neonatal Complications

Figure (4.15) presents the percentage of observed in babies during stay at NICU data distributions as follows sepsis 31.9% (N=15), pulmonary hemorrhage 21.3% (N=10), IVH 10% (N=5), DIC 4.3% (N=2), retinopathy.3% (N=2), and necrotizing enterocolitis4.3% (N=2).

4.3 Inferential Statistics

4.3.1 Premature babies Outcome and Length of Stay

Table 4.5: Premature Outcome and Multiple Pregnancies

Outcome * Multiple pregnancies

		Multiple pregnancies					
		No		Yes		Total	
		N	%	N	%	N	%
Outcome	**Death**	12	15.0%	1	7.1%	13	13.8%
	Alive	68	85.0%	13	92.9%	81	86.2%
Total		80	100.0%	14	100.0%	94	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	0.617	1	0.432
N of Valid Cases			

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 1.94.

b. Computed only for a 2x2 table

Table (4.3) showed that chi-square test of independence was conducted to examine the relationship between the outcome (alive or dead) and the presence of multiple gestation. The test was not statistically significant (p = 0.432), indicating that there is no significant association between the presence of multiple gestation and the likelihood of being alive or dead in the babies who received the surfactant within the first 24 hours of birth.

Table 4.6: Premature Outcomes and Number of Pregnancies, Abortions and Deliveries.

Independent Samples Test							
		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	P-value	T test	df	Sig. (2-tailed)	Mean Difference
Number of Pregnancies	Equal variances assumed	0.529	0.469	-0.446	92	0.656	-0.191
Number of Abortions	Equal variances assumed	0.642	0.425	-0.410	92	0.683	-0.071
Number of deliveries	Equal variances assumed	0.076	0.783	-1.089	92	0.279	-0.363

Table (4.6) presents the results of the independent sample test for the outcome category alive or death and the number with number of pregnancies, abortions and deliveries, after the surfactant administration, and the data was distributed as follows:

Number of Pregnancies

The first row presents the number of Pregnancies linked to the outcome of the variance test for equal variances, where the for equal variance is significant all 0.469,

which is (p >0.05). So, equal variances also in the t-test (Sig. 2-tailed): 0.656 (p > 0.05), this indicates that there is no significant difference in LOS after surfactant administration. (p=0.656).

Abortions

The second row presents the number of abortions linked to the outcome of the variance test for equal variances significant all 0.425, which is (p >0.05). equal variances also in the ttest (Sig. 2-tailed): 0.683 (p > 0.05), which concludes that there is no significant difference in LOS after surfactant administration. (p=0.683).

Number of deliveries

The third row in table (4) which presents the number of deliveries linked to the outcome of the variance test for equal variances significant all 0.783, which is (p >0.05). So, we assume equal variances also in the t-test (Sig. 2-tailed): 0.279 (p > 0.05), which concludes that there is no significant difference in LOS after surfactant administration. (p=0.279).

Table 4.7: Outcome and Gestational Hypertension Cross Tabulation

		Gestational hypertension					
		No		Yes		Total	
		N	%	N	%	N	%
Outcome	Death	6	12.0%	7	15.9%	13	13.8%
	Alive	44	88.0%	37	84.1%	81	86.2%
Total		50	100.0%	44	100.0%	94	%100.0

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.300[a]	1	0.584
N of Valid Cases	94		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 6.09.

b. Computed only for a 2x2 table

Table 4.5 shows results of chi-square test of independence was conducted to examine the relationship between the outcome (alive or dead) and the presence of comorbidities. The test was not statistically significant (p = 0.584), indicating that there is no significant association between the presence of gestational hypertension comorbidities and the likelihood of being alive or dead in the babies who wear receive the surfactant first 24 hours of birth.

Table 4.8: Outcome and Gestational Diabetes Cross Tabulation:

		Gestational diabetes					
		No		Yes		Total	
		N	%	N	%	N	%
Outcome	Death	13	14.0%	0	0.0%	13	13.8%
	Alive	80	86.0%	1	100.0%	81	86.2%
Total		93	100.0%	1	100.0%	94	100.0%

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.162[a]	1	0.687
N of Valid Cases	94		
a. 2 cells (50.0%) have expected to count less than 5. The minimum expected count is .14.			
b. Computed only for a 2x2 table			

Table (4.8) showed result of chi-square test of independence was conducted to examine the relationship between the outcome (alive or dead) and the presence of comorbidities. The test was not statistically significant (p = 0.687), indicating that there is no significant association between the presence of Gestational diabetes comorbidities and the likelihood of being alive or dead in the babies who wear receive the surfactant first 24 hours of birth.

Table 4.9: Outcome and Premature Rupture of Membrane Cross Tabulation:

		Premature rupture of membrane					
		No		Yes		Total	
		N	%	N	%	N	%
Outcome	Death	12	17.9%	1	3.7%	13	13.8%
	Alive	55	82.1%	26	96.3%	81	86.2%
Total		67	100.0%	27	100.0%	94	100.0%

Chi-Square Tests			
	Value	df	Asymptotic Significance (2sided)
Pearson Chi-Square	3.259	1	0.071

	a		
N of Valid Cases	94		
a. 2 cells (50.0%) are expected to count less than 5. The minimum expected count is .14.			
b. Computed only for a 2x2 table			

Table (4.9) showed a result of chi-square test of independence that was conducted to examine the relationship between the outcome (alive or dead) and the presence of comorbidities. The test was not statistically significant (p = 0.071), indicating that there is no significant association between the presence of premature rupture of membrane comorbidities and the likelihood of being alive or dead in the babies who wear receive the surfactant first 24 hours of birth.

Table 4.10: Comparing the Means of Type of Delivery and Early Surfactant Administration:

Independent Samples Test						
		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	P-Value	T	df	Sig. (2-tailed)
Timing of administration for surfactants before the first 24 hr.	Equal variances assumed	0.118	0.732	0.084	92	0.933
	Equal variances aren't assumed.			0.575	91	0.567

Table 4.10 presents the timing of surfactant administration, focusing on whether it was given within the first 24 hours and comparing the delivery method—either normal vaginal delivery or cesarean section. The variance test for equal variances yielded a significance of **0.732** (p > 0.05), indicating that the assumption of equal variances was met. Additionally, the t-test result showed a significance (2-tailed) of **0.933** (p > 0.05), suggesting that there is no significant difference in the timing of surfactant administration

between newborns delivered via normal vaginal delivery and those delivered by cesarean section (p = 0.933).

Table 4.11: Outcome of Sepsis Chi-Square Tests:

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	31.926[a]	1	<0.01		
N of Valid Cases	94				
a. 1 cell (25.0%) have expected count less than 5. The minimum expected count is 2.07.					
b. Computed only for a 2x2 table					

Table (4.11) showed results of chi-square test of independence, which examined the relationship between the outcome (alive or dead) and the presence of sepsis. The test was statistically significant (p = <0.01), indicating that there is a significant association between the presence of sepsis and the likelihood of being alive or dead in the babies who receive the surfactant during the first 24 hours of birth.

Table 4.12: Outcome and Pulmonary Hemorrhage Chi-Square Tests:

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2sided)	Exact Sig. (1-sided)
Pearson ChiSquare	31.926[a]	1	<0.01		
N of Valid Cases	94				
a. 1 cell (25.0%) have expected count less than 5. The minimum expected count is 2.07.					
b. Computed only for a 2x2 table					

Table 4.12 shows results of chi-square test of independence, which examined the relationship between the outcome (alive or dead) and the presence of Pulmonary Hemorrhage. The test was statistically significant (p = <0.01), indicating that there is a significant association between the presence of Pulmonary Hemorrhage and the likelihood of being alive or dead in the babies who receive the surfactant during the first 24 hours of birth.

Table 4.13: Outcome and IVH:

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.168	1	0.681		
N of Valid Cases	94				
a. 1 cell (25.0%) have expected count less than 5. The minimum expected count is 2.07.					
b. Computed only for a 2x2 table					

Table (4.13) showed result of chi-square test of independence was conducted to examine the relationship between the outcome (alive or dead) and the IVH. The test was not statistically significant (p = 0.681), indicating that there is no significant association between the presence of IVH and the likelihood of being alive or dead in the babies who receive the surfactant during the first 24 hours of birth.

Table 4.14: Outcome and S&S before the Surfactant Pearson Chi-Square

	Value	df	Asymptotic Significance (2-sided)
Outcome * Cyanosis	0.699	1	0.403
Outcome * Retraction	1.676	1	0.195
Outcome * Nasal flaring	1.676	1	0.195
Outcome * Grunting	0.640	1	0.800
Outcome * Tachycardia	0.033	1	0.855
Outcome * Tachypnea	0.033	1	0.855

Table (4.14) showed result of chi-square test of independence was conducted to examine the relationship between the outcome (alive or dead) and the signs and symptoms of patients. The test was not statistically significant (p = >0.05), indicating that there is no significant association between the presence of the signs and symptoms of patients and the likelihood of being alive or dead in the babies before receiving the surfactant during the first 24 hours of birth.

Table 4.15: Outcome and S&S after the Surfactant Pearson Chi-Square:

	Value	df	Asymptotic Significance (2-sided)
Outcome * Cyanosis	47.125	1	<0.001
Outcome * Retraction	35.709	1	<0.001
Outcome * Nasal flaring	14.541	1	<0.001
Outcome * Grunting	32.795	1	<0.001
Outcome * Tachycardia	71.644	1	<0.001
Outcome * Tachypnea	3.241	1	<0.001

Table (4.15) illustrates result of chi-square test of independence, which examined the relationship between the outcome (alive or dead) and the presence of the signs and symptoms of patients. The test was statistically significant (p = <0.01), indicating that there is a significant association between the presence of the signs and symptoms of patients and the likelihood of being alive or dead in the babies who receive the surfactant during the first 24 hours of birth.

4.4 Summary

Early administration of surfactant in RDS as a best practice is supported by our findings of lower incidences of premature infants' morbidities and of increased mortality if surfactant treatment is omitted. However, the discharge status results as 87% of the premature infants were alive, and 13%, unfortunately, died. Regarding maternal factors such as the number of pregnancies, number of deliveries, abortion, and new natural outcomes, we found that there was no significant difference in factor after surfactant administration where the ($P>0.05$) for all cases; however, these findings suggest that maternal history may not significantly impact the effectiveness of surfactant treatment in term of neonatal length of a stay or outcome.

Finally, while surfactant treatment might have a role in treating RDS, randomized clinical trials are needed before routine use can be recommended.

Chapter Five: Discussion

5.1 Introduction

This research aimed to assess the relationships between maternal, fetal factors and the outcomes of surfactant administration in premature infants born in Al-Istishari Arab Hospital. The primary focus was on the length of stay (LOS) in different settings (e.g., mechanical ventilation, non-invasive ventilation, oxygen therapy) before and after surfactant administration, as well as the relationship between various maternal and neonatal factors and neonatal outcomes (alive or dead).

In a study by Bel et al., 2019 revealed that the use of surfactant treatment has improved over years from administration. It started to be used after a neonate exceeded a certain cut-off for respiratory support, then changed to prophylactic administration irrespective of clinical status immediately after birth, early vs delayed administration, followed by the use of continuous positive airway pressure (CPAP) to establish functional residual capacity and give surfactant only if needed, and more recently, to either immediate extubating after surfactant or administration of surfactant via thin catheters (Bel et al., 2019).

This study used a retrospective, non-experimental, quantitative study design to illustrate the relationship between early administration of surfactant for premature infants
(at first 24 hours) and the effects on the premature infants admitted to the NICU in AlIstishari Arab Hospital.

At the end of the study, the results will be compared with recent literature and other related studies. It explained to what extent the results of the current study supported or contradict with our research hypothesis. It was handled at Neonatal Intensive Care Units at (NICUs) in Al-Istishari Arab Hospital at Ramallah city and carried out on 102 premature infants.

5.2 Discussion

In this study it revealed that the percentage of premature infants were male about 70.2% (n=66) , and the female about 29.8% (n=28) premature , These results were similar to the results of Taylor et al., 2019 study about surfactant administration

in preterm infants: drug development opportunities which concluded that the most of premature infants were male (n=22985).

According to the findings of this study the birthweight of premature (n=35) most is between (800-1000gm), but in United States of America the most weight of premature is (<600 g). This result is not consistent with our research, and the reasons for this lack of conformity are due to the nature of life and the nature of the country, as developing countries differ from first world countries.

All premature infants in this study were placed on mechanical ventilator, on ETT, these findings were similar to the findings of Taylor et al, (2019) study all premature was on ETT, this is due to the reason that the only way to give treatment is through a tube.

In more details the length of stay after surfactant administrations on MV about average of 17 days, The findings were in contrast to the findings of Ali et al ., (2020) with study about the antenatal corticosteroids and fetal lung immaturity in preterm birth. who pointed out that length of stay on MV about 47 days, this demonstrates the interest in Palestine for new children, especially in the Al-Istishari Arab Hospital, and indicates the amount of care provided to the patient.

As regard to the premature infant discharge, 87 % was discharged alive and death about 13 %, which is contrast to Ali et al., (2020) results 72.2 % discharged alive and 14 % discharged died, it shows the extent of care, the effectiveness of treatment, and the causes of death due to complications, but as Ali et al., (2020) study wrap up that the most complication cause the death is pulmonary hemorrhage about 7.4 % from all complications, but In this study, the rate of complications due to sepsis was notably high at 31.9%. It is essential for nurses working in the NICU to be well-informed and proficient in preventing neonatal infections. Failure to adhere to infection control protocols when caring for premature infants can increase the risk of septicemia and potentially lead to neonatal mortality.

Surfactant therapy has improved the management of Neonatal Respiratory Distress Syndrome (NRDS), significantly improving outcomes for affected newborns. In this study, maternal obstetric characteristics such as the number of pregnancies, number of deliveries, abortion were not significantly impact the effectiveness of surfactant treatment in term of neonatal length of a stay or outcome. However, this is

agreed with Coshal et al., (2021) study showed that maternal factors and maternal health condition do not significantly affect the surfactant therapy in the neutral outcomes which reinforce the notion that maternal history does not significantly influence the effectiveness of the surfactant treatment regarding length of stay.

According to this study, it was examined the effect of many variables like gestational hypertension, diabetes, and premature rupture of membranes.

The study findings revealed that some common comorbidities, such as gestational hypertension and diabetes, may not significantly affect the success of surfactant therapy in terms of immediate neonatal survival ($p>0.05$). This is encouraging news, indicating that these conditions alone may not necessarily diminish the therapy's effectiveness. However, the presence of other conditions like sepsis and pulmonary hemorrhage paints a different picture. These complications were found to have a significant negative association with neonatal outcomes after surfactant administration ($P<0.01$). Contrary to this finding, in a study by (De Bisschopa et al. 2020) reported a significant coalition with pregnancy complications.

According to a previous systematic review study among 38 relevant studies from level-3 neonatal units found that receiving intubate-surfactant-extubate significantly reduced mortality rates and air leaks in neonates. However, the risk of bronchopulmonary dysplasia was found to be higher in those receiving surfactants. Two studies found no variations in the percentage of neonates developing pulmonary hemorrhage, while another observational study reported a higher incidence in those receiving surfactants. The failure rate of the technique requiring mechanical ventilation or referral varied from 34 to 45% in four case-series (Sankar, et al, 2016).

In relation to the percentage of baby's consequences during the stay at NICU after receiving surfactant, the data distribution including sepsis 31.9%, pulmonary hemorrhage 21.3%, IVH 10%. These results were similar to the findings by Kaleem et al., (2023) in randomized controlled trial study about Efficacy and safety of surfactant administration by MIST and INSURE techniques in Neonates with Respiratory Distress Syndrome indicated that Pulmonary hemorrhage followed by PDA and intraventricular hemorrhage were common in the study groups.

The timing of surfactant administration in less than 24 hours and the way of delivery (vaginal vs. cesarean section) did not show a significant difference

(p=0.933). This suggests that the timing of surfactant administration and the mode of delivery do not significantly influence the effectiveness of the treatment or the associated neonatal outcomes. Research indicates that early dispense of surfactant (*in* less than *24 hours* of life) is generally more effective than delayed administration in improving outcomes for preterm infants with respiratory distress syndrome (RDS). These results aligned with a study by (Rodriguez-Fanjul et al., 2021) about early surfactant replacement guided by lung ultrasound in preterm newborns with RDS: the ULTRASURF randomized controlled trial who reported that in cases where surfactant is administered within the first 24 hours, the exact timing (early vs. late within this period) does not significantly alter outcomes, suggesting that the critical factor is the administration itself rather than the precise timing within the first day, however, the mode of delivery (vaginal vs. cesarean section) does not significantly influence the effectiveness of surfactant therapy or neonatal outcomes. This finding is consistent with broader research by (Ulubaşoğlu et al, 2023), which shows that while cesarean deliveries might be associated with higher initial respiratory distress, the administration of surfactant levels the playing field in terms of outcomes for neonates. According to a study by Hashim et al., (2021), showed that early administration of surfactant may play an important role in improving the prognosis of premature neonates with surfactant replacement therapy. Early administration of surfactant (< 1 hours) shows noteworthy improvement in success rate (P value 0.015).

The results of the current study about the presence of signs and symptoms before surfactant administration was not significantly associated with neonatal outcomes ($p > 0.05$). However, signs and symptoms after surfactant administration showed a significant association with outcomes ($p < 0.01$). This finding indicates that the clinical presentation of neonates after receiving surfactant is a crucial determinant of their survival, highlighting the importance of post-treatment monitoring. studies highlight that clinical presentation post-administration is crucial for outcomes. While opposed with the results of (El-Atawi et al., 2024). Premature infants showing persistent symptoms after surfactant treatment often have poorer outcomes, emphasizing the need for vigilant post-treatment monitoring and management to address ongoing respiratory issues or other complications. However, implementing rigorous post-treatment monitoring protocols, clinicians can leverage surfactant

therapy's effectiveness to its fullest potential. This proactive approach empowers them to identify and address any emerging problems promptly, ultimately optimizing the chances of a full recovery for these fragile patients.

5.3 Conclusion

Surfactant therapy has revolutionized the treatment of Neonatal Respiratory Distress Syndrome (NRDS), offering a lifeline to countless premature infants. This study review has delved into various factors that influence the effectiveness of this life-saving intervention, revealing a multifaceted picture demanding a tailored approach to optimize outcomes.

The findings of this study provide valuable insights into the impact of surfactant administration on various clinical outcomes in premature infants. While surfactant administration did not significantly alter overall LOS or the influence of maternal factors, it was associated with a reduction in LOS on NIV. It highlighted the critical impact of sepsis and pulmonary hemorrhage on neonatal survival. These results underscore the importance of early identification and management of sepsis and pulmonary hemorrhage, as well as vigilant post-treatment monitoring to improve outcomes in neonates receiving surfactant therapy. Further research is needed to explore the mechanisms underlying these associations and to develop targeted interventions to enhance the efficacy of surfactant treatment in this vulnerable population.

5.4 Recommendation

For healthcare providers:

1. Continue to enhance their knowledge and skills in the administration of surfactant therapy for premature infants born between 28-34 weeks.
2. Ongoing training, collaboration, and adherence to updated neonatal care protocols are essential to optimize patient outcomes.
3. Additionally, implementing regular evaluations of surfactant administration practices and incorporating feedback from neonatal teams can further improve survival rates and reduce complications.

4. Strengthening support systems for both healthcare providers and families will also enhance the overall quality of care in the neonatal unit.

For policy makers:

1. Investing in advanced medical equipment
2. Ensuring a consistent supply of surfactant, and promoting specialized training programs for healthcare providers are essential steps to improve neonatal outcomes.
3. Additionally, implementing policies that support research, data collection, and the development of evidence-based guidelines will enhance the quality of care.
4. Strengthening partnerships between healthcare institutions and policy bodies can ensure sustainable improvements in neonatal health across the West Bank.

In future research:

1. Studies comparing different surfactant formulations and dosing protocols can provide insights into optimizing treatment effectiveness.
2. Additionally, exploring the role of early surfactant therapy in reducing respiratory and neurodevelopmental complications in preterm infants would be valuable.
3. Collaboration with international neonatal research networks can also help ensure that findings contribute to global standards of care and provide locally relevant solutions for improving neonatal health in the West Bank.

5.5 Strength of the Study

The strength of this study lies in its focused examination of surfactant administration outcomes for premature infants (28-34 weeks) at Al-Istishari Arab Hospital, providing valuable insights into neonatal care within a specific population. By concentrating on a well-defined group of preterm infants, the study offers a clearer understanding of how surfactant therapy impacts respiratory function and survival rates in a local context. The involvement of a multidisciplinary healthcare team, including nurses and doctors, further strengthens the study, as it highlights the collaborative approach needed for effective neonatal care. Additionally, the study's relevance to the unique healthcare setting in the West Bank adds a layer of significance, offering a framework for improving outcomes in similar resource-limited environments.

5.6 Limitations:

1. Sample Size: The limited sample size affects generalizability; larger studies are needed.
2. Single-Center Study: The findings may not apply to other settings; multi-center studies are recommended.
3. Retrospective Design: Potential biases exist; prospective studies with standardized data collection are needed.
4. Limited Maternal Factors: Broader maternal and environmental factors should be considered in future research

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Appendices

Appendix 1: Data Sheath

Outcomes of Surfactant Administration for Premature Infants (28-34weeks) At AlIstishari Arab Hospital - West Bank

Dear mother,

Thank you for agreeing to participate in this study which is mainly done by the researcher to fulfill the requirements of a master's degree in Neonatal Nursing at Arab American University (AAUP). The study aims to investigate the most common outcomes related to surfactant use for premature infants aged of gestation, as well as the most common maternal, neonatal, and surfactant-related factors that correspond to the outcomes.

Please cooperate with the researcher who collects the data using the following data sheet, which consists of several sections related to general information about you and the baby, that will be directly collected from you, while the rest of the data are collected from the infant's medical file, including maternal and neonatal information, as well as data related to the used surfactant and specific outcomes.

We ensure that the collected data are treated in an anonymous and confidential way, where the collected data do not include your or your baby's names or any contact information. Data will be kept in a safe envelope before being sent for analysis, and the collected data will be used only by the researchers and for research purposes. It is your right to withdraw from the study at any time without the need to declare any specific reason. For inquiries, please contact the principal investigator of the study:

Researcher Nmae: Rawd Shawawri . **Phone no**:: +972 59-599-6158.

عزيزتي الأم،

نشكر لك موافقتك على المشاركة في هذه الدراسة التي تهدف إلى التعرف على أهم النتائج المترتبة على استخدام مادة السيرفاكتانت عند المواليد الرضع الخداج، وكذلك التعرف على أهم العوامل المرتبطة بالأم والرضيع وطريقة استعمال المادة على هذه النتائج.

نود التأكيد على أن جميع البيانات الي يتم جمعها يتم التعامل معها بسرّيّة ومصداقية تامة، حيث إنها لا تحتوي على اسمك أو اسم طفلك أو أي معلومات خاصة بالتواصل بك، وأن هذه الأوراق يتم حفظها في مغلفات مغلقة لحين استخدامها للتحليل، وكذلك فإن هذه البيانات لا يتم التعامل معها إلا من قبل الباحثين ولأغراض البحث العلمي فقط لا غير. أيضاً، يمكنك الانسحاب من الدراسة في أي وقت ترغبين ودون الحاجة لإبداء الأسباب.

للاستفسار عن الدراسة، يرجى التواصل مع الباحثة الرئيسة: روض شواروة

موبايل رقم: 97259-599-6158

Part One: Demographic Data of The Mother

Please write in space, or select one answer for the listed answers in the following questions

Questions	**Answers**
1. Maternal age (in complete years)	
2. Maternal education	1. Elementary school or less
	2. High school
	3. Diploma degree
	4. University degree
3. Occupational status	1. Employed (in private or governmental sector)
	2. Self-employed
	3. Unemployed (housewife)
4. Residency	1. City
	2. Village / town
	3. Camp
5. Place of antenatal care of the current pregnancy (Booking and follow-up)	1. Governmental hospital
	2. Private sector
	3. UNRWA
	4. No follow up

Part Two: Maternal factors

Obstetric history	**Answers**
1. Number of previous pregnancies	
2. Number of lived children	
3. Number of abortions	
4. Number of previous premature deliveries	
History of the current delivery	
1. Multiple gestation	1.Single baby
	2. Twins
	3. Triplets
1. Birth type	Cesarean section
	Normal delivery
Risk factors	
Comorbidities during pregnancy	1. Gestational hypertension
	2. Gestational diabetes
	3. Premature rupture of membrane
	4. Diabetes
	5. Pre-eclampsia
	6. Others
2. Smoking	1. Yes, I am currently smoking

	2. No, I have never smoked
3. Received a dose of dexamethasone	Yes -------- No-------- If yes how many doses ----------

Part Three: Surfactant Administration

Questions	**Observed by the researcher**	
1. Time of the first surfactant dose administration (How many Minutes or hours after birth)		
2. Dose of the surfactant (mg/kg)		
3. Type of surfactant	1. Anionic	
	2. Non-ionic	
	3. Cationic	
	4. Amphoteric	
4. Surfactant administration method	1. Invasive (INSURE)	
	2. Non-invasive (LISA)	
Observing and recording the following clinical indicators	**Before surfactant**	**After surfactant**
Signs and symptoms of RDS - Cyanosis - Retraction - Grunting - Nasal flaring - Tachypnea - Tacchydardia		
5. Respiratory rate (breath/min)		
6. Length of stay on mechanical ventilator (hours)		
7. Length of stay on non-invasive ventilation (hours)		
8. Length of stay on supplemental oxygenation (hours)		
9. Length of stay in NICU (days)		

Part Four: observe and record the health outcomes of the premature infants (28-34weeks) after the administration of surfactant

Questions	**Answers**
1. The preterm baby developed one or more of the following consequences	1. Pulmonary hemorrhage
	2. Necrotizing enterocolitis
	3. Bronchopulmonary dysplasia
	4. Pneumothorax
	5. DIC
	6. Meningitis

	7. Sepsis
	8. IVH
	9. Retinopathy of prematurity
	10. Others ----------
2. Final outcome	1. Survived and discharged
	2. Transferred
	3. Died

Appendix 2: IRB Approval

Arab American University
Institutional Review Board - Ramallah

الجامعة العربية الأمريكية
مجلس اخلاقيات البحث العلمي – رام الله

IRB Approval Letter

Study Title: "Outcomes of Surfactant Administration for Premature in Southern Palestine Hospitals/West Bank".

Submitted by: Rawd Ahmed Mohammad Shawawrah

Date received: 20th February 2024

Date reviewed: 25th February 2024

Date approved: 4th April 2024

Your Study titled **"Outcomes of Surfactant Administration for Premature in Southern Palestine Hospitals/West Bank"** with the code number **"R-2024/A/45/N"** was reviewed by the Arab American University Institutional Review Board - Ramallah and it was approved on the 4th of April 2024.

Sajed Ghawadra, PhD
IRB-R Chairman
Arab American University of Palestine

الجامعة العربية الأمريكية - فلسطين
مجلس اخلاقيات البحث العلمي - رام الله
IRB-R
ARAB AMERICAN UNIVERSITY-PALESTINE
INSTITUTIONAL REVIEW BOARD - RAMALLAH

General Conditions:

1. Valid for 6 months from the date of approval.
2. It is important to inform the IRB-R with any modification of the approved study protocol.
3. The Bord appreciates a copy of the research when accomplished.

Appendix 3: Data Sheath Approval

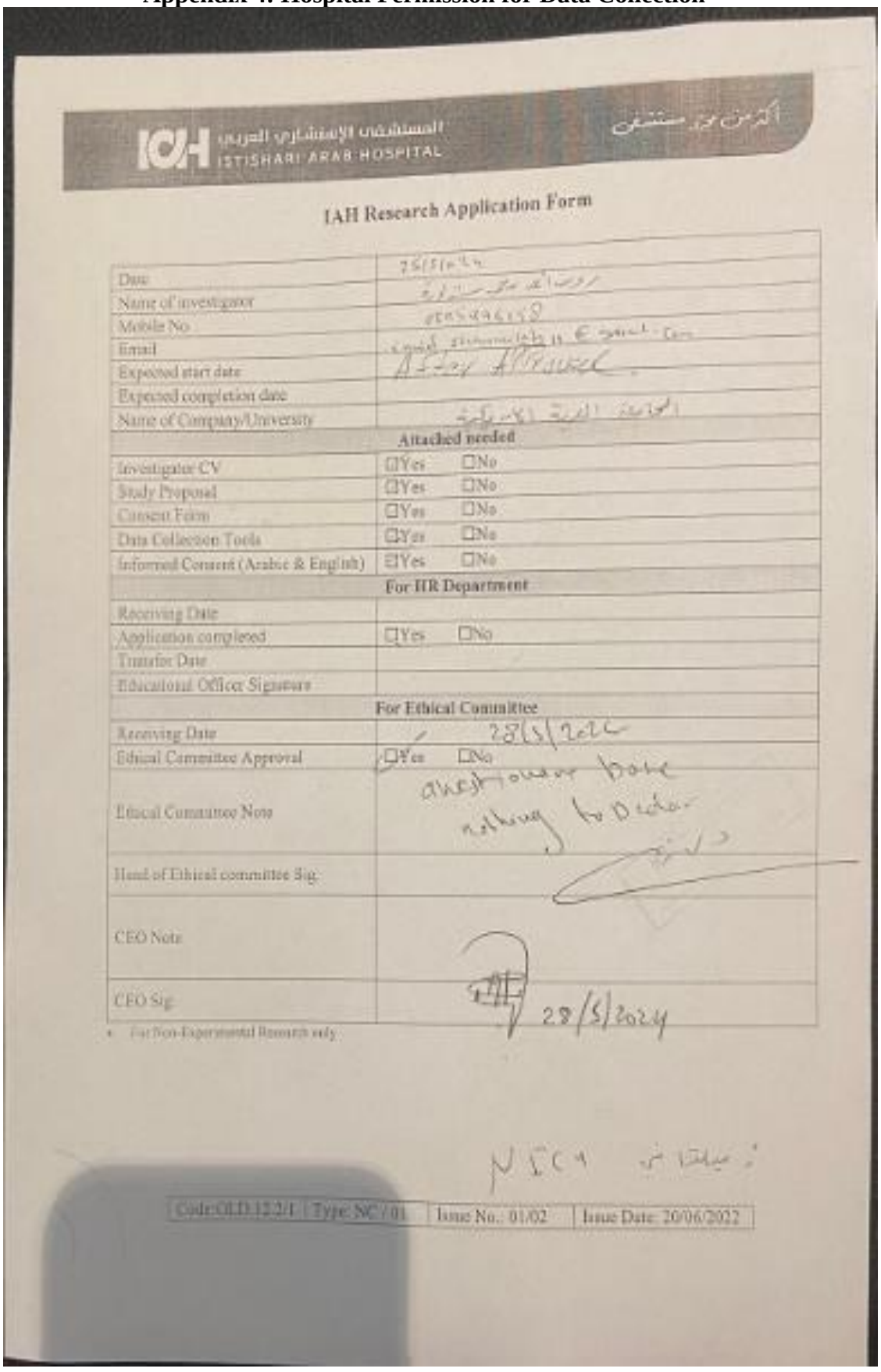
Iyad Ali
إلى أنا

الترجمة إلى العربية

Dear;
The article is already published and whatever information available in the article is open access to everyone and of course ethically you have to cite the article when you use it.
Best regards;
Iyad

On Tue. Jul 16. 2024 at 11:14 AM Rawd Darawi

Appendix 4: Hospital Permission for Data Collection



المستشفى الاستشاري العربي
ISTISHARI ARAB HOSPITAL

الرمز بر مستشفى

IAH Research Application Form

Date	28/5/2024
Name of investigator	[illegible]
Mobile No	0565496552
Email	[illegible]
Expected start date	[illegible]
Expected completion date	
Name of Company/University	[illegible]
	Attached needed
Investigator CV	☐Yes ☐No
Study Proposal	☐Yes ☐No
Consent Form	☐Yes ☐No
Data Collection Tools	☐Yes ☐No
Informed Consent (Arabic & English)	☐Yes ☐No
	For HR Department
Receiving Date	
Application completed	☐Yes ☐No
Transfer Date	
Educational Officer Signature	
	For Ethical Committee
Receiving Date	28/5/2024
Ethical Committee Approval	☐Yes ☐No
Ethical Committee Note	[illegible]
Head of Ethical committee Sig.	
CEO Note	
CEO Sig.	28/5/2024

* For Non-Experimental Research only

[illegible]

Code: QLD.12.2/1	Type: NC / 01	Issue No.: 01/02	Issue Date: 20/06/2022

Appendix 5: Family Approval sheath

عزيزي ولي امر المشارك/ة

..... السلام عليكم ورحمة الله وبركاته

يطيب لي أنا الباحثة **روض شواورة** أن أتقدم بخالص شكري ومحبتي لكم على مشاركتكم في بحثي العلمي الذي يحمل عنوان

Outcomes of Surfactant Administration for Premature infants (28-34weeks) at Al-Istishari Arab Hospital - West Bank

إن هذا البحث هو جزء أساسي من دراستي لاستكمال مشروع التخرج من الجامعة العربية الامريكية – فلسطين تخصص ماجستير تمريض عناية الاطفال الخدج، وقد تم ترشيح اطفال حضرتكم من بين مجموع المشاركين في هذه الدراسة لتعبئة الاستبيان المتعلق بالدراسة.

نود اعلامكم بان الهدف من البحث هو التعرف على أهم النتائج المترتبة على استخدام مادة السيرفاكتانت عند المواليد الرضع الخداج، وكذلك التعرف على أهم العوامل المرتبطة بالأم والرضيع وطريقة استعمال المادة على هذه النتائج.

سيتم اعلامكم ايضا بالتالي:

- كم من الوقت سوف تكون في البحث
- ما الذي سيحدث لك ما هي التجربة
- المخاطر أو المضايقات المنافع لك أو لغيرك
- من الذي سيطلع على معلوماتك

أيما يكون قرارك فان ذلك لن يؤخذ ضدك

إذا كان لديك أسئلة، اهتمامات، أو شكوى، أو تعتقد أن البحث قد يضر بك، يمكنك التحدث إلى الباحثة سنشرح لك الباحثة الرئيسية محتويات هذا البحث وتأثيره على طفلك. وفى هذا الإقرار

سيتم إعلامك بإجراءات البحث، والمخاطر والفوائد من المشاركة، وكيفية الحفاظ على سرية المعلومات.كما أن سماحكم لي باستخدام المعلومات المستقاة من ملفات طفلكم الخدج ستُعامل بسرية تامة ألا تستخدم إلا لأغراض البحث العلمي فقط، مع العلم أن كتابة اسم الطفل هو اختيارياً لذا أرجو التكرم السماح لي بتعبئة الاستبانة كاملة بدقة وواقعية وعليه نرجو منك اخذ الوقت الكافي في طرح الأسئلة لكي تتخذ قرارك إذا كنت ستسمح بمشاركة طفلك البحث أم لا .وهذه الموافقة تسمى الموافقة المستنيرة، إذا قررت المشاركة في البحث، سيطلب منك التوقيع على هذا الإقرار.

تم شرح وتفسير طبيعة الدراسة وهدفها عن طريق الباحث **روض شوامرة** لقد تم إخباري عن طبيعة البحث من حيث المنهجية والاثار السلبية المحتملة والمضاعفات بعد معرفة وفهم جميع المزايا والعيوب المحتملة لهذا البحث، أوافق طواعية بمحض إرادتي على مشاركة طفلي في البحث السريري المحدد أعلاه. أفهم أنه يمكنني الانسحاب من هذا البحث في أي وقت دون إبداء أي سبب على الاطلاق.

إن توقيعك الوثيقة هي موافقتك للطفل المعني الذي سيكون جزء من البحث اسم الطفل(كتابة)

(توقيع الوالد أو الفرد المخول قانونا للموافقة على الرعاية الطبية العامة الطفل) التاريخ

توقيع الشاهد (إن توقيعي الوثيقة أدناه يؤكد بان المعلومات في وثيقة الموافقة وأية معلومات مكتوبة قد تم شرحها بدقة، وظهرت مفهومة من قبل المتقدم وتم إعطاء الموافقة من قبل الموقع وبكامل الحرية توقيع الشاهد للموافقة على سير العملية

اسم الشخص الشاهد لعملية الموافقة (كتابة) التاريخ

أؤكد أنني أوضحت للمشارك طبيعة وهدف البحث المذكور أعلاه:

روض شواورة التاريخ

نتائج إعطاء الفاعل بالسطح للأطفال الخدج (28-34 أسبوع) في المستشفى الاستشاري العربي – الضفة الغربية

روض أحمد محمد شواورة

لجنة الإشراف:

د. نجوى صبح

د فائدة قطيط

د. ابتسام سويقات

ملخص

المقدمة: الأطفال الخدج هم الأطفال الذين يولدون أحياء قبل 37 أسبوعاً من الحمل، ويمكن أن تحدث الولادات المبكرة بسبب المخاض المبكر التلقائي أو المؤشرات الطبية للولادة القيصرية المبكرة أو تحريض المخاض.

هدف الدراسة :التحقيق في نتائج إعطاء مادة الفاعل بالسطح عند الأطفال الخدج بين الأطفال المولودين في مستشفى الاستشاري العربي.

الطرق استخدمت الدراسة تصميما وصفيًا غير تجريبياً وكمياً ورجعياً، وشمل 94 رضيعًا خديجا يعانون من متلازمة الضائقة التنفسية الحادة وعلاج مادة الفاعل بالسطح. تم تحليل البيانات باستخدام برنامج IBM SPSS مع الإحصاء الوصفي وتحليل التباين تقدم الدراسة رؤى قيمة حول تأثير إعطاء مادة الفاعل بالسطح المبكر على الأطفال الخدج ونتائجهم.

النتائج تدرس الدراسة العوامل التي تؤثر على نتائج إعطاء مادة الفاعل بالسطح وتأثيرها على خصائص الأم.وتركز على الولادات المبكرة في وحدة العناية المركزة لحديثي الولادة خلال عام 2023، بمتوسط مدة إقامة 58.3 (LOS) يوماً. كانت طريقة إعطاء المادة الخافضة للتوتر السطحي المستخدمة 100 باستخدام طريقة الأنبوب الرغامي. وكان توزيع الجنس 70.2% ذكور و 29.8% إناث. وكان متوسط معدل التنفس لدى الأطفال الخدج 63 نفسًا في الدقيقة قبل إعطاء المادة الخافضة للتوتر السطحي. وكان متوسط طول فترة الإقامة على التهوية الميكانيكية 1.7 يوماً، مع بقاء معظم الأطفال بالقرب من المتوسط. وكان وزن المواليد الخدج 1079جراماً، وكان أثقل وزن 2700 جرام. وبعد إعطاء المادة الخافضة للتوتر السطحي، كان 87%من الأطفال الخدج على قيد الحياة، وتوفي 13% . كما فحصت الدراسة أيضًا تأثيرات إعطاء المادة الخافضة للتوتر السطحي على مدة الإقامة في حالات الولادات المتعددة (MV) ومدة الإقامة في وحدة العناية المركزة لحديثي الولادة (NIV) بعد إعطاء المادة الخافضة للتوتر السطحي. ولم يتم العثور على فرق كبير في مدة الإقامة قبل وبعد إعطاء المادة الخافضة للتوتر السطحي.كما فحصت الدراسة نتائج الأطفال الخدج الذين تلقوا المادة الخافضة للتوتر السطحي خلال أول 24 ساعة من ولادتهم.أظهرت النتائج عدم وجود ارتباط كبير بين الأمراض المصاحبة لارتفاع ضغط الدم الحملي واحتمال الوفاة لدى الأطفال الذين تلقوا مادة الفاعل بالسطح. كما فحصت الدراسة توقيت إعطاء مادة الفاعل بالسطح ونوع الولادة، سواء كانت ولادة طبيعية مهبلية أو قيصرية.

الخلاصة: أدى علاج مادة الفاعل بالسطح إلى تحسين علاج متلازمة الضائقة التنفسية الوليدية (NRDS)بشكل كبير عند الأطفال حديثي الولادة. ومع ذلك، فإن فعالية إعطاء مادة الفاعل بالسطح معقدة وتتطلب نهجًا مخصصاً. وجدت الدراسة أنه في حين أن إعطاء مادة الفاعل

بالسطح لم يغير بشكل كبير طول فترة الإقامة أو العوامل الأمومية بشكل عام، إلا أنه قلل من طول فترة الإقامة في حالة التهوية غير الطبيعية.هناك حاجة إلى مزيد من البحث لتطوير تدخلات مستهدفة.

التوصـية: التوصـية هي تنفيذ بروتوكولات مراقبة صـارمة بعد إعطاء مادة الفاعل بالسـطح، وتطوير إرشـادات للكشـف المبكر عن الإنتان والنزيف الرئوي وعلاجهما، وإنشـاء خطط رعاية مخصصة، وتثقيف الآباء بشأن المضاعفات وإجراء دراسات متعددة المراكز أكبر لتأكيد النتائج.

الكلمات المفتاحية: سـابق لأوانه إدارة الفاعل بالسـطح، متلازمة الضـائقة التنفسـية، العلاج بالفاعل بالسطح.