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Why Full-term Infants Are Being Admitted to the Neonatal Intensive Care Unit (NICU) in Al-Elwiya Teaching Hospital

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Sincerely,

Research group

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Abstract

Background :

The birth of a baby is a very complex process that brings about various changes in the baby's as well as the mother's body. Before birth, all the major functions like eating, excretion, protection, etc. of the baby are taken care of by the mother's body. However, after birth, the baby's systems must function independently. Many babies find the transition difficult and may require intensive care. When babies are born early, have health problems, or have a difficult birth they go to the hospital's NICU. NICU stands for "neonatal intensive care unit." There, babies get around-the-clock care from a team of experts. A NICU combines advanced technology and well-trained professionals to provide specialized treatment to newborns. In a NICU, the baby is taken care of extensively by a team of experts specializing in newborn care and is attended by neonatologists (doctors specializing in newborn intensive care), various specialists, pediatricians, dietitians, well-trained nurses, etc. The admission of neonates in the Neonatal Intensive Care Unit (NICU) is not an uncommon occurrence. All newborns admitted to the NICU attain benefits, such as highly specialized care, but there are also associated risks and high costs. Usually, newborns that get admitted to the NICU are those of premature delivery, however, newborns of full-term birth also get admitted to the NICU for various reasons we are going to focus on.

Objectives :

To gain an insight into the main causes of full-term babies' admissions to the NICU, and summate the possible leading problems to those established causes. And identify the benefits and risks of their duration of stay at the NICU. Alongside this, provide any possible solutions to decrease the number of admissions to NICU.

Methods :

A descriptive cross-sectional study was performed from October first, 2022 to December first, 2022 at the Al Elwiya Maternity Teaching Hospital. The data was collected using information based on the infant's and mother's medical records. A total of 79 term neonates were included in the study.

Results :

A total of 360 neonates were admitted to the neonatal intensive care unit (NICU) at Al Elwyia Maternity Teaching Hospital during the study period, of which 79 (21.94%) were term neonates. Of the 79 term neonates admitted to the NICU, 51 (64.6%) were males, while females were 28 (35.4%). 70 (88.6) of term neonates were of birth weight between 2.5 to 4.0 Kg, the birth weight of 4 neonates (5.1%) was less than 2.5 Kg, the birth weight of the rest 5 neonates (6.3%) was more than 4.0 Kg. The gestational age of 78 neonates (98.7) was between 37 to 40 weeks, only one neonate was between 40+1day-42 weeks. Those who were delivered by CS (cesarean section) [65 (82.3%)]

were higher than those who were delivered by NVD (normal vaginal delivery) [14 (17.7%)]. Most pregnancies were singleton [78(98.7%)], and one pregnancy was multiple (1.3%). Cesarean sections were categorized into 3 groups, 35 (53.8%) were emergency cesarean sections without trial of labor, 22 (33.8%) were elective cesarean sections, and 8 (12.3%) were cesarean sections after trial of labor. 5 (62.5%) of cesarean sections after trial of labor were due to fetal distress, and 3 (37.5%) were due to failure of progress. General anesthesia was used in 46 (70.77%) of cesarean sections, and spinal anesthesia was used in 19 (29.23%) of cesarean sections. The mortality rate among the admitted term neonates was 7.6%.

The mean maternal age was 27.39 (std. deviation = ∓7.12), 63 belonged to the age group 18-34 years old (79.7%), 8 belonged to the age group ≥40 years old (10.1%), 5 belonged to the age group 35-39 years old (6.3%), 3 belonged to the age group ≤17 years old (3.8%). The majority of mothers have the blood type O+ [30(38%)], and only one has the blood type B- (1.3%). 13 mothers were primiparous (16.5%), and 66 were multiparous (83.5%). 57 had no previous abortion (72.2%), 14 had one previous abortion (17.7%), 5 had 2 previous abortions (6.3%), 3 had 3 previous abortions (3.8%). In regard to antenatal care, 47 received irregular antenatal care (59.5%), 27 received regular antenatal care (34.2%), 5 received no antenatal care (6.3%). 6 out of the 79 mothers were smoking during pregnancy (7.6%), 2 out of 79 drank alcohol during pregnancy (2.5%). 11 mothers had hypertension, 7 were diabetic, and 1 had hypothyroidism. Drugs used during pregnancy are shown in Table 4. The Hb level at time of delivery was ≥11 g/dL in 46 mothers (58.2%), between 9.0 and 10.9 g/dL in 29 mothers (36.7), and between 7.0 and 8.9 g/dL in 4 mothers (5.1%). The primary cause of admission to NICU was due to transient tachypnea of the newborn (TTN) [47(59.5%)], the least common cause of admission was birth trauma [1(1.3%)]. The mean stay at NICU was 3.03 days with a standard deviation ∓2.298. 50% of deaths were due to congenital anomalies, 33% were due to respiratory distress syndrome, 16% were due to meconium aspiration. The fatality rate of congenital anomalies was 43%, the fatality rate of respiratory distress syndrome was 28.6%, the fatality rate of meconium aspiration was 16%. 2 infants with metabolic complications (hypoglycemia) [66%] had mothers who are diabetic.

Conclusion :

The NICU at our hospital has found that neonatal mortality is linked to RDS, congenital anomalies, and meconium aspiration. Fortunately, these causes of neonatal mortality are preventable and treatable through careful assessment and risk detection. Unfortunately, a significant number of mothers did not receive regular antenatal care, which could have prevented many complications that led to neonatal admission to the NICU. Additionally, many mothers with hypertension or diabetes did not receive medication to manage their medical condition, leading to complications that could have been prevented with proper antenatal care.

Introduction

Overview :

The transition from a fetus to a newborn is the most complex adaptation that occurs in the human experience. Lung adaptation requires the coordinated clearance of fetal lung fluid, surfactant secretion, and the onset of consistent breathing. With the removal of the low-pressure placenta, the cardiovascular response requires striking changes in blood flow, pressure, and pulmonary vasodilation. The newborn must also quickly control its energy metabolism and thermoregulation [(1)]. The smooth transition to the extra-uterine environment is essential to help the newborns survive the most critical period of life with good outcomes [(2)]. Many babies find the transition difficult and may require intensive care [(3)]. When babies are born early, have health problems, or have a difficult birth they go to the hospital's NICU. NICU stands for "neonatal intensive care unit." There, babies get around-the-clock care from a team of experts [(4)]. The advance in neonatal care services over the past few decades has significantly improved the survival rate of newborns, particularly premature neonates. As a result, neonatal admissions and the resulting neonatal morbidities are rising [(2)].

Gestational Age Evaluation :

Gestational age was calculated based on the date of the last menstrual cycle and/or fetal ultrasound measurements performed in the first trimester [(5)]. The estimated date of confinement (EDC), or due date, is based on the assumption that a woman has a 28-day cycle, with ovulation on Day 14 or 15. Pregnancy lasts for 280 days (40 weeks) from the LMP. The EDC is therefore 9 calendar months plus 7 days from the start of the LMP; it is customary to estimate the EDC by counting back 3 calendar months and adding 7 days to the LMP (Naegele's rule). Because ovulation does not always occur at midcycle (the postovulatory phase in any cycle lasts for 14 days), the EDC must be adjusted accordingly [(6)]. The concept of "term" gestation provides guidance to clinicians and influences the public's perceptions about the optimal timing of delivery for a healthy pregnancy. Currently, a term birth is defined as a delivery that occurs neither preterm nor post-term. Because preterm is classically defined as delivery prior to 37 weeks following the onset of the last menstrual period and post-term as after 42 weeks, the term has been conventionally defined as delivery between 37 and 42 weeks. The International Classification of Diseases defines the term pregnancy as delivery between 37 weeks 0 days and 41 weeks 6 days [(7)].

Neonatal Intensive Care Unit (NICU) :

A neonatal intensive care unit (NICU), or an intensive care nursery (ICN), is an intensive care unit specializing in the treatment of ill or premature-born infants. A NICU combines advanced technology and well-trained professionals to provide specialized treatment to the newborns. In a NICU, the baby is taken care of extensively

by a team of experts specializing in the newborn care and is attended by neonatologists (doctors specializing in newborn intensive care), various specialists, pediatricians, dietitians, well-trained nurses, etc. It provides complex nutritional and respiratory support, cardiorespiratory monitoring, as well as more focused nursing care [8]. Thus when babies are born early, have health problems, or have a difficult birth they go to the hospital's NICU. There, babies get around-the-clock care from a team of experts. Most of these babies go to the NICU within 24 hours of birth. How long they stay depends on their health condition. Some babies stay only a few hours or days; others stay weeks or months [4]. All newborns admitted to the NICU attain benefits, such as highly specialized care,but there are also associated risks and high costs [9]. Admissions to the neonatal intensive care unit (NICU) carry significant social and financial burdens on the involved families and healthcare facilities [10]. In addition to the potential complications and high treatment costs associated with admission to the NICU, the separation of the mother and neonate after birth damages mother-infant bonding reduces the physiological benefits of bonding, and disrupts the feeding of the infant [11]. To improve neonatal survival with better overall outcomes and less severe morbidities, early identification of the risk factors is paramount so that appropriate interventions can be directed toward the most prevalent and treatable neonatal illnesses. To achieve this goal, it is important to study the pattern of neonatal admissions [2].

Preterm Infants Admissions to the NICU :

Worldwide, of the 130 million neonates born every year, 15 million neonates are born preterm. Moreover, prematurity is still a major cause of neonatal and infant mortality and morbidity and a significant contributor to long-term adverse health outcomes [12]. This greater risk for mortality has frequently been pertaining to neonatal sepsis [13]. Moreover, they have a higher risk for short- and long-term complications, such as neurological, cognitive, and motor disorders. Likewise, they are more prone to malnutrition, chronic illnesses, and early death [14]. The delivery of preterm infants has been linked to many factors. Studies found that ethnicity, mothers' age, and smoking are risk factors for preterm birth. Others identified that mothers' education is also a risk factor for preterm birth [15]. Besides, other studies revealed that interventions, such as labor induction and cesarean section (C.S.), attributed to preterm birth [16]. Early‐term infants have unique care needs that should be recognized and managed appropriately. Morbidity risks for ET infants included a significant increase in NICU admissions. There are many factors that indicate the admission of preterm infants to NICU, such as respiratory distress syndrome (RDS), feeding difficulties, apnea, neonatal jaundice (NJ), necrotizing enterocolitis (NEC), hypoglycemia, neonatal sepsis (NS), intraventricular hemorrhage (IVH), and temperature instability [17]. Despite care at NICU, immaturity at birth has a lifelong impact on various systems, disabilities, and delayed neurodevelopment, such as learning, hearing, and visual complications [18]. Moreover, a short-term impact increases with decreasing gestational age [19].

Full-term Infants Admissions to the NICU :

NICU admission event for term neonates, probably independent of the diagnosis at admission, is a remarkable event with a significant association with the risk for long-term childhood mortality. Neonates at term admitted to NICU may benefit from long-term focused health care and risk-reducing interventions [(20)]. A growing number of term infants are admitted unexpectedly to the NICU. The risk factors and pattern of admission of term infants to the NICU should receive more attention in quality improvement and management agendas [(21)]. The most common reasons for a term infant to be admitted to the NICU after birth are temperature instability, hypoglycemia, respiratory distress, and hyperbilirubinemia [(22)]. Interestingly, neonates admitted to NICU with potentially early detectable and treatable diagnoses like jaundice and common metabolic complications without any background of metabolic or other diseases (dehydration and electrolytes disorders, hypoglycemia, infant to a diabetic mother) exhibited likewise a sustained long-term childhood mortality risk, at least until 4 years of age. Importantly, hyperbilirubinemia and hypoglycemia in NICU-admitted term neonates are complications that are not overlooked and carefully observed; medical management is sufficient and well tolerated [(23)].

Methodology

A descriptive cross-sectional study was performed from October first, 2022 to December first, 2022 at the Al Elwiya Maternity Teaching Hospital.

The data was collected using information based on the infant's and mother's medical records. The questions included data about the infant as gestational age, sex, the primary cause of admission, length of stay at NICU, the fate of the baby, and birth weight. It also had a section devoted to mothers such as age, blood group, mode of delivery, antenatal care, pregnancy type, gravida, para, abortions, past medical history, history of infertility, tobacco, and alcohol use, if there were any pregnancy or labor complications and hemoglobin level at the time of delivery. The study included all full-term infants (gestational age $\geq$ 37 weeks) admitted to the NICU during the time of the study. Babies and mothers with incomplete medical records were excluded from the study.

According to the World Health Organization (WHO) criteria, A hemoglobin value of less than 11.0 g/dL was considered anemia During pregnancy. The level of anemia (9.0–10.9 g/dL) were mild anemia,(7.0–8.9 g/dL) moderate anemia, and (less than 7.0 g/dL) severe anemia. [24]

The estimated date of confinement (EDC) is based on the assumption that a woman has a 28-day cycle, with ovulation on Day 14 or 15. Pregnancy lasts for 280 days (40 weeks) from the LMP. The EDC is therefore 9 calendar months plus 7 days from the start of the LMP; it is customary to estimate the EDC by counting back 3 calendar months and adding 7 days to the LMP (Naegele's rule). Or by ultrasound [6].

The study was ethically approved by the Medical Ethical Committee at Al-kindy College of Medicine. The data collected was analyzed by using the program IBM SPSS Statistics version 26. Tables and figures (pie charts) were used to display the results. analytical tests (Chi-square test) were employed. Categorical data were presented as number of data and percentages and numerical data were mean ± standard deviation if normally distributed.

Results

A total of 360 neonates were admitted to the neonatal intensive care unit (NICU) at Al Elwyia Maternity Teaching Hospital during the study period, of which 79 (21.94%) were term neonates. Of the 79 term neonates admitted to the NICU, 51 (64.6%) were males, while females were 28 (35.4%). 70 (88.6) of term neonates were of birth weight between 2.5 to 4.0 Kg, the birth weight of 4 neonates (5.1%) was less than 2.5 Kg, the birth weight of the rest 5 neonates (6.3%) was more than 4.0 Kg. The gestational age of 78 neonates (98.7) was between 37 to 40 weeks, only one neonate was between 40+1day-42 weeks. Those who were delivered by CS (cesarean section) [65 (82.3%)] were higher than those who were delivered by NVD (normal vaginal delivery) [14 (17.7%)]. Most pregnancies were singleton [78(98.7%)], one pregnancy was multiple (1.3%).

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Parameter	Category	Frequency	Percentage
Sex	Female	28	35.40%
	Male	51	64.60%
Birth Weight	Less than 2.5 Kg	4	5.10%
	2.5-4.0 Kg	70	88.60%
	More than 4.0 Kg	5	6.30%
Gestational Age	37-40 Weeks	78	98.70%
	40+1Day-42 Weeks	1	1.30%
Fate of the Infant	Discharged	72	91.10%
	Transferred to another hospital	1	1.30%
	Deceased	6	7.60%

Table 1: The demographic and clinical characteristics of term neonates

Parameter	Category	Frequency	Percentage
Age	≤17	3	3.8%
	18-34	63	79.7%
	35-39	5	6.3%
	≥40	8	10.1%
Blood type	A-	5	6.3%
	A+	19	24.1%
	AB+	4	5.1%
	AB-	0	0%
	B-	1	1.3%
	B+	18	22.8%
	O-	2	2.5%
	O+	30	38%

Table 2: Age groups and blood types of mothers

Primary Cause of Admission	Frequency	Percentage
Transient tachypnoea of the new-born (TTN)	47	59.50%
Congenital anomalies	7	8.90%
Meconium aspiration	6	7.60%
Birth asphyxia (hypoxic ischemic encephalopathy)	5	6.30%
Respiratory distress syndrome (RDS)	7	8.90%
Metabolic complications (Hypoglycaemia)	3	3.80%
Neonatal Jaundice	3	3.80%
Birth trauma	1	1.30%
Total	79	100%

Table 3: Primary cause of admission of term neonates.

Parameter	Category	Frequency	Percentage
Pregnancy type	Multiple	1	1.30%
	Singleton	78	98.70%
Type of Anesthesia	General	46	70.77%
	Spinal	19	29.23%
Parity	Primiparous	13	16.50%
	Multiparous	66	83.50%
Previous Abortions	0	57	72.20%
	1	14	17.70%
	2	5	6.30%
	3	3	3.80%
Antenatal care	Irregular	47	59.50%
	Regular	27	34.20%
	None	5	6.30%
Tobacco use	No	73	92.40%
	Yes	6	7.60%
Alcohol use	No	77	97.50%
	Yes	2	2.50%
History of infertility	No	77	97.50%
	Yes	2	2.50%
Medical history	Diabetes Mellitus	7	8.90%
	Hypertension	11	13.90%
	Hypothyroidism	1	1.30%
Drug use	Insulin	2	2.50%
	Aldomet	1	1.30%
	Alendronate	1	1.30%
	Thyroxine	1	1.30%
	None	74	93.70%
Hb level at the time of delivery	≥11	46	58.20%
	9.0-10.9	29	36.70%
	7.0-8.9	4	5.10%

Table 4: The demographic and clinical characteristics of mothers

Parameter	Category	Frequency	Percentage	Category	Frequency	Percentage	Category	Frequency	Percentage
Mode of Delivery	C-section	65	82.30%	Emergency after trial of labour	8	12.30%	Failure of progress	3	37.50%
							Foetal distress	5	62.50%
				Emergency Without trial of labout	35	53.80%			
				Elective	22	33.80%			
	Vaginal Delivery	14	17.70%						

Table 5: Mode of delivery

Primary Cause of Admission * The Fate of the Baby Cross Tabulation					
		The fate of the baby			Total
		Dead	Discharged	Transferred to another hospital	
Primary cause of admission	Birth asphyxia (hypoxic ischemic encephalopathy)	0	5	0	5
	Birth trauma	0	1	0	1
	Congenital anomalies	3	3	1	7
	Meconium aspiration	1	5	0	6
	Metabolic complications (Hypoglycemia)	0	3	0	2
	Neonatal Jaundice	0	3	0	3
	Respiratory distress syndrome (RDS)	2	5	0	7
	Transient tachypnea of the newborn (TTN)	0	47	0	47
	Total	6	72	1	79

Table 6: Primary Cause of Admission * The Fate of the Baby Cross Tabulation

Primary Cause of Admission * DM Crosstabulation				
		DM	No DM	Total
Primary Cause of Admission	Metabolic complications (Hypoglycemia)	2	1	3
	Neonatal Jaundice	1	2	3
	Transient tachypnea of the newborn (TTN)	4	43	47
	Total	7	46	53

Table 7: Primary Cause of Admission * DM Crosstabulation

Relation between Neonatal Deaths and other Variables			
Categories		**Neonatal Death**	
		Frequency	**Percentage**
Birth Weight	2.5-4.0 Kg	4	66.67%
	Less than 2.5 Kg	2	33.33%
	More than 4.0 Kg	0	0%
Mode of Delivery	C-section	4	66.67%
	Vaginal Delivery	2	33.33%
Antenatal Care	Irregular	5	83.33%
	Regular	1	16.67%
	None	0	0%
Mothers' Medical Condition	Diabetes Mellitus	0	0%
	Hypertension	1	16.67%
	Hypothyroidism	0	0%
	Anemia	1	16.67%
	None	4	66.67%
Gestational Age	37-40	6	100%
	40+1Day-42	0	0%
Primary Cause of Admission	Congenital Anomalies	3	50%
	Respiratory Distress Syndrome (RDS)	2	33.33%
	Meconium Aspiration	1	16.67%

Table 8: Relation between Neonatal Deaths and Other Variables

Discussion

The results of this study indicate that a significant proportion of neonates admitted to the NICU at Al Elwyia Maternity Teaching Hospital were term neonates. In particular, 79 out of 360 neonates admitted during the study period were term neonates, representing 21.94% of all admissions. This finding is consistent with previous research that has shown that term neonates account for a substantial proportion of NICU admissions (Nguyen et al., 2022)[25]. A study conducted in America reported that (20.7%) of neonates admitted to the NICU were term neonates (Chornock et al., 2023)[26]. Other studies had significantly lower admission rates, such as a study in a Saudi tertiary teaching hospital that reported that (4.1%) of neonates admitted were term neonates (Al-Wassia et al., 2017)[21]. However, a study conducted in Turkey reported a higher percentage of term neonates admitted to the NICU (54%)(Anik et al., 2021)[27]. The reasons for admission of term neonates to the NICU could be due to various factors such as birth asphyxia, neonatal infections, and respiratory distress syndrome.

The study also found that the majority of term neonates admitted to the NICU were male, with 64.6% of term neonates being male and 35.4% being female. This sex difference is consistent with previous research, which has found that male neonates are more likely to be admitted to the NICU than females (Darmstadt et al., 2013)[28]. A study conducted in Lagos, Nigeria, reported that males accounted for (52%) of neonates admitted to the NICU (Olusanya 2013)[29]. Another study conducted in Turkey reported (55.9%) of the NICU admissions were males (Anik et al., 2021)[27]. The reason for the higher percentage of male-term neonates admitted to the NICU in this study is not clear and warrants further investigation.

In terms of birth weight, the majority of term neonates admitted to the NICU had birth weights between 2.5 and 4.0 Kg, with 88.6% falling within this range. This finding is expected and it's consistent with previous research, that reports most term newborns weigh between 2.5 kg and 4.0 kg (Mohammed et al., 2019)[30]. However, it is notable that a small proportion of term neonates in this study had birth weights below 2.5 Kg or above 4.0 Kg, as these extremes are also associated with an increased risk of adverse outcomes (Mohammed et al., 2019)[30].

The gestational age of the majority of term neonates admitted to the NICU in this study was between 37 and 40 weeks, with only one neonate being between 41-42 weeks. This finding is consistent with the definition of term birth as being between 37 and 42 weeks of gestation (American College of Obstetricians and Gynecologists, 2013)[31]. However, the fact that one neonate was admitted to the NICU despite being within this gestational age range suggests that other factors may have contributed to their need for specialized care.

The study also found that the mode of delivery was associated with NICU admission, with a higher proportion of term neonates delivered by CS than by NVD. This finding is consistent with previous research, which has shown that CS delivery is associated with an increased risk of NICU admission (Tita et al., 2009)[32]. The present study found that the majority of neonates admitted to the neonatal intensive care unit (NICU) were delivered by cesarean section (82.3%), which is consistent with previous research showing that cesarean section rates have been steadily increasing worldwide (Boerma et al., 2018; Betrán et al., 2016)[33][34]. The

cesarean sections were further categorized into three groups: emergency without trial of labor, elective, and emergency after trial of labor. The highest percentage of cesarean sections was emergency (53.8%), followed by elective (33.8%), and after trial of labor (12.3%). This finding is also consistent with previous research showing that emergency cesarean sections are more common than elective cesarean sections (Vogel et al., 2015)[35]. The present study also found that the most common reason for cesarean section after trial of labor was fetal distress (62.5%), followed by failure of progress (37.5%). This finding is consistent with previous research showing that fetal distress is the most common indication for cesarean section (Maskey et al., 2019)[36]. It is worth noting that cesarean section whether it's after trial of labor is associated with a higher risk of neonatal morbidity and mortality compared to vaginal delivery (Signore, et al., 2009)[37]. Therefore, it is important to carefully monitor and assess fetal well-being during labor to minimize the need for cesarean section after trial of labor.

Regarding the type of anesthesia used during cesarean section, the present study found that general anesthesia was used in the majority of cases (70.77%), followed by spinal anesthesia (29.23%). This finding is consistent with previous research showing that general anesthesia is more commonly used for emergency cesarean sections (Wiskott et al., 2020)[38]. However, general anesthesia is associated with a higher risk of neonatal respiratory depression and other adverse outcomes compared to regional anesthesia (Wiskott et al., 2020)[38]. Therefore, regional anesthesia should be considered as the first choice whenever feasible.

The present study found a mortality rate of 7.6% among admitted term neonates. This finding is higher than the average neonatal mortality rate in developed countries, which is around 1.8% (UNICEF, 2023)[39]. The high mortality rate in the present study may be attributed to several factors, including the high rate of cesarean section and the use of general anesthesia, which are associated with a higher risk of neonatal morbidity and mortality, as discussed above. The present study highlights the importance of careful monitoring and assessment of fetal well-being during labor to minimize the need for cesarean section after trial of labor. It also emphasizes the importance of considering regional anesthesia as the first choice whenever feasible to minimize the risk of neonatal respiratory depression and other adverse outcomes associated with general anesthesia. Further research is needed to identify strategies to improve neonatal outcomes in high-risk deliveries, including those delivered by cesarean section.

The primary cause of admission to the NICU was transient tachypnea of the newborn (TTN) in 62% of cases, which is a common respiratory disorder in term neonates that usually resolves within 48-72 hours of birth. The high incidence of TTN in this study could be attributed to the high proportion of cesarean section delivery among term neonates, as neonates born via cesarean section are at an increased risk of developing TTN (Joseph et al., 2021)[40]. The findings of this study are consistent with previous studies that have reported on the characteristics and outcomes of term neonates admitted to NICU. For instance, a study conducted in Jordan reported that 30% of the term neonates admitted to the NICU after elective cesarean sections were due to respiratory distress syndrome or transient tachypnea of the newborn, and the mortality rate was 5% (Khasawneh et al., 2020)[41]. Another study conducted in Colorado reported that cesarean sections account for 9.3% of NICU admissions with higher

respiratory morbidity rates (Kamath et al., 2009)[42]. These studies suggest that TTN and cesarean section are common factors contributing to the admission of term neonates to NICU and mortality in these neonates. This finding highlights the need for careful monitoring and management of neonates born via cesarean section to prevent respiratory complications. However, there are some differences in the findings of this study compared to other studies. The most significant one is that the rate of cesarean section in this study was lower than the rate reported in both of the mentioned studies. In contrast, birth trauma was the least common cause of admission, with only one case reported. Birth trauma is a potentially life-threatening condition that can occur during delivery and is associated with perinatal asphyxia, shoulder dystocia, and fractures (Birth Injury: Birth Asphyxia and Birth Trauma, 2018)(Collins et al., 2018)[43]. The low incidence of birth trauma in this study could be attributed to the quality of obstetric care and the prompt management of obstetric emergencies.

In terms of maternal factors, the significant variables were age, blood type, the quality of antenatal care, maternal pre-existing conditions, Hb level during delivery, and personal habits such as smoking or alcohol consumption.

In terms of age, the mean maternal age in this study was 27.39 years, with the majority of mothers belonging to the age group 18-34 years old (79.7%). This finding is consistent with previous research that has shown that younger maternal age is associated with an increased risk of preterm birth and admission to the NICU (Kang et al., 2015)[44]. On the other hand, older maternal age (≥40 years) is also a risk factor for neonatal morbidity and mortality (Kang et al., 2015)[44]. The majority of mothers had blood type O+ (38%), while only one had blood type B-. This finding is consistent with the distribution of blood types in the general population, where O+ is the most common blood type. The study also found that a high proportion of mothers received irregular antenatal care (59.5%) or no antenatal care (6.3%). This is a concerning finding since adequate antenatal care is essential for the prevention and management of pregnancy-related complications and can help identify and address risk factors for neonatal morbidity and mortality (WHO, 2016)[45]. We found that a significant proportion of mothers had pre-existing medical conditions, such as hypertension (14%), diabetes (9%), and hypothyroidism (1.3%), which may have contributed to adverse neonatal outcomes. Two infants with metabolic complications (hypoglycemia) had mothers who were diabetic, representing a 66% incidence rate. Maternal diabetes is a well-known risk factor for neonatal hypoglycemia, and it can result from the transfer of excess glucose from the mother to the fetus, leading to hyperinsulinemia and subsequent hypoglycemia. Previous studies have identified maternal diabetes as a risk factor for neonatal hypoglycemia and other metabolic complications (Abramowski et al., 2022)[46]. Therefore, early identification and management of maternal diabetes during pregnancy may help to prevent these complications and reduce neonatal morbidity and mortality. These findings highlight the importance of preconception counseling and the management of maternal health conditions during pregnancy to reduce the risk of adverse neonatal outcomes.

The hemoglobin (Hb) level of mothers during delivery is an essential indicator of maternal health, and it can have significant implications for neonatal outcomes. In the present study, the

Hb level at the time of delivery was ≥11 g/dL in 46 mothers (58.2%), between 9.0 and 10.9 g/dL in 29 mothers (36.7), and between 7.0 and 8.9 g/dL in 4 mothers (5.1%). The results suggest that a considerable proportion of mothers had lower Hb levels, which could potentially affect fetal development and birth outcomes. Maternal anemia has been associated with low birth weight, preterm delivery, and perinatal mortality (Kumari et al., 2019)[47]. Only a small proportion of mothers reported smoking (7.6%) or drinking alcohol (2.5%) during pregnancy. This finding is lower than the reported prevalence of smoking and alcohol use during pregnancy in other populations (Dukes et al., 2017; Diamanti et al., 2020)[48][49]. However, the study may have underestimated the prevalence of these behaviors since they rely on self-reported data, which is subject to social desirability bias.

The mortality rate among the admitted term neonates in this study was 7.6%, which is higher than the reported neonatal mortality rate in developed countries, such as the United States and Canada (Unicef 2023)[39]. The high mortality rate in this study may be attributed to several factors, such as the high incidence of emergency cesarean sections and the high prevalence of maternal comorbidities, including hypertension and diabetes.

The primary causes of death are congenital anomalies (50%), Respiratory Distress Syndrome (33%), and meconium aspiration (16%). Congenital anomalies are a leading cause of neonatal mortality and can result from genetic, environmental, or multifactorial causes (Verma 2021)[50]. The high fatality rate among neonates with congenital anomalies and respiratory Distress Syndrome in this study highlights the need for early detection and prompt management of these conditions. Meanwhile, Meconium aspiration is typically a self-limiting condition that rarely results in death. Also, worth mentioning that Congenital anomalies were the cause of admission in 14% of cases, with a high fatality rate of 43%. This highlights the importance of antenatal screening and early detection of congenital anomalies, which can help to improve outcomes for affected neonates.

The mean stay at the NICU in this study was 3.03 days, with a standard deviation of 2.298. The length of stay in the NICU can vary depending on the underlying conditions, and it is usually longer for neonates with more severe illnesses. The relatively short duration of stay in this study could indicate that the majority of neonates had mild to moderate conditions that required short-term management.

Overall, this study provides valuable insights into the characteristics and outcomes of term neonates admitted to the NICU at Al Elwyia Maternity Teaching Hospital. The findings highlight the need for improved antenatal care, particularly for mothers with medical conditions such as diabetes and hypertension, as well as the need for better management of cesarean delivery and its associated complications. However, it is important to note that the study was conducted at a single institution and thus may not be generalizable to other settings. Further research is needed to better understand the factors contributing to NICU admission among term neonates and to develop strategies for preventing or reducing such admissions alongside exploring the underlying causes of neonatal mortality in this population and identifying effective interventions to improve neonatal outcomes.

Conclusions

The NICU at our hospital has found that neonatal mortality is linked to RDS, congenital anomalies, and meconium aspiration. Fortunately, these causes of neonatal mortality are preventable and treatable through careful assessment and risk detection. Unfortunately, a significant number of mothers did not receive regular antenatal care, which could have prevented many complications that led to neonatal admission to the NICU. Additionally, many mothers with hypertension or diabetes did not receive medication to manage their medical condition, leading to complications that could have been prevented with proper antenatal care.

Recommendations

1. Modify ways to receive adequate antenatal care as it's an important type of preventive healthcare and plays a huge part in preventing many neonatal admissions and improving maternal health risk factors; by regulating medical check-ups, providing routine prenatal screening and diagnosis and offering medical information such as maternal physiological changes in pregnancy, biological changes, and prenatal nutrition including prenatal vitamins, which prevents potential health problems throughout the course of the pregnancy and promotes the mother and child's health alike.
2. Identify ways to make antenatal care affordable and accessible to mothers considering the economic situation of the majority of the population in our country.
3. Indicate regional anesthesia as the first choice whenever feasible.
4. Offer prompt management and list treatment solutions for pre-existing maternal health complications.
5. Early detection and address ways to carefully assess and manage maternal pregnancy-related complications that can arise such as DM and hypertension.
6. carefully assess and monitor fetal well-being during labor to minimize C/S admissions.
7. Emphasize the importance of maintaining a healthy maternal lifestyle and advise mothers to regularly check with their gynecologist.
8. Highlight the need for further research to develop further strategies to reduce such neonatal admissions, explore the underlying causes of neonatal mortality and identify interventions to improve neonatal outcomes.
9. it is recommended that more efforts should be made by health institutions and hospital workers to improve the filling of medical records and not neglect any information.

Limitations

Limitations of this study include its retrospective design, which may have resulted in incomplete or inaccurate data, as well as the relatively small sample size. Additionally, the study was conducted at a single institution, which may limit the generalizability of the findings. Future studies should aim to overcome these limitations and provide a more comprehensive understanding of the factors influencing neonatal outcomes in developing countries.

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