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Original Article

Analytical Study for Cases with Neonatal Emergencies Admitted in Al-Azhar Assuit Neonatal Intensive Care Unit

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Abstract

Background: Neonatal period, the first 28 days of life, is the most vulnerable time for the survival of newborn.

Objectives**:** The aim of this work was analysis for cases with neonatal emergencies admitted to Al-Azhar Assuit neonatal intensive care unit (NICU) regarding their classification, aetiology, presentation, management &outcomes.

Study design**:** The present study was conducted in neonatal intensive care unit (NICU), pediatric department, Al-Azhar Assuit hospital; it is retrospective study from January 2019 to October 2019 and prospective study from November 2019 to April 2020.

Results: The neonates admitted in NICUs included in this study were subjected to bubble CPAP (27.2%), mechanical ventilation with blood transfusion (24%), procedure not required (14.7%), mechanical ventilation (13.4), bubble continuous positive airway pressure (CPAP) with blood transfusion (10%), blood transfusion only (5.2%), , chest tube with mechanical ventilation (4.7 %) and lumbar puncture (0.9 %).

Conclusions**:** Childhood mortality remains a significant global challenge and the commonest diagnosis during NICU admissions were respiratory distress syndrome (RDS) followed by Sepsis (Pneumonia, Meningitis, urinary tract infection (UTI), Disseminated intravascular coagulopathy (DIC),and necrotizing enterocolitis (NEC)).

Key words: Neonatal, emergencies, intensive, care Unit

Introduction

The efficient health care services of a country are categorized from neonatal morbidity and mortality [1,2]. Studies reported around 3 million mortality in neonates observed during this period, amounting to total of 45% of under-five deaths worldwide [1,3]. According to World Health Organization (WHO), 2015 nearly 2.7 million children died globally in the neonatal period, contributing to 45% of the total (under five mortality). Of these, almost 1 million neonatal deaths occurred in the first 24 hrs and close to 2 million died in the first week [4]. In 2018 the global neonatal death rate was 18 per 1000 live births, accounting for 2.5 million neonatal deaths. This represents approximately 7000 neonatal deaths every day [5].

The mortality rate of newborn in Egypt in 2013 was (11.8 per 1000 live births), which accounted for almost 54% of deaths of children under the age of 5 years [6].

The commonest primary diagnoses during admission to NICU were prematurity with respiratory diseases (36.6%), septicemia (22.7%), and perinatal asphyxia (16.2%) and the remaining reasons for NICU admission were meconium aspiration syndrome (13.9%), jaundice (6.0%) and others (4.6%) [7]. Neonatal deaths are due to infections, prematurity and perinatal asphyxia but recrudescence of these deaths differ between NICUs [8]. In a recently published study reporting the national demographic health survey it was reported that the annual rates of reduction for child mortality among neonates was -0.33% per annum, 3.13% per annum among post-neonatal, 0.9% per annum for infant, 2.47% per annum for child, and 1.19% per annum for under five [1].

The aim of work: The aim of this work was analysis for cases with neonatal emergencies admitted to Al-Azhar Assuit NICU regarding their classification,

aetiology, presentation, management and outcomes.

Methods

The present study was conducted at Al-Azhar Assuit NICU, it is retrospective study from January 2019 to October 2019 and prospective study from November 2019 to April 2020.

Inclusion criteria

The study included all neonates admitted to Al-Azhar Assuit NICU presented with neonatal emergency either respiratory, cardiac, hematological, neurological, metabolic, endocrinal, infections & surgical……etc.

Exclusion criteria

Age more than 28 days, cold cases as Jaundice, those with mild RD and neonates need routine delivery room care were excluded from our study.

Ethical consideration

Oral and written consents have been taken from parents or guardians of the patients. The aim of work was explained to the parents before collection of the data. The privacy of all data collected was assured.

All Neonates enrolled in this study were subjected to:

A thorough history including the following items: Personal history (name, age, sex, address and order among siblings). History of present illness: Onset, course, duration, associations and related symptoms. Past history of 1st 28 days: -as trauma. Family history: Thorough history about other members affected by the same disease from either sides of the patient's family as in hematological diseases. Perinatal history: Prenatal history: pregnancy condition including (drug intake, smoking, and seizures in pregnancy, hospitalization in early pregnancy, severe anemia frequency of prenatal visits, prior fetal death, and birth interval). Natal history: Labour and delivery (spontaneous or induced) onset and duration of labour, methods of delivery (NVD or CS), signs of fetal distress, problem during pregnancy or delivery, medicines given

to the mother e.g. pethidine. Postnatal history: Apgar score and Down score, any resuscitation needed, any abnormalities detected, birth weight and head circumference, estimated gestational age and vitamin K given. Developmental history as well as nutritional history (breast feeding or artificial feeding).

Full clinical examination: General examination: Down score, Apgar score, built, height, weight, complexion and any visible anomalies. Systemic examination: as chest, cardiac, abdominal and neurological examination.

Investigations: Investigations indicated according to the presentation: Complete blood count with differential, C-reactive protein, prothrombin time, partial thromboplastin time, international normalizing ratio, thyroid stimulating hormone, free thyroxin-3, free thyroxin-4, random blood glucose and blood film, blood gas analysis, chest& abdomen X-ray, ECG and echocardiography, abdominal &pelvic ultrasound, brain, abdomen and pelvic CT & MRI according to the case.

Blood sampling: On admission, one ml of venous blood in EDTA containing tube was aspirated for complete blood count and platelet indices (by automated cell counter system KX 21N, Japan) and another capillary blood sample was aspirated in pre-heparinized syringe for blood gas analysis (ABG) by ABG analyzer (Cobras b 221 Roche diagnostic GmbH- Germany) for all neonates was used.

Statistical analysis

Collected data was coded, analyzed and computed using Statistical package for social sciences (SPSS) version 2016. The collected data were revised, organized, tabulated and statistically analyzed using statistical package for social sciences (SPSS) version 23.0 for windows. Data are presented as the Mean ± standard deviation (SD), frequency, and percentage. Categorical variables were compared using the chi-square (χ^2) and Fisher's exact tests (if required).

Descriptive analysis of the results in the form of percentage distribution for qualitative data (minimum, maximum, mean and standard deviation) calculation for quantitative data was used. Cross tabulation test: For comparison between percentages values (Chi-squared). Student t- test: For comparison between means of two groups. Binary logistic regression: In order to identify independent prognostic factors, multiple regression analysis was performed with outcome (discharged, and died).

Ethics approval and consent to participate: The study was approved by Ethical Committee of Pediatric Department, Faculty of Medicine, Al-Azhar University (Assuit) and written consents were obtained from all fathers or care givers of all neonates included in the study.

Results

The neonates admitted in NICUs included in this study were subjected to bubble CPAP (27.2%), mechanical ventilation with blood transfusion (24%), procedure not required (14.7%), mechanical ventilation (13.4), bubble continuous positive airway pressure (CPAP) with blood transfusion (10%), blood transfusion only (5.2%), , chest tube with mechanical ventilation (4.7 %) and lumbar puncture (0.9 %) as shown in tables (1-6) Figures (1,2).

Discussion

Neonatal intensive care units (NICUs) provide life support to neonates; however, admission to an NICU entails risks for both families and their admitted infants, including high costs.[1,2]. Admission to the NICU interrupts the mother-infant bonding and establishment of breastfeeding [5]. Childhood mortality remains a significant global challenge. Almost 7 million children under 5 years of age die each year, including 3 million neonates in their first month of life (5). Overall, it is estimated that up to 50% of all neonatal deaths occur within the first 24 hours after birth, and 75% by one week of age. Ninety eight percent of neonatal deaths occur in low- and

middle-income countries (LMIC) where most births and deaths happen at home [6]. The commonest primary diagnoses during admission to NICU were prematurity with respiratory diseases (36.6%), septicemia (22.7%), and perinatal asphyxia (16.2%). and the remaining reasons for NICU admission were meconium aspiration syndrome (13.9%), jaundice (6.0%), and others (4.6%).[7] While, the most common causes of neonatal deaths are infection, prematurity and intrapartum related causes ("birth asphyxia"); the frequencies of these deaths vary between and within regions. Achieving reductions in neonatal mortality globally has been challenging for a variety of reasons, including limited political prioritization of newborn health, inadequate financial commitment to neonatal care by funding sources, and slow scale up of high impact maternal-child interventions. The mortality rate of newborn in Egypt in 2013 was (11.8 per 1000 live births), which accounted for almost 54% of deaths of children under the age of 5 years [8].

In our study that shown in Table (1), the mean of gestational age of the studied group was (32±4.3) weeks, the mean of neonatal age at admission was (4.08±9.7) days. The percent of preterm were (63.4 %). The mean of birth weight was 2800±1100 gm and (37.5%) of neonates were ≥ 1500 gm. In a similar study Tekleab et al.[7]showed that (39.8%) were preterm and (60.2%) were term.

Lawn et al. [8], identified that malnutrition, lack of nutritional education and lack of early antenatal care are significant risk factors for low birth weight babies. The commonest diagnosis during NICU admission were presented in (Table 2) these were as follow: cases with RDS were (22.8%) followed by Sepsis (Pneumonia, Meningitis, UTI, DIC, &NEC) (20.3%), TTN (13.8%), Prematurity (9.5%), HIE (7.3%), MAS (5.6%), and Surgical (5.2%).

Hospitalization and death rates due to birth asphyxia have been reported as

even higher (up to 41%) by Shah and Padbur.[9], Table (5) showed that the neonatal sepsis was the most common cause of neonatal death (44.9 %) followed by Respiratory distress syndrome (22.8 %), Prematurity (11.5 %), Meconium aspiration syndrome (5.1 %) and HIE (3.8%). (2.7%). Lawn et al.[8] showed that neonatal deaths are due to infections, prematurity and perinatal asphyxia but recrudescence of these deaths differ between NICUs.[8]

The known predisposing factors for neonatal infections are poor obstetric care and un-sterile delivery practices in resource poor settings where most of deliveries are conducted at home and outside health facilities.[8]

The most common causes of neonatal morbidity and mortality were birth asphyxia, prematurity, neonatal infection and congenital abnormality [8]. The neonates admitted in NICUs included in this study were subjected to bubble CPAP (27.2%), mechanical ventilation with blood transfusion (24%), procedure not required (14.7%), mechanical ventilation (13.4) ,bubble CPAP with blood transfusion(10%), blood transfusion (5.2%), , chest tube with mechanical ventilation (4.7 %) and lumbar puncture (0.9 %) as showed in (Table 6).

Liu et al[10],mentioned that surfactant therapy combined with ventilation can improve the clinical symptoms and blood gas analysis index of neonates with RDS. All of the studied neonates received antibiotics while (98.3%) received parenteral nutrition and, (41.8%) received positive inotropes and (35.3%) received caffeine citrate. In a study of Qari et al. [11] 47.3% of babies received antenatal steroids and 52.7% didn't receive, 32% were treated by antibiotics while 68% didn't.

In our study, the mean of maternal age of the studied group was (26.1±5.8) years, (19.8%) were paragravida part 1, (77.2%) didn't have disease; (2.6 %) suffered from anemia and (3.9%) with diabetes.

Lawn et al.[8] reported that infants born to diabetic women have certain distinctive characteristics, including large size and high morbidity risks. The neonatal mortality rate is in diabetic mothers is five times over that of infants of non-diabetic mothers and is higher at all gestational ages and birth weight for gestational age (GA) categories. Qari et al.[11] reported that 4.4% of mothers were diabetic while 95.6% were healthy, 3.3% of mothers had hypertension and 96.7% were not hypertensive, In our study, from maternal cases, (77.2%) did not receive any medications and (18.5%) have methyldopa, (9.1%) received Packed RBCs transfusion.

De Luca et al.[12],studied insulin treatment of maternal diabetes mellitus and respiratory outcome in late-preterm and term singletons; he mentioned that there are two main concerns in attempting to link DM and the respiratory status of the newborn at birth which interact with prematurity and the route of delivery, he stated that the incidence of prematurity in pregnancies with DM is known to be increasing, especially in poorly controlled DM with frequent hyperglycemic events.

Increased emergency C.S in this study matched with Egypt demographic and health survey (EDHS) 2014 ,stated that overall 87 % of all live births delivered in hospital and slightly more than half of births (52%) were by C.S; this represented a sharp increase from 2008 when 28% of births were C.S, on the contrary, Tekleab et al.[7] showed different results as 40%, 11.66%, 31.9% and 30.4% were born by C.S. respectively.

Qari et al.[11] found that the risk of respiratory distress in near-term and full-term infants has been found to be up to 3.9-fold higher when the birth occurs by caesarean section. They showed that 57.1% of newborn were male gender and 42.9% were female, 4.4% of babies were extreme preterm, 86.5% were preterm, 4.4% were late preterm and 4.7% were full term.

Respiratory distress is the leading cause for hospitalization in neonatal intensive care units. RDS considered the major cause for increased mortality and morbidity among infants. Neonatal respiratory distress syndrome (RDS) occurs in infants whose lungs have not yet fully developed [11]. It can also be due to genetic problems with lung development. Most cases of RDS occur in babies born before 37 to 39 weeks. The more premature the baby is, the higher the chance of RDS after birth. The problem is uncommon in babies born full-term (after 39 weeks) [13]. Respiratory distress syndrome (RDS) is diagnosed by the presence of at least two of the following clinical signs: tachypnea (>60/min), dyspnea with inspiratory subcostal or intercostal retractions, nasal flaring, expiratory grunting and cyanosis in room air. Most frequently diagnosis of RDS occurs during the first 48 hours with transient tachypnea of the newborn, infections, meconium aspiration syndrome, hyaline membrane disease (HMD) and perinatal asphyxia [14].

Saeed et al.[15]determine the prevalence and etiology of respiratory distress in the neonates delivered in Armed Forces Hospital Sharurah Kingdom of Saudi Arabia over a period of one year from January 2008 to December 2008, they deduced that the overall prevalence of respiratory distress (RD) was 4.24%; 19.7% in preterm and 2.3% in full term. The greatest risk factor for respiratory distress syndrome is prematurity, 86.5% of our infants were preterm, both extreme and full-term newborn constitute 4.4% while only 4.7% of patients were full term.

Bricelj et al.[16] concluded that combination of prematurity, cesarean birth and hypertension act independently to increase the risk of RDS in newborn when he searched for neonatal respiratory morbidity in late-preterm births in pregnancies with and without gestational diabetes mellitus.

Septic neonates were represented 47 (20.3%) with 12 (7.8%) were discharged and 35 (44.9%) were died. Neonatal sepsis is said to have always been a significant task for caregivers, particularly in low- and middle-income countries.[17] .In a study conducted by Kanodia et al.[18], neonatal sepsis is reported as 35%, Bucens et al.[19] reported 38%.

Twenty two cases (9.5%) represent prematurity with 13 (8.4%) discharged and 9 (11.5%) died. However, prematurity was the leading cause of death among preterm neonates, followed by asphyxia, and sepsis according to Yasmeen et al.[20].

Meconium aspiration syndrome were represented 13 (5.6%) with 9 (5.8%) were discharged and 4 (5.1%) were died. Meconium cause mechanical obstruction to the airways, resulting in air trapping, hyperinflation, and increased risk for pneumothorax. Meconium components also inactivate surfactant, trigger an inflammatory response with the release of cytokines, and increase the production of the vasoconstrictor's endothelin and thromboxane [5]. IDM represent 11 (4.7%) with 8 (5.1 %) discharged and 3 (3.8%) died. while 8 (3.5%) represent Congenital heart disease with 6 (3.9%) discharged and 2 (2.6%) died.

Conclusions

It is concluded that childhood mortality remains a significant global challenge and commonest diagnoses during NICU admission were RDS followed by Sepsis (Pneumonia, Meningitis, UTI, DIC and NEC).

List of Abbreviations:

CPAP: continuous positive airway pressure

DIC: Disseminated intravascular coagulopathy

NEC: Necrotizing enterocolitis (NEC)

NICU: Neonatal intensive care unit

RDS: Respiratory distress syndrome

UTI: Urinary tract infection

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Author's contributions

AE conceived the study, carried out its designing, coordinated the implementation, helped to perform the statistical analysis and drafted the manuscript. AA revised the statistical data, drafted the final manuscript and shared in study design. NO was responsible for interpretation of laboratory data of patients, revised the statistics of the manuscript. All authors read and approved the final manuscript.

Conflict of interest

There are no any financial or non-financial competing interests to declare in relation to this manuscript.

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Table (1): Sociodemographic and clinical characteristics of neonates admitted to Al-Azhar Assuit NICU.

Variables	**No.=232**	**%**
Gestational age (weeks)		
Range (Min-Max)	19 (22-41)	
Mean ±SD	32±4.3	
Preterm (<37 weeks)	147	63.4%
Term (≥ 37weeks)	85	36.6%
Neonatal age at admission (days)		
Range (Min- Max)	(0-26)	
Mean ±SD	4.08±9.7	
<1 day< 24 hrs	184	79.3%
1-3 days> 24 hrs	27	11.7%
4-7 days < 7 days	13	5.6%
8-28 days> 7day	8	3.4%
Sex		
Male	126	54.3%
Female	106	45.7%
Birth weight (gm)		
Range (Min- Max)	(600-4100)	
Mean ±SD	2800±1100	
ELBW (<1000gm)	9	3.8%
VLBW (1000-<1500gm)	40	17.3%
LBW (1500-<2500 gm)	87	37.5%
Birth weight ≥ 2500 gm	96	41.4%

→Data presented as Frequency and (%). No.=Number, %=Percentage
LBW=low birth weight. ELBW=extremely low birth weight. VLBW=very low birth weight.

Table (2): Pattern of neonatal emergencies of neonates who admitted to Al-Azhar Assuit NICU.

Diagnosis	**No.=(232)**	**%**
Respiratory distress syndrome (RDS)	53	22.8
Sepsis (Pneumonia, Meningitis, UTI& DIC)	47	20.3
Transient tachypnea of newborn	32	13.8%
Prematurity(low birth wt & NEC)	22	9.5%
Hypoxic ischemic encephalopathy	17	7.3%
Meconium aspiration syndrome	13	5.6%
Surgical	12	5.2%
• Choanal atresia	1	0.43%
• Duodenal atresia	3	1.3%
• Pyloric stenosis	2	0.85%
• Congenital diaphragmatic hernia	3	1.3%
• Tracheoesophogeal Fistula	2	0.85%
• Hirchsbrunge disease	1	0.43%
Infant of diabetic mother (hypoglycaemia, macrosomia)	11	4.7%
Congenital heart disease	8	3.5%
Neonatal seizure	6	2.6%
Haemorrhagic disease of newborn	4	1.7%
Aspiration pneumonia	4	1.7%
Dysmorphic features (Edwared syndrome ??)	3	1.3%

→Data presented as Frequency and (%). No.=Number, %=Percentage
NEC: necrotizing enterocolitis, DIC: disseminated intravascular coagulation, UTI: urinary tract infection.

Table (3): Intervention performed in studied group of neonatal emergencies.

Intervention	No.	%
Bubble CPAP	63	(27.2)
Mechanical ventilation with blood transfusion	56	(24)
Procedure not required	34	(14.7)
Mechanical nentilation	31	(13.4)
Bubble CPAP with blood transfusion	23	(10)
Blood transfusion	12	(5.2)
Chest tube with mechanical ventilation	11	(4.7)
Lumbar puncture	2	(0.9)

→Data presented as Frequency and (%). No.=Number %=Percentage
CPAP: continuous positive airway pressure

Table (4): Outcome according to the gender

Items		**Discharged No.=154**		**Died No.=78**		**P-Value**
Gender(232)		No.	%	No.	%	
Male	126(54.3)	80	51.9	46	59.0	0.41
Female	106(45.7)	74	48.1	32	41.0	

→Data presented as Frequency and (%). No.=Number %=Percentage

Table (5): Outcome according to the type of neonatal emergencies

Items		Discharged No.=154		Died No.=78		P-Value
Neonatal emergencies(232)		No.	%	No.	%	
Prematurity with RD$	53 (22.8)	34	22.1	19	24.4	0.26
Sepsis	47 (20.3)	12	7.8	35	44.9	<0.001*
Transient tachypnea of newborn	32(13.8)	29	18.8	3	3.8	0.045*
Prematurity	22 (9.5)	13	8.4	9	11.5	0.04*
Hypoxic ischemic encephalopathy	17 (7.3)	14	9.9	3	3.8	0.48
Meconium aspiration syndrome	13 (5.6)	9	5.8	4	5.1	0.038*
Surgical	12(5.2)	12	7.8	-	-	-
Infant of diabetic mother	11 (4.7)	8	5.1	3	3.8	0.048*
Congenital heart disease	8 (3.5)	6	3.9	2	2.6	0.22
Neonatal seizure	6(2.6)	6	3.9	-	-	-
Hemorrhagic disease of newborn	4(1.7)	4	2.6	-	-	-
Aspiration pneumonia	4(1.7)	4	2.6	-	-	-
Dysmorphic features (Edward syndrome?)	3(1.3)	3	1.9	-	-	-

→Data presented as Frequency and (%). No.=Number %=Percentage
*Significant; ** highly significant.
RDS: Respiratory distress syndrome

Table (6): Outcome according to the intervention performed on studied groups of neonatal emergencies

Items		Discharged No.=154		Died No.=78		P-Value
Neonatal emergencies (232)		No.	%	No.	%	
Bubble CPAP	63(27.2)	63	40.9	-	-	-
Mech. vent. with blood transfusion	56(24)	13	8.4	43	55.1	0.001**
Procedure not required	34(14.7)	34	22	-	-	-
Mechanical ventilation	31(13.4)	12	7.8	19	24.4	0.047*
Bubble CPAP with blood transfusion	23(10)	18	11.7	5	6.4	0.068
Blood transfusion	12(5.2)	8	5.2	4	5.1	0.2
Chest tube with mech. ventilation	11(4.7)	4	2.5	7	9	0.054
Lumbar puncture	2(0.9)	2	1.3	-	-	-

→Data presented as Frequency and (%). No.=Number %=Percentage
*Significant; ** highly significant.
CPAP: continuous positive airway pressure

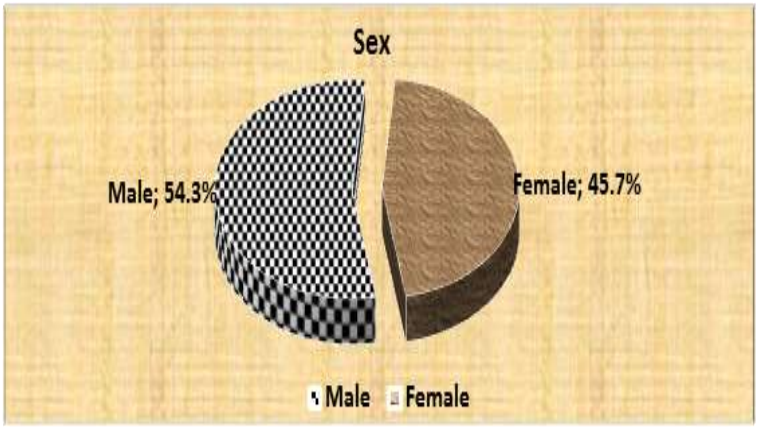

Figure (1): Sex distribution in studied groups

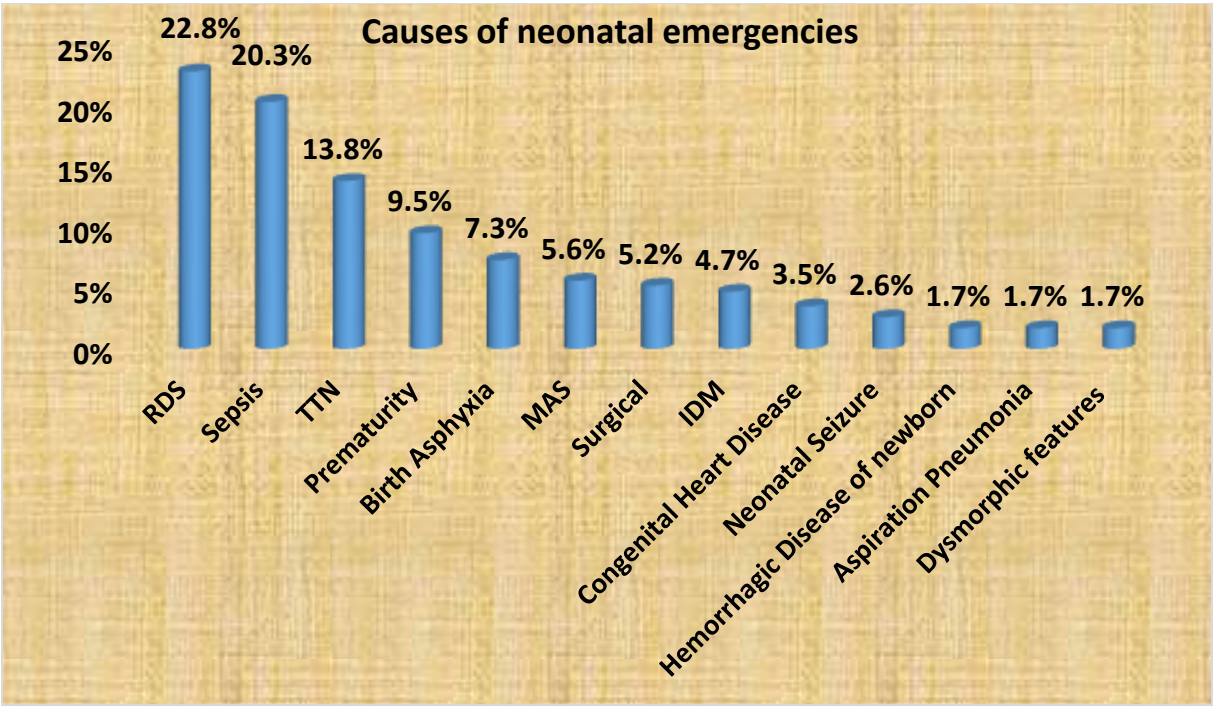

Figure (2): Distribution of neonatal emergencies in studied groups.

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