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Comparison Study of Causes and Neonatal Mortality Rates of Newborns Admitted in Neonatal Intensive Care Unit of Al-Sadder Teaching Hospital in Al-Amara City, Iraq

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Abstract

Background

Each year about 32.4 million of children are born with low birth weight, which is below the 10th percentile for their gestational ages; moreover, about fifteen million of them are premature. Actually, about 60% of neonatal deaths occur in low birth weight neonates related to their prematurity. This study aimed to determine the neonatal death rate and the most common causes of the hospital inborn admissions to the Neonatal Intensive Care Unit (NICU).

Materials and Methods

A descriptive cross sectional study was conducted in NICU, during two separated periods one in 2007 and the other during 2015. All consecutive live born babies from 1st of January to 31st of December of 2007 were included as 1st period studied and the second period from 1st of January to 31st of December 2015. The neonatal mortality rate (NMR), and causes of deaths in two years, were studied and compared.

Results

In 1st period, the neonatal death rate in NICU was 27.2 %, while in 2nd period; it was 33.9%, which was higher. The commonest causes of neonatal death were the same but, the percentages were different and the leading causes of death from the higher frequencies down were hyaline membrane syndrome, birth asphyxia, congenital anomalies, meconium aspiration and others.

Conclusion

The neonatal death rate in the NICU was higher in 2015, compared to 2007. This needs special efforts for strengthen the strategies of neonatal care and management at the time of delivery and even before and during intrauterine life through good antenatal care to improve the NICU outcome.

Key Words: Birth asphyxia, Infants, Neonatal death rate, RDS, Preterm.

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1- INTRODUCTION

Neonatal period (up to first 28 days after birth), is the most risky period of human life as it accounts for very high morbidities and mortalities, which mostly are preventable. Moreover, it accounts for 45% of all deaths occur under the age of 5 years worldwide; a child born in developing countries is likely to die during the first 28 days of life that is 14 times more than one born in undeveloped countries (1). Approximately, out of 130 million children born each year, about 4 million had died in the first 28 days of life worldwide, around 75% of death occurs in the first seven days of life, and 25% occurs in the first 24 hours of life (1-3). The neonatal mortality rate used to be higher than in post neonatal under 5-year period (4). Neonatal mortality rate (NMR), is the number of deaths during the first 28 completed days of life per 1000 live births in a given year or period (5). Neonatal death classified to: early, which occur in the first week of life, and late, that occur from [7- 28] completed days of life (5). Most of the hospitals admitted newborns were preterm (i.e., born before 37 weeks of pregnancy), and have a low birth weight (less than 2.5 kg), and/or serious medical conditions, so they need intensive care setting and admission to the Neonatal Intensive Care Unit (NICU), (6).

In fact, the Neonatal mortality rate is one of the important and sensitive indicators of the availability, utilization and effectiveness of the health services in the community (7). It is varying according to the health services and place of birth (hospital or home) (8, 9). Worldwide, the main causes of death in neonatal period are congenital anomalies, prematurity, and perinatal asphyxia (10). According to World Health Organization (WHO) report in (2009), the neonatal death in developed countries, were mainly due to unpreventable causes such as congenital abnormalities, while the preventable conditions, as (infections, birth asphyxia, and prematurity), are the major causes of death among infants in developing countries (11). Progress in health services lead to decrease in premature infants admissions to NICUs and hence the mortality rate (12–15). Globally, there was improvement gained in the last few years regarding acceleration in progress towards Millennium Development Goal (MDG IV), yet for all the remarkable gains, aware that inequalities persist and that progress has been uneven. Nevertheless, the neonatal death decreases globally by 47% between 1990 and 2015 (from 36 to 19 deaths per 1,000 live births). In the 1st 28 days of life the number of deaths decrease from 5.1 million to 2.7 million, this decreasing in death number is less than that under-5 mortality (47% compared with 58% globally) (16).

In Iraq, NMR has been declined from 27.1 per 1000 in 1990 to 21.1 in 2007, then to 18.4 in 2015, which are promising (17). In favor of achieving the Goal Target (Millennium Development Goal 4), equivalent to an average annual reduction of 4.4%, major reductions in neonatal mortality are going to be required (18, 19). To achieve the goal of 12 deaths per 1000 live births by 2030, we need a major improvement of our health services especially for antenatal care and delivery services (20). The study aimed to assess, evaluate, and compare the outcome of admitted neonates to NICU in 2007, 2015 (8 years apart), in favor to improve the neonatal care level and management strategies in the delivery room as well as in NICU in favor of decreasing neonatal mortality rate in the future and to be used as a database for further studies (21, 22).

2- PATIENTSAND METHODS

A retrospective descriptive cross sectional study with analyzed element conducted in the NICU of Al-Sadder

Teaching Hospital in Missan province, Iraq, during two separated periods, one during 2007, and the other during 2015 (eight years later). The data were collected from hospital records of neonatal care unit to made comparison study between results of 2007 and 2015, which included gender of neonate, type of delivery, gestational age, causes of death, total admission to the neonatal care unit, and total live birth in hospital. The permission obtained from the Missan directorate of health and Al-Sadder Teaching Hospital to carry out this study. Data analysis carried out and presented as number, percentages, tables and figures using Micro-Software Excel and Statistical Packages for Social Science, version 18.0 (SPSS-18.0). To measure the association significance among variables of study uses Chi-square test (χ2-test), whenever the P-value was equal or less than 0.05, it considered significance statistically.

3-RESULTS

Total number of live births during the 1st studied period (from the 1st of January to 31st of December 2007), were 10,349 out of which, 513 (4.95%) were admitted to the NICU, and a total number of live births in the 2nd studied period (the whole 2015), were 13,580 out of which, 725 (5.33%) were admitted to the NICU. The increment in admission rate was 0.38%. The total deaths of admitted cases in 2007 were 140 (27.2%), while in 2015 were 242 (33.9 %), which means a higher mortality rate by 6.7%. This increment opposed by the same percentage decrement in neonatal discharging well ratio from 72.7% in 2007, to 66% in 2015 as showed in **Table.1**.

Regarding delivery type, total delivery was higher in 2015 (725) than 2007 (513), and the ratio of Normal Vaginal Delivery/ Caesarian (NVD/CS), was 83%, 17%, and 76.3%, 23.7%, respectively, caesarian section delivery increased by approximately 6.7 % from 2007 to 2015, 17% to 23.7%, respectively. While NVD had decreased the same percentage from 2007 to 2015, 83% to76.3%, respectively.

In both years (2007 and 2015), neonatal death of CS delivery was higher than of NVD. In 2007, neonatal death among delivery type was 36.2% CS, 24.4 % NVD; while the opposite for discharging rate, 63.8% CS, 75.6 % NVD, which shows statistical significant association (P= 0.009).

In 2015, neonatal death among delivery type was 42.8% CS, 31.1%NVD, while the opposite for discharging rate 57.2% CS, 68.9% NVD, with statistical significant association (P= 0.004) as showed in **Table.2**.

Regarding neonatal maturity admission to the NICU, the full term admission decreased from 69% to 61% by about 8%, while preterm admission increased from 31% to 39 % in 2015. This reflects increased preterm deliveries and complications.

In 2007, the death rate was higher among preterm neonates than full term 50.3%, 80 out of 159 (50.3%), 60 out of 354 (17%), respectively. Accompanied by higher discharging well rate for full terms, 298 out of 354 (83%) in 2015, than preterm 79 out of 159 (49.7%,), in 2007; which was statistically significant association (P= 0.0001).

In 2015, principally, the death rate was higher in preterm 52.2 % compared to full term 22.1 %, which results in better improvement of full term over preterm neonates 77.9% , 41.1%, respectively. Moreover, collectively both (preterm, full term) deaths, were higher in 2015 than 2007; which was statistically significant association (P= 0.001), as showed in **Table.3**.

Regarding gender admission, in 2007, percentage of gender admission ratio were

60.8% male, and 39.2% female. While in 2015, 60.1% male and 39.9% female, that is approximately the same. While the gender admission ratio in both years was (1.5 male: 1 female) the differences regarding gender admission were not statistically significant (P= 0.3).

In 2007, male gender carries a higher mortality rate than female gender 91 out of 312 (29.2%), 49 out of 201 (24.4%), respectively, and a lower improvement rate 221 out of 312 (70.8%), than female sex 152 out of 201(75.6%).

In 2015, the same trend regarding male gender predilection for death as in the following results, the male death rate 154 out of 436 (35.3%), was higher than 92 out of 289 (31.84%) female deaths. While the improvement rate among female gender 197 out of 289 (68.16%), was higher than the male rate 282 out of 436 (64.70%) with no significant association statistically (P= 0.8), this showed in **Table.4**. Regarding the main causes of death: in 2007, Respiratory Distress Syndrome (RDS), was the major cause, which represents 62.8% followed by birth asphyxia 21.4%, congenital anomalies 11.4%, meconium aspiration syndrome 2.9%, sepsis and others 1.5%.

In 2015, RDS also was the commonest cause of death 65.85%, followed by birth asphyxia 21.95%, congenital anomalies 9.4%, meconium aspiration 1.6%, sepsis, and others.1.2%. As showed in **Table.5**. The rate of Neonatal death in the NICU at Al-Sadder teaching hospital Amarah city in 2007 and 2015 were 27.2%, 33.9%, respectively. While the NMR for the total live births at the hospital were 13.5 in 2007 and 18.1 in 2015 per 1000 live birth, **Figure.1**.

Table-1: The number of live births, admissions and deaths during the 2007 and 2015

Years	Neonatal birth and admission to NICU						
	Hospital live births	Admissions		Discharged well		NICU Death rate	
	No.	No.	%	No.	%	No.	%
2007	10349	513	4.95	373	72.7	140	27.2
2015	13580	725	5.33	479	66	246	33.9

Table-2: Distribution of live births and neonatal admissions to NICU according to the delivery type

Delivery type		Hospital live births		Neonatal admissions to NICU						
				Death		Discharge well		Total		P-value
		No.	%	No.	%	No.	%	No.	%	
2007	NVD	8589	83	95	24.4	294	75.6	389	100	0.009
	C/S	1760	17	45	36.2	79	63.8	124	100	
	Total	10349	100	140	27.2	373	72.8	513	100	
2015	NVD	9271	76.3	172	31.1	380	68.9	552	100	0.004
	C/S	2884	23.7	74	42.8	99	57.2	173	100	
	Total	12155	100	246	33.9	479	66.1	725	100	

NVD: Normal Vaginal Delivery; C/S: Caesarian.

Table-3: Distribution of neonatal admissions to NICU according to the maturity

Maturity		Neonatal admission to NICU						
		Death		Discharge well		Total		P- value
		No.	%	No.	%	No.	%	
2007	Full tem	60	17	294	83	354	69	0.0001
	preterm	80	50.3	79	49.7	159	31	
	Total	140	27.3	373	72.7	513	100	
2015	Full tem	98	22.1	344	77.9	442	61	0.001
	Preterm	148	52.2	135	47.8	283	39	
	Total	246	33.9	479	66.1	725	100	

Table-4: Distribution of neonatal admission to NICU according to the gender

Gender		Neonatal admission to NICU 2007						
		Death		Discharge well		Total		P- value
		No.	%	No.	%	No.	%	
2007	Male	91	29.2	221	70.8	312	60.8	0.3
	Female	49	24.4	152	75.6	201	39.2	
	Total	140	27.3	373	72.7	513	100	
2015	Male	154	35.3	282	64.7	436	60.1	0.8
	Female	92	31.8	197	68.2	289	39.9	
	Total	246	33.9	479	66.1	725	100	

Table- 5: Neonatal death distribution according to the causes during 2007 and 2015

Causes	Neonatal death			
	2007		2015	
	No.	%	No.	%
RDS	88	62.8	162	65.9
Asphyxia	30	21.4	54	21.9
Congenital anomalies	16	11.4	23	9.4
Meconium aspiration	4	2.9	4	1.6
Others+ sepsis	2	1.5	3	1.2
Total	140	100	246	100

RDS: Respiratory Distress Syndrome.

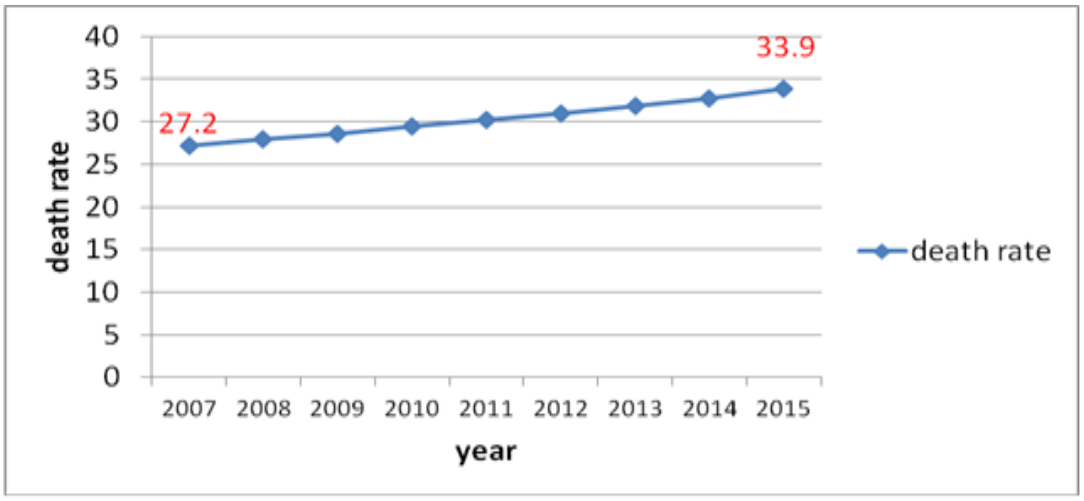

Fig. 1: Trend of neonatal death rate in the NICU from 2007-2015

4- DISCUSSION

Neonatal mortality rate is one of the important indices that used to evaluate and assess the progression of neonatal and perinatal health services in the community, and consider as standard indicator for education, social, community health system, nutritional status and medical programs in neonatal care in any country (23). Our study emphasizes the need to address specific risk factors and causes of neonatal mortality in the NICU of Al-Sadder teaching hospital in Amarah city, Iraq. We compared the distribution of death and morbidity among admitted inborn neonates to the NICU in two separate periods 2007 and 2015 in association with gender difference, delivery type, and gestational age (term or preterm). Hospital records derived data although do not actually reflects NMR in the community as a whole, but has the advantage of being more accurate regarding the causes of death and represent the quality of available medical and nursing services and the management strategy planning.

This comparative study over separate periods (8 years apart), in the same NICU, will enables to assess the real challenging situation in the hospital by estimating NMR mortality. Moreover, it helps reevaluation of the practicing strategies in favor of improving the existing one and working progressively towards correction of any shortage in personnel, equipment, supplies and medicines or suboptimal practicing management, and emphasizes on support and promotion of the preventive measures and educational programs that help to decrease the offending risk factors for neonatal morbidity and mortality as the common causes of death were preventable.

Regarding the neonatal admission in 2007 and 2015; the rate increased from 4.95% to 5.33%, respectively. Approximately by 0.4% which may be attributed to natural community growth, increased; fertility, marriages, adolescent pregnancies, hospital birth rate, demands for admissions, and increased total deliveries based on sociocultural factors and economic factors. This total NICU admission increment agreed with an epidemiological study in U.S.A from 2007 to 2012 (24), but with different rates.

Moreover, in our study there is a trend of increasing preterm admission to NICU by about 8% from 31% to 39% in 2007 and 2015. This raised premature admissions agreed with a study in Argentina, in which the incidence of preterm births increased by 38% between 2009 and 2012 (25), and a study in India (26). Although neonatal mortality rates (NMRs), have fallen globally during 1990 and 2010 (27-29), the absolute numbers and rates of preterm birth, have

increased during this period (30). WHO had documented a fact in 2016 that "Every year, an estimated 15 million babies are born preterm, and this number is rising" (31), which agreed our study finding. Regarding delivery type, the total delivery types admissions, were higher in 2015 over 2007. Moreover, caesarean section delivery had increased approximately by 6.7 %, from 2007 to 2015, 17%, 23.7%, respectively. While NVD had decreased the same percentage from 2007 to 2015, 83% to 76.3%, respectively. The higher percentages of CS delivery agreed by a study in Al-Diwaniya (32), and many other studies (33-36). According to the most recent studies, global rate of CS is 18.6% in 2015, we exceeded this rate, CS estimated ratio in Asia is 6.4%, Africa 4%, in Europe 3.4% (37), while the CS rate of 10- 15%, consider as ideal globally (38).

Caesarean section delivered neonates had a higher death rate than those born vaginally. In 2007, mortality among CS delivered newborns was higher than newborns of NVD, 36.2%, 24.4%, respectively; which indicates a statistically significant association (P=0.009). In 2015, mortality of neonates delivered by CS was 42.8% versus 31.1% NVD; which indicates a statistically significant association between the CS and neonatal death (P=0.004). This association agreed by a study in Canada in 2015 (39), and a study in Nigeria (40). Moreover, well-discharged neonates delivered by CS, were less than a well discharged NVD neonates, 57.2 %, 68.9 %, respectively in 2015 and 75.6%, 63.3% in 2007.

Regarding neonatal maturity, full term admission rate decreases from 2007 to 2015, 69%, 61% by 6%, respectively; while the preterm admission rate had increased the same ratio. This agreed with two studies in India (17 years. apart), showed increase preterm admissions to the same NICU from 21.2% in 1998 to 30.95 in 2015 (26, 41); that synchronized with the WHO fact sheet 2016: 65 countries including Iraq show an increase in preterm birth rates over the past 20 years (31). This study showed that the neonatal mortality was higher among preterm neonatal admissions in both studied years. In 2007, preterm mortality was higher than full term 50.3 and 17%, respectively. In 2015, again, the preterm death rate was higher than full term 52.2 and 22.1%, respectively. This reflects a significant association between preterm delivery and higher neonatal death rate (P = 0.0001 in 2007), and (P =0.001 in 2015), which is highly significant, this association agreed by a lot of studies in U.S.A and Europe (33-36), and by Numan study in Baghdad (done over 3 years period 2007-2009), in which premature death occurred in 80% of admitted preterm; while in our study, it is around 50%. In addition, the rising preterm death in our study agreed the WHO fact sheet 2016, in which 15 million children were born too early each year, more than 1 in 10 children were preterm and the number is rising (31).

For NICU gender admission, the male admission rate was slightly higher in 2007 than 2015, 60.8% and 60.1%, respectively; while female admission was rate reversed 39.2% and 39.9%. Actually, there is a very slight difference between 2007 and 2015, regarding gender admission rates. Moreover, male: female ratio was the same 1.5:1 in both years, the results agreed with a study result in Nigeria (42), and to Numan study in Baghdad (43), in which males deaths was 58.3%, while female death was 41.7%, and male to female ratio was 1.4:1.

Male gender carry poor outcome. In our study, the male death increased from 29.2% to 35.3% in (2007, 2015), respectively, and female death increased from 24.4% to 31.84%. While Male: female death ratio was 1.85:1 in 2007, which decreased to 1.67:1 in 2015. Our results were similar to Numan study in Baghdad regarding higher male death rate, but differ regarding Male: female ratio 1.5: 1. In addition, it is similar to another study in Canada (44). Higher male mortality may be explained due to gender

differences in genetic and biological makeup (44). Moreover, male sgender has a higher incidence of infection (sepsis), and respiratory distress syndrome than female children (45, 46). As a result, male death was higher than female death in both years of the study, which means male gender is a risk factor for poor prognosis and death, while female gender is a good prognostic factor for recovery. Anyhow, Neonatal mortality rates in the NICU at Al-Sadder Teaching Hospital Al-Amarah city-Iraq in 2007 and 2015, were 27.2%, 33.9%, respectively. Both were higher than Numan study, 18.5% (2007-2009) (43), and higher than a study in Brazil 18.6 % (47). Moreover, higher than a study in Bangladesh 2010 (15.5%) (48).

Furthermore, our results showed an increment in the neonatal death rate in spite of working to create an account of progress towards the achievement of MDG IV. At a country level, Iraq had achieved a three-fold increase in the rate of reduction of under-five mortality since the early 1990s; this includes the NMR reduction (49, 50). Our hospital NICU death rate of 27.2% in 2007, increased to 33.4% in 2015, with increment of 6.2%. These neonatal death rates were higher than, a study in Al-Diwaniya, 13.1% (32), Numan study in Baghdad 18.5% (43), a study in Canada 4% (51), and a study in Pakistan 9% (52). The differences in mortality rates may be due to availability of proper health services and facilities in community as they differ from country to country, and between hospitals and even between health centers.

The top cause of neonatal death in our study was RDS, 62.8% in 2007 increased to 65.85% in 2015. This agreed to study in Philippine (2006), as a top cause of death, but in lower rate 21.5% (53), and agreed with Lamia study in Baghdad (2007) (54). Our study higher RDS death rate reflects increased preterm admissions and complications. The second cause of death was birth asphyxia (the baby does not get enough oxygen during the birth process), increased from 21.4% to 21.95 %, which is approximately the same in 2007 and 2015, respectively. Our results were higher than Numan study 9% (43), and lower than Jehan, study in Pakistan (2009) (54). The third was congenital abnormalities 11.4% and 9.4% in 2007 and 2015, respectively, it shows slightly decreases probably, because the majority of anomalies is incompatible with life and died in early intrauterine life or aborted. The fourth, was Meconium Aspiration Syndrome ((MAS), it was 2.9% in 2007 decreased to 1.6 in 2015, which is much less than Numan study in Baghdad (2007) (43), and Lamia study (2007) (54).

This lower rate may be attributed to reduction in full term or post term admissions (only 5% of these infants develop MAS), compared to preterm admission. Sepsis and others include (intracranial hemorrhage [ICH], hypoglycemia, etc.), are 1.5% in 2007 decreases to 1.2% in 2015, which indicates an improvement of therapeutic strategies and infection control programs in our NICU.

4-1. Limitations of the study

In this study the data collection, it was reflect percentage of our province, and not all cities in our country. The children including in our study composed about all cases attend to hospital. We need more information and studies for covering such subjects.

4-2. RECOMMENDATIONS

We recommend better care of preterm babies, especially those with respiratory distress syndrome (DRS), and steps to prevent or decrease RDS, birth asphyxia and congenital anomalies. By increase orientation, improve the antenatal care services and offer advanced planning strategies to improve neonatal outcome.

5- CONCLUSION

The neonatal death rate was higher in 2015 than 2007. There was a high male to female ratio in both admission and death rate, and high percent of preterm deliveries and admissions, all were higher in 2015 than 2007. The leading causes of death were respiratory distress syndrome, then following by birth asphyxia, congenital anomalies, meconium aspiration syndrome and neonatal sepsis.

6- CONFLICT OF INTEREST: None.

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