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The Neonatal Outcomes and resuscitation rate of Neonates at Imam Reza Hospital, Mashhad, Iran

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ABSTRACT

Background & aim: Neonatal mortality rate (NMR) is an important health index, which reflects the socio-economic and health status of a community. According to the literature, almost 20% of NMR can be prevented through the implementation of simple resuscitative interventions. This study was conducted to review the neonatal outcomes and resuscitation rate of neonates.

Methods: This record review was carried out using records of 4683 birth from March 2016 to March 2017 in Imam Reza Hospital, Mashhad, Iran. The variables reviewed included the birth conditions, neonatal outcomes and resuscitation interventions. The data were collected using a self-structured record form and analyzed using descriptive statistics.

Results: The findings showed 179 neonatal deaths out of 4683 births (including those who were born dead or the ones who died shortly after birth in delivery rooms). NMR was 3.8% in the current study. The rate of cesarean deliveries was 5% higher than normal vaginal delivery rate. Moreover, 18% of births were related to the gestational age lower than 36 weeks. The rate of low and very low birth weight infants was 6.42% of births. Approximately, 20% of the newly born infants were resuscitated.

Conclusion: The results of this study revealed that Imam Reza Hospital of Mashhad, Iran was not in a good condition compared to the developed countries, in terms of the status of births, mortality rate, and resuscitation interventions.

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Introduction

Health indicators reflect the level of health in the community (1) and neonatal mortality rate (NMR) is one of the most important health indicators (2). The NMR in Iran is 12-15 per 1000 births and it is 5 per 1000 births in the developed countries (3). The United Nations Children's Fund (UNICEF) considers NMR as one of the most important indicators of the socio-economic development of countries (4). Reduction in NMR is one of the Millennium Development Goals in the world and governments are obliged to fulfill this end (5). Despite the decline in NMR in recent decades, the mortality rate in the first month of birth is still at a high level (6). The highest rate of neonatal mortality is observed in the first 24 h of life, which accounts for 65% of the total infant deaths (3).

Annually, more than 5 million neonatal deaths occur worldwide (7), and 99% of them are seen in the developing countries (8). It has been stated that birth asphyxia accounts for

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19% of these deaths, suggesting that the outcome might be improved through the implementation of simple resuscitative techniques (7). A negligible number of infants require resuscitation at birth (9). The transition from dependence on placental gas exchange in a liquid-filled intrauterine environment to spontaneous breathing of air occurs at the time of birth. This presents a dramatic set of physiological challenges to an infant that might subsequently result in a need for resuscitation. It is worth mentioning that this type of resuscitation is different from resuscitation of the older infants or children (7). The present study aimed to evaluate the data obtained from the birth conditions of newborns, infants' resuscitation, and neonatal outcomes for the first time at Imam Reza Hospital, Mashhad, Iran, after cardiopulmonary resuscitation.

Materials and Methods

This cross-sectional descriptive study was conducted to assess the birth condition, resuscitation interventions, and neonatal outcomes of newly born infants at Imam Reza Hospital of Mashhad, Mashhad, Iran. The data were collected through a researcher-designed form between March 2016 and March 2017.

Neonates were categorized based on the type of deliveries (including cesarean section and natural delivery), gestational age, baby weight, type of resuscitation, and neonatal outcomes during the 12 months of study. The frequency of infants with gestational age <32, 32-36, >36, and >42 weeks, as well as birth weight <1000, 1000-1499, 1500-2499, 2500-4000, and >4000 g were determined and compared in different months. The required type of resuscitation was another investigated variable. Accordingly, the initial steps of resuscitation, including drying, warming, and oxygen therapy, were categorized as the first type of resuscitation. Moreover, positive pressure ventilation, chest compressions, and medication prescription were the second, third, and fourth types of resuscitation, respectively. Neonatal outcomes in this study included the admission of newborns to the rooming-in, their transfer to NICU, their death before birth, and their death in the delivery room. Frequency percentage and Excel software were used to describe the data.

Results

In the course of the study, 4683 births occurred through 2222 (47.44%) normal vaginal delivery and 2461 (52.66%) cesarean section. Table 1 shows the frequency percentage of both types of deliveries in different months of the study. Cesarean section delivery had a higher frequency in spring, autumn, and winter seasons, while in all three months of summer (4, 5, 6) less than 50% of deliveries were normal vaginal delivery. Gestational age less than 32 weeks was recorded in 303 births, whereas 561 infants were born with the gestational age of 32-36 weeks. According to Table 1, approximately 82% of births occurred at gestational age higher than 36 weeks. No case of gestational age>42 weeks was observed in this study.

Table 1. Frequency percentages of cesarean section, natural delivery, and gestational age of neonates

Months	Type of delivery		Gestational age		
	FPNVD	FPCS	FP of <32 weeks	FP of 32-36 weeks	FP of >36 weeks
1	45.77	54.22	7.51	9.62	82.86
2	44.23	55.77	5.05	12.74	82.21
3	44.31	55.69	4.84	7.75	87.41
4	54.87	45.13	7.09	13.69	79.22
5	50.24	49.76	6.31	10.28	83.41
6	51.85	48.15	5.81	9.93	84.26
7	49.32	50.68	7.16	10.61	82.23
8	47.71	52.29	9.44	11.99	78.57
9	48.13	51.87	5.99	11.72	82.29
10	43.57	56.43	6.36	12.47	81.17
11	45.33	54.67	5.55	12.17	82.27
12	43.89	56.11	4.53	17.86	77.6
Average	47.435	52.565	6.304	11.736	81.959

FP = Frequency Percentage, NVD= normal vaginal delivery, CS= Cesarean Section

Table 2. Frequency percentage of the birth weight of neonates

Months	FP of Birth Weight				
	code 1	code 2	code 3	code 4	Code 5
1	4.05	4.28	13.51	76.80	1.35
2	4.16	1.85	15	75.98	3
3	3.04	2.80	10.98	78.97	4.205
4	4.89	2.44	16.62	73.59	2.44
5	3.5	1.87	13.55	77.57	3.5
6	2.66	2.42	12.83	78.69	3.39
7	3.71	2.92	13.26	75.59	4.51
8	3.32	5.36	11.22	72.19	7.91
9	3.125	2.60	12.5	78.125	3.645
10	4.07	2.54	12.97	78.37	2.03
11	2.38	3.97	14.55	75.13	3.97
12	2.13	3.2	14.13	77.06	3.46
Average	3.42	3	13.43	76.5	3.62

Birth weight (Code 1: <1000 g, Code 2: 1000-1499 g, Code 3: 1500-2499 g, Code 4: 2500-4000 g, Code 5: >4000 g)
FP = Frequency Percentage

Table 3. Number and frequency percentage of various resuscitation activities and frequency percentage of neonatal outcomes

Months	Resuscitation								FP of Neonatal Outcomes			
	N				FP							
	code 1	code 2	code 3	code 4	code 1	code 2	code 3	code 4	code 1	code 2	code 3	code 4
1	58	11	3	1	79.45	15.07	4.11	1.37	83.11	12.61	3.38	0.90
2	64	17	4	2	73.56	19.54	4.59	2.298	84.72	13.19	1.16	0.925
3	70	25	1	2	71.43	25.51	1.02	2.04	82.71	13.32	2.80	1.17
4	47	21	6	1	62.66	28	8	1.33	80.93	14.91	3.18	0.98
5	32	12	3	3	64	24	6	6	83.84	11.94	3.51	0.70
6	62	16	1	2	76.54	19.75	1.23	2.47	82.52	14.56	2.43	0.485
7	73	17	3	1	77.66	18.08	3.19	1.064	81.167	12.99	4.51	1.326
8	80	11	3	2	83.33	11.46	3.12	2.08	77.948	18.46	3.589	0
9	54	9	4	3	77.14	12.86	5.71	4.285	82.198	14.13	2.356	1.31
10	46	17	1	1	70.77	26.15	1.54	1.54	82.44	13.23	3.816	0.51
11	49	15	2	3	71.01	21.74	2.89	4.38	81.55	15.24	2.41	0.8
12	52	18	2	1	71.23	24.66	2.74	1.37	76	21.86	1.6	0.53
Average	57.25	15.75	2.75	1.83	73.23	20.57	3.68	2.51	81.595	14.7	2.89	0.80

N: number, FP: frequency percentage

The 167 of neonates had the very low birth weight of less than 1000 g. Out of 4683 births, 146 infants belonged to the category of 1000-1499 g of birth weight, and 652 of births were recorded with the weight range of 1500-2499 g. Table 2 provides the average percent of different birth weight categories, indicating that more than 76% of infants had a normal birth weight.

According to the findings, resuscitation was needed for 931 of neonates. This meant that 19.88% of the newborns were resuscitated through a different set of interventions. Table 3 shows the details of the resuscitation operation and neonatal outcomes in different months. The number of neonates who needed oxygen therapy and warm-keeping was 687 (73.79%), while 189 (20.30%) infants experienced positive pressure ventilation. Chest compression was required for 33 (3.54%) neonates, and in 22 cases (2.36%) medication was administered. In the month 12 of study, 708 infants were transferred to NICU after birth. The number of infants who were born dead and died shortly after birth were 140 and 39 (4.91% of total resuscitated newborns), respectively.

Resuscitation (Code 1: initial steps of resuscitation, oxygen therapy and warm keeping, Code 2: positive pressure ventilation, Code 3: chest compressions, Code 4: prescribing medication) and Neonatal Outcomes (Code 1: keeping the baby in the rooming-in, Code 2: transfer to NICU, Code 3: dead birth, Code 4: death in the delivery room)

Discussion

As we know, this study was the first attempt to investigate the Resuscitation and neonatal outcomes of the neonates in Mashhad; however, the data collection was limited to one hospital.

The findings of this study showed that the initial steps of resuscitation, including oxygen therapy, and warm keeping, were performed in 73.79% of infants. In a study conducted by Afjeh et al., it was revealed that out of the 4629 live births, 4522 newborns (97.7% of live births) recovered through early steps of resuscitation (10). In a study performed by Wyckoff et al. (11), it was indicated that 37949 infants out of 37972 neonates did not receive any resuscitation, including positive-pressure ventilation, chest compressions, and medications. Hornik et al. (12) showed that 2231 (0.25%) out of 887,910 hospitalized infants needed cardiopulmonary resuscitation.

After the initial steps of resuscitation, the positive pressure ventilation was the most frequent resuscitative activity and performed on 20.30% of neonates who needed resuscitation. Among 87464 infants born in IWK Health Centre in Nova Scotia, Canada, positive pressure ventilation was conducted for 3658 (4.2%) of neonates at birth (13). In a retrospective study conducted by Bensouda et al. (14) in Montreal, Canada, it was revealed that out of 131 neonates born in Maisonneuve Rosemont Hospital, 113 received positive pressure ventilation in the delivery room. According to Niles et al. (15), there were 6812 live deliveries in the US tertiary academic hospital within 18 months and 401 (6%) of these newborns received positive pressure ventilation.

According to the 2010 International Liaison Committee on Resuscitation guidelines, the initial steps of cardio –respiratory resuscitation are delayed cord clamping, keeping a neutral temperature, applying pulse oximetry and if needed non-invasive ventilation. Poor respiratory drive, muscular weakness, delay in the maturation of both the Na^+/K^+ ATP are dependent pumps and surfactant metabolism are known as important factors for positive pressure ventilation and oxygen supplementation in neonates (10). Preterm infants after birth cannot normally achieve normal body temperature (10) since newborn babies are vulnerable to room temperature. The environmental heat that feels comfortably warm for adults is not suitable for them (11). The association between hypothermia and mortality during hospital stay has been known for more than a century (9), especially in preterm and/or very low birth weight infants (11). Hypothermia at birth has been also associated with serious morbidities, such as intraventricular hemorrhage, need for respiratory support, hypoglycemia, and late-onset sepsis (9).

In the current study, 0.7% and 0.47% of infants required chest compressions and drug intervention, respectively (no of births: 4683, no of chest compressions: 33, and no of drug intervention: 15). According to a systematic review conducted by European resuscitation council, the application of chest compressions and/or use of adrenaline was observed just in 0.1% of babies born at term condition (9). In a 2-year study of Perlman and Risser (16), it was shown that out of 30,839 newborns, 0.12% of infants needed chest compression or drug administration. According to a study conducted by Aziz et al. for 2 years (17), 0.1% of the neonates needed chest compression and 0.08% of them needed the administration of epinephrine (no of newborns: 4565). Wall et al. (18) reported the need for chest compression and drug intervention in 0.1% and 0.05% of neonates, respectively. A study carried out by Trevisanuto et al. (19) showed that 0.25% and 0.18% of neonates were resuscitated using chest compression and drug administration, respectively, along with other therapeutic measures.

As was shown in the current study, the rate of cesarean was higher than normal vaginal delivery (52.66% versus 47.44%, respectively). On the basis of the literature, cesarean delivery can increase the issues related to respiratory transition at birth, through which medical interventions are required, especially for deliveries before the gestational age of 39 weeks (20, 21).

In the present study, 179 deaths occurred out of 4683 births. This mortality rate (3.8%) included both dead birth and death in the delivery room. In a study performed by Alexander et al. (22), the NMR values of

American infants were 3.24%, 3.45%, and 8.16% for whites, Hispanics, and blacks, respectively. The rate of dead births was indicative of the poor quality of cares during pregnancy and neonatal deaths during the first hours of infant life. This indicated the low quality of care services before, during, and after delivery (23).

According to the results of this study, 18% of births occurred at gestational age lower than 36 weeks. In a study carried out by Sareshtedari et al. (3), gestational age <36 weeks was seen in 70% of infants transferred to the NICU. In the present study, it was shown that 6.42% of births were related to the low (3%) and very low (3.42%) birth weight infants. In the United States, approximately 7-8% of births were related to the low and very low birth weight infants (24). Furthermore, the obtained results of the current study indicated that 19.85% of births occurred at weights lower than 2500 g. In a study conducted by Nayeri et al. (2), 82.7% of neonatal deaths were related to infants with birth weight of 2500 g and less. The United States reported a decrease in infant mortality rates to 89% between 1915 and 1998 (25). Despite neonatal survival strategies has progressed since 1980, no remarkable improvement was observed in reducing the low birth weight and preterm delivery during this period (26).

Conclusion

This study was conducted to evaluate Imam Reza Hospital of Mashhad as a tertiary care center in Iran in terms of resuscitation and neonatal outcomes. The obtained results of the current study were indicative of that higher rate for cesarean surgery compared to normal vaginal delivery. The mortality rate, the number of low birth weight, and the rate of resuscitation actions were higher compared to the reported results of the studies conducted in developed countries. Accordingly, it is needed to study this issue at the national level with respect to CPR consequences in Iran.

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Conflicts of interest

The authors declare no conflicts of interest.

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