Research Article

The Prevalence of Neonate Resuscitation and Some Related Factors in an Academic Center in the North of Iran

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Abstract

Background: The phenomena of transformation from the intrauterine environment to independent breathing proceeds successfully in 90% of newborns. However, timely resuscitation is crucial for the 10% remaining.

Objectives: We investigated the neonate resuscitation (NR) status, predisposing factors, and outcomes.

Methods: This retrospective descriptive research was conducted at Al-Zahra hospital (Guilan-Iran) between April 2018 to March 2019. During the study period, all files of born neonates were reviewed, and relevant maternal and neonate information was extracted and analyzed.

Results: A total of 4,850 files were reviewed, and the data from 2,131 complete ones were analyzed. Among them, 14.1% needed resuscitation, 10.2% basic interventions, while 3.9% required advanced interventions. Neonate resuscitation outcome was significantly associated with gestational age (in less than 32 gestation weeks, 84.9% of neonates needed resuscitation) (P < 0.001), meconium staining of amniotic fluid (in 38.3% of cases whose amniotic fluid was stained with meconium, resuscitation was required) (P < 0.001), mode of delivery (in cesarean delivery, 18.7% of infants were resuscitated) (P < 0.001), birth weight (49.3% of infants weighing less than 2,500 grams needed resuscitation) (P < 0.001), multiple pregnancies (in multiple pregnancies, 66.1% resuscitation was needed (P < 0.001), Apgar score at minute 1 and 5 (in infants with an Apgar score below 7 in minute 1, 57.7% and in infants with an Apgar score below 7 in minute 5, 90.8% of neonates needed resuscitation) (P < 0.001).

Conclusions: Screening pregnant women for early detection of high-risk cases and attendance of a skilled NR team at the time of delivery results in better outcomes.

Keywords: Newborn, Resuscitation, Related Factors

1. Background

Most of the newborns successfully pass the intrauterine to extrauterine environment (1). However, approximately one out of ten births need some form of assistance. Overall, in 90% of deliveries, there is no need for resuscitation; nevertheless, some interventions are required to begin breathing in 10% of live births, and advanced resuscitation is necessary for 1% of live births (2, 3) neonate resuscitation (NR) involves all efforts performed to improve neonate outcome (4) and is divided into basic and advanced steps (5). The majority of newborns start breathing spontaneously within 30 seconds, and most of the remaining respond well to smooth stimulation, warmth, and drying. Altogether, positive pressure ventilation (PPV) and chest compression (CC) are required for 3% and 0.1%, respectively, with or without epinephrine. In the NR process, firstly, stimulation, drying the baby and cleaning the secretions of mouth and nose, and if not responding, PPV with a proper face mask would be considered. If it was unsuccessful, endotracheal intubation, CC, and epinephrine would be performed (6, 7). In order to find better outcomes and an improved survival rate, timely intervention is necessary. To achieve the goal and immediately resuscitation, the first step would be accurate detection of the high-risk cases and then the availability of a skilled NR team with the necessary equipment (8, 9). The literature in Iran is limited; in addition, the findings of the researches from other areas could not be generalized to the other centers.

2. Objectives

The real status of NR is unknown in our hospital as an academic and referral center with more than 5,500 births annually. This study aimed to investigate the prevalence of NR, its related factors, and outcomes.

3. Methods

This retrospective descriptive research was conducted at Al-Zahra, an academic hospital in the north of Iran, affiliated to Guilan University of Medical Sciences (GUMS). This obstetrics and gynecology hospital, with about 5,500 deliveries annually, is a referral center for high-risk pregnancies. All the files of born neonates delivered both normal vaginal delivery (NVD), and caesarean section (CS) were reviewed from April 2018 to March 2019. Inclusion criteria were all the files of neonates born in Al-Zahra Hospital during the study period. Exclusion criteria were files with incomplete information of mother or baby.

A questionnaire containing the required information, maternal age, gravida, number of abortions, gestational age, risk factors during pregnancy, risk factors during delivery, mode of delivery, gender, birth weight, Apgar score at 1 and 5 minutes, frequency of NR, and the outcomes, was filled out by a responsible medical student who was completely educated theoretical and practical regarding NR steps.

3.1. Sample Size

The required sample size was determined as 478 with a confidence level of 95%, based on the Safinejad et al. study in which 11.4% of neonates needed some form of resuscitation ([10]).

3.2. Statistical Analysis

Finally, the data were analyzed by SPSS version 21, and the association between the mentioned factors and the need for NR and outcomes were investigated. The mean and standard deviation were used for analyzing quantitative variables, and numbers and percentages were used for qualitative variables. The normal distribution of quantitative variables was measured using the Shapiro-Wilk test. The relationship between each of the variables and NR was analyzed using the Chi-square test and Fisher's Exact test. Then, variables that had a P-value of less than 0.2 in the single variable logistic regression were selected and were analyzed by multiple logistic regression analysis. The statistical significance level was considered P < 0.05.

4. Results

In this study, 4,850 files were reviewed, and finally, the data from 2,131 ones with complete information regarding both mother and neonate were analyzed. We found that 14.1% of our newborns required resuscitation, with 10.2% basic steps (suction, bag-mask ventilation) and 3.9% advanced interventions, including chest compression (CC), endotracheal tube (ETT), and adrenaline. Moreover, NR outcome was significantly associated with gestational age (in less than 32nd gestation week, 84.9% of neonates needed resuscitation) (P < 0.001), meconium staining of amniotic fluid (in 38.3% of cases whose amniotic fluid was stained with meconium, resuscitation was required) (P < 0.001), mode of delivery (in cesarean delivery, 18.7% of infants were resuscitated) (P < 0.001), birth weight (49.3% of infants weighing less than 2,500 grams needed resuscitation) (P < 0.001), multiple pregnancies (in multiple pregnancies, 66.1% resuscitation was needed (P < 0.001), Apgar score at minute 1 and 5 (in infants with an Apgar score below 7 in minute 1, 57.7% and in infants with an Apgar score below 7 in minute 5, 90.8% of neonates needed resuscitation) (P < 0.001).

Maternal demographic data are presented, and gravida and abortion, mode of delivery, and gestational age in Table 1. Newborns' data are presented in Table 2. Also, 47.1% of newborns were female, and 52.9% were male. Further, 18.1% had low birth weight, and 40.4% of the deliveries were associated with no risk factor, while the remaining had at least one predisposing factor. Among 302 resuscitated neonates, 21 (7%) died, and 218 (72.2%), 51 (16.9%), and 12 (4%) were transferred to premature ward, neonate intensive care unit, and returned to their mother after rescue, respectively. Diabetes mellitus was the most common mother comorbidity 299 (23.6%), followed by hypertension 217 (17.1%), thyroid disease 203 (16%), anemia 161 (12.7%), 301 (23.77%), 203 (16%) infertility 42 (3.3%), addiction 12 (1%), any type of infection 21 (1.65%). Moreover, 1,266 of all births had maternal risk factors. The correlation between NR and factors is shown in Table 3, which indicates that birth weight, Apgar score minute 1 and 5, gestational age, neonate gender, mode of delivery, maternal risk factors during pregnancy and delivery were significantly associated with the need for NR (P < 0.001). In addition, 693 cases had the proposed risk factors during delivery. The most common factor found to be fetal was distress 198 (28.6%), followed by meconium staining of amniotic fluid 175 (25.2%), breech presentation 121 (17.5%), multiple pregnancies 77 (1.1%). Premature rupture of membranes 51 (7.4%), placenta abruption 30 (4.3%), emergence CS 25 (3.6%), prolonged labor 16 (2.3%). Additionally, the collected data were analyzed by multiple logistic regression test

and variables, including gestational age, gender, mode of delivery, Apgar score at 1 and 5 minutes, maternal risk factors during delivery were significantly associated with a higher risk of the need for neonate resuscitation (P < 0.001) (Table 4).

Table 1. Maternal Demographic Data and Clinical Characteristics [a]

Variables	Values
Maternal age	
Less than 20 years	85 (4)
20 - 35 years	1576 (74)
More than 35 years	470 (22)
Maternal age (Mean ± SD)	30.58 ± 6.02
Gravida	
First pregnancy	777 (36.5)
Second pregnancy	819 (38.4)
Third pregnancy and more	535 (25.1)
Gravida (Mean ± SD)	2 ± 1.01
Number of abortions	
No abortion	1678 (78.7)
One abortion	324 (15.2)
Two abortions and more	129 (6.1)
Number of abortions (Mean ± SD)	0.28 ± 0.6
Gestational age	
Less than 32 weeks	128 (6)
32 - 36 weeks	364 (17.1)
More than 36 weeks	1639 (76.9)
Gestational age (Mean ± SD)	37.2 ± 2.78
Mode of delivery	
Normal vaginal delivery	1358 (63.7)
Cesarean section	773 (36.3)

[a] Values are expressed as No. (%) unless otherwise indicated.

5. Discussion

In the current study, we investigated the NR status in an academic referral center. Based on the current literature, it is estimated that approximately 3 - 8% of newborns require initial efforts, and 0.1 - 0.3% receive advanced interventions (8). In this research, we found that 14.1% of our newborns required resuscitation, with 10.2% basic steps (suction, bag-mask ventilation) and 3.9% advanced interventions including CC, ETT, and adrenaline. The number of CS deliveries was markedly higher than NVD, and due to the risk of general anesthesia-related to neurotoxicity in

Table 2. Neonates' Demographic Data and Clinical Characteristics [a]

Variables	Values
Gender	
Girl	1004 (47.1)
Boy	1127 (52.9)
Birth weight	
Less than 2500 grams	386 (18.1)
More than 2500 grams	1745 (81.9)
Birth weight grams (Mean ± SD)	2979.8 ± 666.3
Apgar score at 1 min	
Less than 7	520 (24.4)
8 - 10	1611 (75.6)
Apgar score at 1 minute (Mean ± SD)	7.85 ± 2.84
Apgar score at 5 minute	
Less than 7	119 (5.6)
8 - 10	2012 (94.4)
Apgar score at 5 minute (Mean ± SD)	8.92 ± 1.23

[a] Values are expressed as No. (%) unless otherwise indicated.

the developing brain, which has been recently focused on (11-13) and other advantageous, the majority of our CS deliveries were performed under spinal anesthesia. According to the recent evidence-based literature, 99% of newborns deaths occur in low and middle-income countries (3), and the most common critical outcomes for NR were death, blindness, cerebral palsy, deafness, and neurodevelopmental defects (14). Here, we acclaim that because it was a retrospective study, we could not evaluate the NR outcomes. Searching the literature in Iran reveals limited and not inconstant results. The need for NR was 11.4% in the Safaeenjad study, 9.9% and 1.5% for basic and advanced resuscitation, respectively. They reported that maternal comorbidities had a positive association, while the maternal level of education had a negative association with the need for NR (10). Afjeh et al. conducted similar research in an academic hospital in Tehran. They reported an NR rate of 2.3%, with only 1.15% need for advanced intervention. Low birth weight, preterm labor, meconium staining of amniotic fluid, multiple pregnancies, and fetal distress had a significant correlation with the need for NR (15). Wyckoff et al. from Texas reported that only 0.47% of their newborns required resuscitation, and 0.08% of them needed advanced steps (16). In Trevisanuto et al. work from Italy, less than 2% of their newborns needed advanced resuscitation (17). In Molkenboer et al., breach presentation significantly correlated with the need for NR (18). It is notable that during the last decades, the most significant progress

Table 3. The Relationship Between Neonate Resuscitation and Risk Factors During Delivery

Variables	Dead, No. (%)	Live, No. (%)	Total, No. (%)	P-Value
Prolonged labor				> 0.999
Yes	0 (0)	8 (100)	8 (100)	
No	21 (7.1)	273 (92.9)	294 (100)	
Placental abruption				0.382
Yes	0 (0)	22 (100)	22 (100)	
No	21 (7.5)	259 (92.5)	280 (100)	
Premature rupture of the membrane				0.053
Yes	0 (0)	45 (100)	45 (100)	
No	21 (8.2)	236 (91.8)	257 (100)	
Multiple pregnancies				0.003
Yes	9 (18)	41 (82)	50 (100)	
No	12 (4.8)	240 (95.2)	252 (100)	
Emergency CS				0.379
Yes	0 (0)	19 (100)	19 (100)	
No	21 (7.4)	262 (92.6)	283 (100)	
Breech presentation				0.090
Yes	1 (1.7)	58 (98.3)	59 (100)	
No	20 (8.2)	223 (91.8)	243 (100)	
Meconium staining of amniotic fluid				0.006
Yes	0 (0)	67 (100)	67 (100)	
No	21 (8.9)	214 (91.1)	235 (100)	
Fetal distress				0.006
Yes	0 (0)	76 (100)	76 (100)	
No	21 (9.3)	205 (90.7)	226 (100)	

regarding NR outcomes has been reported from Europe and the USA [19]. Bjorland et al. from Norway showed the need for NR in 6.2% of their newborns, of whom 0.5% required advanced interventions [20]. Comparison of our results with others' emphasizes the need for improving the present state. Moreover, in this report from a tertiary-level center with a high turnover, NR might be underestimated. It seems that in some cases, the high-risk pregnancies are missed, and the delivery room is not well prepared to face an unplanned NR. Our hospital has a NICU ward, a general labor unit, and an operating room for emergency and elective CS. In our hospital, a pediatrician is always available for NR. In the delivery room, obstetric residents and midwives, and nurses firstly are faced with the newborn; indeed, the first most important minutes before the pediatrician arrives. Therefore, they also should be well qualified and trained. Furthermore, tighter screening strategies should be performed to identify high-risk cases. However, to decrease the occurrence of some avoidable condi-

tions, such as preterm labor and low birth weight, preventive strategies are crucial through proper prenatal care and providing adequate information for mothers. Finally, the efficacy of NR workshops should be evaluated as Niknafas et al. study from Iran concluded that the skill of NR depends on active practice and cooperation in the NR process, and just participation in educational courses is not sufficient [21].

The reported incidence of NR, which varies among studies from different areas, presents valuable findings regarding the quality of NR team, prenatal care, fetal monitoring to timely intervention such as emergence CS, medical team, including obstetrics, anesthesiologist, and pediatrician experience and communication. Thus it is a multifactorial issue, and discrepancy among studies is expectable. The differences consist of hospital policies and characteristics, referral or not, private or governmental, academic or not, maternal level of education and knowledge. The experience and qualifications of the medical

Table 4. Factors Associated with Neonate Resuscitation Based on a Logistic Regression Model

Variables	Simple Logistic Regression		Multiple Logistic Regression	
	Adjusted Odds Ratio (AOR) (Confidence Interval 95%)	P-Value	Crude Odds Ratio (Confidence Interval 95%)	P-Value
Maternal age	1.005 (0.985, 1.025)	0.643		
Gravida	0.856 (0.753, 0.973)	0.017		
Number of abortions	1.037 (0.852, 1.262)	0.717		
Gestational age (w)	0.627 (0.593, 0.663)	< 0.001	0.696 (0.632, 0.767)	< 0.001
Gender		0.032		0.010
Girl	(Reference) 1		(Reference) 1	
Boy	1.310 (1.024, 1.677)		1.894 (1.162, 3.087)	
Mode of delivery		< 0.001		0.017
Normal vaginal delivery	(Reference) 1		(Reference) 1	
Cesarean section	3.475 (2.517, 4.797)		3.567 (1.251, 10.168)	
Birth weight	0.998 (0.998, 0.998)	< 0.001		
Apgar score at 1 minute	0.087 (0.066, 0.115)	< 0.001	0.176 (0.128, 0.243)	< 0.001
Apgar score at 5 minute	0.074 (0.056, 0.099)	< 0.001	0.378 (0.289, 0.496)	< 0.001
Maternal risk factors during pregnancy		< 0.001		
No	(Reference) 1			
Yes	2.495 (1.935, 3.218)			
Maternal risk factors during delivery		< 0.001		
No	(Reference) 1		(Reference) 1	< 0.001
Yes	17.252 (12.797, 23.259)		17.969 (9.081, 35.556)	

team are not the same among different centers. Obviously, a referral, teaching educational center with a high turnover admitting high-risk pregnancies from all areas of province by educational way that the majority of procedures are performed by residents and medical students, could not be compared with a private and local hospital. As expected, studies demonstrate that the need for NR is significantly higher in low-resource settings compared to high-resource with comprehensive maternal and prenatal care and accurate fetal monitoring ([20]). The rate of CS, extreme preterm newborns (< 28 weeks), general anesthesia, and low birth weight newborns are some influencing factors.

5.1. Limitation

Although valuable information was achieved by this research, we acclaim some limitations due to the nature of a retrospective study. Firstly, long-term follow-up was impossible to detect the late outcomes. In addition, we had no data about arterial umbilical blood gases. Obviously, Apgar score only presents newborns' conditions after birth and NR interventions. However, umbilical cord blood gas is a valuable predictor for neonates' outcomes and real fetal distress. The exclusion of the incomplete files was the other limitation.

5.2. Conclusion

According to the predisposing factors for NR, a great attempt should be made to early identification of high-risk cases and being adequately prepared. Obviously, preventive strategies such as prenatal care, close monitoring, and providing enough information during pregnancy are crucial to achieving better outcomes. Furthermore, well-planned prospective studies are welcomed to provide the possibility of identifying long-term outcomes.

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Footnotes

Authors' Contribution: Study concept and design: GB and FF. Analysis and interpretation of data: YCH. Drafting of the manuscript: MA. Critical revision of the manuscript for important intellectual content: MMGH and ZR. Statistical analysis: ER. Collecting the data: PH

Conflict of Interests: The authors report no conflicts of interest

Ethical Approval: After the permission of the local ethics committee of GUMS, this descriptive study was conducted at Al-Zahra teaching hospital. It was registered as IR.GUMS.REC.1398.254.

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