THE FIRST 24 HOURS OF LIFE MORTALITY AT FOUR TEACHING HOSPITALS IN SOUTH OF TEHRAN: PREVALENCE AND RISK FACTORS

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Abstract- Despite reduction in infant mortality rate, neonatal mortality rate particularly during the first 24 hours of life is still high in developing countries. A cross-sectional study was performed to determine neonatal mortality prevalence during the first 24 hours of life (F24NM) and its probable risk factors. Data collection were performed by a structured form containing maternal and neonatal characters. Newborns' mothers underwent an interview about their age, gravidity, parity, history of chronic illnesses, history of reproduction (including stillbirth, abortion and infertility) and conditions during recent pregnancy (including vaginal bleeding, multiple pregnancy, gestational illnesses and duration of premature rupture of membranes [PROM]). Neonatal characters contained sex, gestational age (GA), birth weight (BW), first minute Apgar score (FMAPG), visible congenital malformation, meconium stained amniotic fluid, nonperipheral cyanosis, hydrops fetalis, type of first respiration and neonatal death during first 24 hours of life which were obtained from medical records. A total of 1220 live-born neonates were studied during autumn 1999 at four teaching general hospitals in south of Tehran. The prevalence of F24NM was 22/1000. There were 48.42% males and 51.58% females. Of twenty seven first 24 hours neonatal deaths 23 cases (85.19%) were delivered prematurely or were low birth weight (LBW). Eighty nine percent of cases had abnormal FMAPG or cried for the first time only after resuscitation. Prolonged premature rupture of membranes and positive history of stillbirth (SB) was found in 29.63% and 18.52% of the mothers, respectively. FMAPG less than 4 (odds ratio [OR] 46.87, 95% confidence interval [CI] 3.97-55.85), history of SB (OR 12.48, CI 3.45-45.12), visible congenital malformation(s) (OR 12.44, CI 2.06-75.00), PROM longer than 24 hours (OR 9.77, CI 3.64-26.19), birth weight less than 1500g(OR 8.45, CI 1.22-58.38), vaginal bleeding during recent pregnancy (OR 6.61, CI 1.93-22.60) and nonperipheral cyanosis(OR 6.55, CI 1.76-24.30) were significant risk factors for the F24NM by multiple logistic regression. According to this study, it seems offering adequate prenatal care particularly in high risk pregnancies and on time management of high risk labors or deliveries might reduce the number of neonatal deaths during the first 24 hours of life.

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Key words: Neonate, infant mortality rate, birth weight, risk factor, prematurity, prevalence, first 24 hours of life

INTRODUCTION

Neonatal mortality (NM) defines newborns' death during the first four weeks of life after birth. It accounts for more than 60% of infant mortality rate (IMR) (1,2). More than half of the total number of NM occur in the first six days of life after birth (early neonatal mortality) mostly in the first 24 hours (3-10). Neonatal deaths are generally attributable to low birth weight (LBW), prematurity and congenital anomalies (2,11-14). Although, neonatal mortality rate (NMR) in developed countries is low, it is still high in a large number of developing countries. Because of the important role of first 24 hours neonatal mortality (F24NM) to NM, determining of F24NM prevalence and it's risk factors would be one of the very first stages in increasing survival of newborn infants and in reducing NMR and ultimately reducing IMR in

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developing countries. Moreover improvement in practice of family planning programs in developing societies necessitates keeping alive every live-born infant in order to reduce the emotional and economical burden on their families and communities. NMR is 16/1000 in Iran, but there is no statistics about F24NM. This study was performed at 4 teaching hospitals in south of Tehran in autumn 1999 to determine the prevalence and risk factors of F24NM in these hospitals.

MATERIALS AND METHODS

All live born neonates who were delivered in 4 teaching hospitals in south of Tehran during autumn 1999 were included in this cross-sectional study. Almost all of the newborns were remained at the hospitals for the first 24 hours of life and all of them were examined by a pediatrician. There were no exclusion criteria, so all of live born neonates were included without regard to gestational age or birth weight. Data collection were performed by a structured form which contained two parts. In order to complete first part, mothers underwent an interview about their characters including age, gravidity, parity, history of chronic illness(es), history of reproduction (including stillbirth, abortion and infertility) and conditions during recent pregnancy (including vaginal bleeding, multiple gestation, gestational illnesses, and duration of PROM). The second part was about neonates' characters including sex, gestational age (GA),birth weight (BW),first minute Apgar score (FMAPG), visible congenital malformation(s), meconium stained amniotic fluid (MSAF), nonperipheral cyanosis, hydrops fetalis (HF) and type of the first respiration. These parts of data were obtained from medical records. Whenever a newborn infant was referred to another center or exited the hospital during the first 24 hours of life, data about F24NM were collected by phone contact. Data analysis were performed by SPSS FOR WINDOWS (ver 10) program. Chi square test and Fisher exact test were used for univariate analysis and multiple logistic regression (MLR) was used for statistical comparisons.

RESULTS

A total of 1220 live born neonates were included in this study. Distribution of maternal and neonatal characters by F24NM are summarized in table 1 and table 2, respectively.

Table 1. Distribution of maternal characters and the first 24 hours of life neonatal mortality by maternal characters in the study population*

Maternal characters	All cases	Neonatal mortality	*P* value
Age			0.76†
< 20	64(5.25)	5(11.11)	
≥ 20	1156(94.75)	22(88.89)	
Gravidity			0.001‡
1	520(42.62)	8(26.63)	
2-3	527(43.20)	14(51.58)	
≥ 4	173(14.18)	5(18.51)	
Parity			0.3†
Primipar	569(46.64)	10(37.04)	
Multipar	651(53.36)	17(62.96)	
History of abortion			0.26‡
+	177(14.51)	6(22.22)	
-	1043(85.49)	21(77.78)	
PROM			0.001‡
0-6	933(76.48)	17(62.96)	
7-24	230(18.85)	2(7.4)	
>24	57(4.67)	8(29.63)	
Vaginal bleeding			0.001†
+	36(2.95)	4(14.81)	
-	1184(97.05)	23(85.19)	
History of stillbirth			0.001†
+	26(2.13)	5(18.52)	
-	1194(97.87)	22(81.48)	
Chronic illnesses			0.25†
+	167(13.50)	6(22.22)	
-	1053(86.50)	21(77.78)	
Gestational illnesses			0.56†
+	149(12.15)	4(14.81)	
-	1071(87.85)	23(85.19)	
History of infertility			1†
+	63(5.20)	1(3.70)	
-	1157(94.80)	26(96.30)	
Multiple gestation			1†
+	60(4.92)	1(3.70)	
-	1160(95.08)	26(96.30)	

*Data are given as number (percentage).
† Fisher exact test
‡ Chi square test

The most common chronic illness(es) among neonates' mothers were thyroid diseases (including hypothyroidism [2.7%], simple goiter [l.9%] and hyperthyroidism [0.81%]), heart diseases (1.9%), HB_sAg carrier (0.81%), hypertension (0.65%) and epilepsy (0.57%). During recent pregnancy, 48 gestational hypertension (3.9%), 38 preeclampsia (3.1%), 18 UTI (1.47%) and 9 gestational diabetes (0.7%) emerged as the most frequent illnesses among mothers. Of 24 neonates (l.96%) who had visible congenital malformations, CNS malformations (20%) and musculoskeletal malformations (20%) were observed more commonly and 11 cases (45.8%) had multiple anomalies. The prevalence of extremely low birth weight (ELBW) (< l000 g), very low birth weight (VLBW) (1000-1499 g), moderately low birth weight (MLBW) (1500-2499 g) and normal BW

(≥ 2500 g) neonates were 1.31%, 3.28%, 12.04% and 84.67%, respectively.

There were 27 deaths (14 females and 13 males) during the first 24 hours of life. F24NM among ELBW, VLBW, MLBW and normal BW neonates were 37.5%, 23.3%, 5.45% and 0.39%, respectively. Overall F24NM among low birth weight neonates (<2500 g) was 30 folds higher than normal BW neonates. Moreover 11% of preterm infants died during the first 24 hours of life and this figure was 27 folds higher than F24NM among term neonates (0.4%). Of 27 neonatal deaths, 7 cases (23.95%) had congenital malformations including anencephaly (l case), diaphragmatic hernia (l case), hypoplastic thorax (l case), meningoencephalocele and omphalocele (l case) and multiple anomalies especially craniofacial malformations (3 cases).

In univariate analysis F24NM was significantly related to the following maternal or neonatal characters: gravidity, vaginal bleeding, history of SB, duration of PROM, BW, GA, FMAPG, nonperipheral cyanosis, visible congenital anomalies, HF and type of the first respiration (Table 1 and 2).

Table 2. Distribution of neonatal characters and the first 24 hours of life neonatal mortality by neonatal characters in the study population*

Neonatal characters	All cases	Neonatal mortality	*P* value
Sex			0.82†
Male	613(50.29)	13(48.15)	
Female	607(49.71)	14(51.85)	
Birth weight			0.001‡
<2500	192(17.35)	23(85.19)	
≥2500	1001(82.65)	4(14.81)	
Gestational age			0.001‡
<37	210(17.33)	23(85.19)	
≥37	1010(82.67)	4(14.81)	
First minute apgar score			0.001‡
≤7	119(9.75)	24(88.89)	
8-10	1101(90.25)	3(11.11)	
Meconium stain of amnion fluid			0.39‡
+	61(5)	2(7.41)	
-	1159(95)	25(92.59)	
Non peripheral cyanosis			0.001‡
+	75(6.15)	19(70.37)	
-	1145(93.85)	8(29.63)	
Congenital malformation			0.001‡
+	24(1.97)	7(25.93)	
-	1196(98.03)	20(74.07)	
Hydrops fetalis			0.001‡
+	4(0.33)	3(11.11)	
-	1216(99.67)	24(88.89)	
Type of first respiration			0.001‡
Spontaneously or with stimulation	1146(93.93)	3(11.11)	
With resusitation	74(6.07)	24(88.89)	

*Data are given as number (percentage).
† Chi square text
‡ Fisher exact text

The results of MLR analysis about relation between F24NM and maternal or neonatal characters are summarized in table 3 and table 4, respectively. GA, type of the first respiration and HF showed statistical significance with F24NM in univariate analysis but when we used adjusted OR (Table 3 and 4), they were not significant anymore. It means that these characters are not independent factors for F24NM. As expected among maternal characters, history of SB, history of prolonged PROM and vaginal bleeding during recent pregnancy had relative strong effect on F24NM, while gravidity, maternal age, parity, chronic illnesses or gestational illnesses were not highly associated with neonatal deaths (Table 2).

Furthermore newborns with FMAPG <4, visible congenital anomalies, nonperipheral cyanosis or BW< 1500g had higher prevalence of neonatal deaths. The effects of FMAPG 5-7, BW 1500-2499 g, sex and prematurity were less marked on F24NM (Table 2).

Table 3. Estimates of adjusted odds ratios of maternal risk factors on the first 24 hours of life neonatal mortality

Risk factor	Sig	Odds ratio	95% CI
Age			
<20	0.96	1.03	0.32-3.28
20-35	---	Ref	---
>35	0.66	1.39	0.32-6.10
Gravidity			
1	---	Ref	---
2-3	0.39	1.85	0.46-7.45
≥ 4	0.93	0.89	0.06-12.96
Parity			
Primipar	0.65	1.55	0.23-10.23
Multipar	---	Ref	---
History of abortion			
+	0.95	0.96	0.26-3.57
-	---	Ref	---
PROM			
0-6	---	Ref	---
7-24	0.34	0.47	0.10-2.27
>24	0.001	9.77	3.64-26.16
Vaginal bleeding			
+	0.003	6.61	1.93-22.60
-	---	Ref	---
History of stillbirth			
+	0.001	12.48	3.45-45.12
-	---	Ref	---
Chronic illnesses			
+	0.16	2.05	0.76-5.55
-	---	Ref	---
Gestational illnesses			
+	0.91	1.07	0.34-3.37
-	---	Ref	---
History of infertility			
+	0.24	0.25	0.02-2.50
-	---	Ref	---
Multiple gestation			
+	0.66	0.62	0.07-5.42
-	---	Ref	---

Abbreviation: CI, Confidence Interval;Sig, Significance

Table 4. Estimates of adjusted odds ratio of neonatal risk factors on the first 24 hours of life neonatal mortality

Risk factor	Sig	Odds ratio	95% CI
Birth weight			
<1500	0.03	8.45	1.22-58.38
1500-2499	0.09	4.52	0.77-26.45
≥ 2500	---	Ref	---
First minute apgar score			
≤ 4			
5-7	0.002	46.87	3.97-55.85
≥ 8	0.37	2.90	0.28-30.16
	---	Ref	---
Sex			
Male	---	Ref	---
Female	0.4	1.67	0.51-5.30
Gestational age			
<37	0.47	1.85	0.34-9.96
≥ 37	---	Ref	---
Meconium stain of amnion fluid			
+	0.92	0.89	0.11-7.33
-	---	Ref	---
Non peripheral cyanosis			
+	0.005	6.55	1.76-24.30
-	---	Ref	---
Congenital malformation			
+	0.005	12.44	2.06-75.00
-	---	Ref	---
Hydrops fetalis			
+	0.96	0.89	0.01-59.64
-	---	Ref	---
Type of first respiration			
Spontaneously	---	Ref	---
With stimulation	0.83	0.76	0.06-8.90
With resusitation	0.88	0.81	0.05-12.47

Abbreviation: CI, Confidence Interval; Sig , Significance

DISCUSSION

F24NM prevalence was 22 per 1000 live births in our neonates. This figure is very close to the figure of F24NM in a study which was performed in Tehran at Shariati hospital during 1993-1995 (18.8/1000) (15). Both of these figures are even more than NMR in Iran. It is probably because many referral and complicated pregnancies are admitted in these teaching hospitals. Our F24NM rate is much more than F24NM rate in developed countries (Table 5).

Table 5. The first 24 hours of life neonatal mortality rate (F24NM rate) in developed countries

Country	F24NM rate
France	1.3/1000
Sweden	1.3/1000
Japan	1.4/1000
Netherlands	2/1000
UK	2.6/1000
Canada	3/1000
US	3.98/1000

The only data about F24NM among developing countries is from Vietnam (12.2/1000) (16). Other studies have showed that the developed countries with the lowest IMR have tended to have the lower mortality rate in the first 24 hours of life (17,18).

Moreover deaths occur earlier among the smallest infants. Therefore developed countries with the lowest IMR and lowest incidence of registered VLBW infants have the fewer numbers of deaths during the first 24 hours of life (l7, 18). Several other causes may explain the difference between our results and other studies. First of all two hospitals in our study do not have any neonatalogist or NICU. Secondly, prenatal diagnosis and termination of pregnancies are performed rarely in our hospitals like other hospitals in Iran. Therefore the numbers of live births with life-threatening conditions (major congenital anomalies, chromosomal defects, hydrops fetalis, and severe prematurity) would be high. Thirdly, racial or ethnic characteristics of our newborns might differ from newborns in other countries which necessitate designing more extensive studies. In present study 4.59% of all live births were VLBW newborns and more than 60% of deaths have occurred in them.

In two studies in India (19) and Brazil (20) LBW significantly increased the risk of F24NM of newborns and this finding is in agreement with our results, but contrary to Indian study there was no significant relationship between sex, prematurity or multiple pregnancy and F24NM in our babies. The relative small sample size and low numbers of premature newborns or multiple pregnancies might cause this bias. Despite we could obtain significant relationship between F24NM and several maternal or neonatal factors including history of SB, prolonged PROM, vaginal bleeding during recent pregnancy, FMAPG< 4, visible congenital anomalies, BW< 1500g and nonperipheral cyanosis, no other study has investigated these risk factors. Very low rate of F24NM in developed countries justify low numbers of reports. Overall there are a few recommendations to reduce the F24NM based on our study: Increasing BW of newborns probably by offering better prenatal care services ,on time skilful management of high risk pregnancies (e.g. positive history of stillbirth, prolonged PROM or vaginal bleeding) in pregnant mothers and suitable handling of life-threatening conditions in newborns (e.g. FMAPG <4, visible congenital malformations or nonperipheral cyanosis) by employment of neonatalogists and using NICU technologies and expert personnel. At last we recommend larger cross-sectional studies on F24NM both for Tehran and the country as a whole.

REFERENCES

1. Behrman R, Kliegman R, Jenson H. Nelson Textbook of Pediatrics. Philadelphia: W B Saunders Company; 2000: 451-452.

2. Carmichael SL, Iyasu S, Hatfield-Timajchy K. Cause-specific trends in neonatal mortality among black and white infants, United States, 1980-1995. Matern Child Health J 1998; 2(2): 67-76.

3. Alberman E, Botting B, Blatchley N. A new hierarchical classification of causes of infant deaths in England and Wales. Arch Dis Child 1994; 70(5): 403-409.

4. Tariq P, Kundi Z. Determinants of neonatal mortality. J Pak Med Assoc 1999; 49(3): 56-60.

5. Vukicevic S. Neonatal mortality in the Prokuplje General hospital (1979-1988). Srp Arh Celok Lek 1990; 118(11-12): 467-470.

6. Leach A, McArdle TF, Banya WA, Krubally O, Greenwood AM, Rands C, Adegbola R, de Francisco A, Greenwood BM. Neonatal mortality in a rural area of The Gambia. Ann Trop Paediatr 1999; 19(l): 33-43.

7. Garcia-Marcus L, Guillen Perez JJ, Martinez Torres A, Martin Caballero M, Barbero Mari P, Borrajo Guadarrama E. Mortality rates in childhood and their causes in Spain. 1991. An Esp Pediatr 1998; 48(1): 39-43.

8. Fikree FF, Gray RH. Demographic survey of the level and determinants of perinatal mortality in Karachi, Pakistan. Paediatr Perinat Epidemiol 1996; 10(l): 86-96.

9. Fonseka P, Wijewardene K, Harendra de Silva DG, Goonaratna C, Wijeyasiri WA. Neonatal and Post-neonatal mortality in the Galle district. Ceylon Med J 1994; 39(2): 82-85.

10. Mosquera Tenreiro C, Gonzalez-Rico M. The quality of the registry of perinatal deaths. Asturias 1986-90. Gac Sanit 1994; 8(42):112-116.

11. Kaushik SL, Parmar VR, Grover N, Kaushik R. Neonatal mortality rate: relationship to birth weight and gestational age. Indian J Pediatr 1998; 65(3): 429-433.

12. Michel J. Preterm Singleton Births- United States, 1989-1996. MMWR Morb Mortal Wkly Rep 1999; 48(9): 185-189.

13. Dupuis O, Thoulon JM, Mellier G. Value of cervical echography in the prediction of premature delivery:literature review. Contracept Fertil Sex 1999; 27(2): 147-154.

14. Phukan RK, Mahanta J. A study of neonatal deaths in the tea gardens of Dibrugarh district of upper Assam. J Indian Med Assoc 1998; 96(11): 333-337.

15. Mirsharifi F, Mosavat F. A study of Neonatal Mortality Rate at neonatal ward of Shariaty hospital in Tehran (1993-1995). Thesis, Tehran University of Medical Sciences, Tehran.

16. Hoan PT, Bao TV, Phong DN, Huong NT, Lazare M, Boelaert M. Early neonatal mortality at the gynaecological-obstetrical hospital of Hanoi, Vietnam. Bull Soc Pathol Exot 2000; 93(l): 62-65.

17. Sepkowitz S. International rankings of infant mortality and the United States' vital statistics natality data collecting system-failure and success. Int J Epidemiol 1995; 24(3): 583-588.

18. Philip AG. Neonatal mortality Rate: is further improvement possible? J Pediatr 1995; 126(3): 427-433.

19. Ravikumara M, Bhat BV. Early neonatal mortality in an intramural birth cohort at a tertiary care hospital. Indian J Pediatr 1996; 63(6): 785-789.

20. Menezes AM, Barros FC, Victora CG, Tomasi E, Halpern R, Oliviera AL. Risk factors for perinatal mortality in Pelotas, a southern city of Brazil, 1993. Rev Saude Publica 1998; 32(3): 209-216.