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Prevalence and Etiology of Perinatal Period Mortality Rates in Hospitals, Iran

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Abstract: Perinatal mortality has been used as a comparative measure of health care across regions. The aim of this study was to determine the prevalence and etiologic factors of mortality during perinatal period at hospitals, Iran. This study has been surveyed with a cross-sectional, descriptive and analytical method done using census from 2013-2014. Population study was all of fetus and neonatal that has died during 22 completed weeks of gestation and ends 28 completed days after birth. Data analysis was conducted using Chi-square test (χ^2) and fisher exact test at significant level of $\alpha = 0.05$. Perinatal mortality has been estimated 17.4 per 1000. Mothers' age diagnosed with perinatal mortality ranged from 15-45 years old. Pregnancy week ranged from 22-41 with average value of 29.64±0.48 and standard deviation of 5.94. In addition, the weight at birth time ranged from 250-5500 g with a mean of 1447.810±84.73 and standard deviation of 1048.02. Perinatal mortality had a significant difference with not only gender of fetus ($p = 0.121$) but had significant difference with the congenital abnormalities ($p<0.001$) and maternal underlying diseases ($p<0.001$) to pregnancy disease. Mortality of perinatal can be prevented largely via screening/monitoring the high risk women and referring them to appropriate care centers. Moreover other factors witch include counselling, before, during and after pregnancy, rapid detection and appropriate time for delivery of high-risk pregnancies, creating intensive care unit, providing expert medical team and coordination between them are needed.

Key words: Perinatal death, etiology, prevalence, pregnancy, Iran

INTRODUCTION

Perinatal Mortality rate is a sensitive indicator of obstetric quality and neonatal care (Rudge *et al*., 2011). It is a key population heath indicator and commands widespread public attention since it reflect economic development, social equity and health care services within a population (Deb *et al*., 2015). Perinatal mortality has long been used as a comparative measure of health and health care across regions, countries and continents (Rankin *et al*., 2005).

According to world health organization perinatal period is defined as the internal between either 22 or 28 weeks of pregnancy to 7 days after birth (Kliegman *et al*., 2007). There is also a definition else standing for 20 weeks of fetal period to 7 days after birth (Kliegman *et al*., 2007). Perinatal related deaths are deaths of babies from 20 weeks gestation (or if gestation is unkown a birth weight from 400 g) to 28 completed days of life (Farquhar *et al*., 2015).

Another definition enumerates the perinatal period from 28 weeks of pregnancy until the seventh day after birth and the other definition stands for 20 weeks from fetal period until 7 days after birth (Kliegman *et al*., 2007).

Perinatal mortiality refers to death around the time of delivery and includes both fetal deaths (at least 20 weeks of gestation) and early in fant (neonatal) deaths (Gregory and MacDorman, 2015). Another definition enumerates the perinatal period from 28 weeks of pregnancy until the 28 day after birth (Martin *et al*., 2014).

The extended perinatal mortality rates (EPMR; still births and neonatal deaths, deaths within the first 28 days of life) have been advocated as a better reflection of perinatal events (Rankin *et al*., 2005). According to the World Health Organization (WHO), 98% of perinatal deaths arise in developing countries. Every year, approximately 6 million perinatal deaths occur worldwide which 98% of these instances are in developing countries (Matendo *et al*., 2011a). These estimates are based on

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surveys in both urban and rural areas and they may under represent the problem in rural areas (Matendo *et al*., 2011). Intrauterine fetal deaths include about half of perinatal mortality (Jahani *et al*., 2015). Perinatal mortality rates have recently declined, however are the highest in developing countries, particularly in Africa (Weiner *et al*., 2003).

Prevention of perinatal mortality is much more difficult than preventing infant mortality (Jokhio *et al*., 2005). Infant's mortality in the United States of America, approximately, two third of death rates observed in children under 1 years old are related to neonatal period. Annually, about 8 million perinatal mortalities occur throughout the world while most often is detected in developing countries (Kliegman *et al*., 2007). In PERU at 2011-2012, national NMR of 12.8 deaths per 1000 Live births was estimated (Avila *et al*., 2015).

The relative perinatal mortality is higher in post-term delivery compared with delivery at term and has been associated with an increased frequency of neonatal morbidity. However, some studies have demonstrated an increased risk of perinatal complication with deliveries as early as 40 weeks (Garate *et al*., 2011). Gender is an important factor that influences the outcome of perinatal mortality. Difference in infant mortality (within 1 year) is mostly pronounced at extremely early birth (23-24 gestational weeks); being 60% for boys compared with 38% for girls (2% of gender is umbiguous) (Ingemarsson, 2003), low risk women have no increased risk of perinatal mortality compared with women with one or more favourable factors. The >98% of the estimated 3.7 million neonatal deaths and 3.2 million stillbirths per year occur in developing countries. In developing countries, the major causes of neonatal mortality are birth asphyxia, infection and low-birth-weight/prematurity (Matendo *et al*., 2011b). India accounts for more of these neonatal deaths and 2.6 million annual still births than any other country in india (Belgaum), the highest proportion of neonatal deaths was attributed to birth asphyxia (31.8-38.7%). Followed by low birth weight/prematurity and other causes (Goudar *et al*., 2015).

It has been estimated that perinatal mortality accounts for about 7% of total global burden of disease. From 133 million births around the world in 2004, 5.9 million were estimated to have died during perinatal period and the vast majority of these deaths occurred in developing countries such as about 97000 perinatal deaths in Indonesia (Burke *et al*., 2011). Low Birth Weight (LBW) presents an increased risk of developing perinatal asphyxia (Coutinho *et al*., 2011). It is believed that low birth weight is the main individual factor determining the newborn's likelihood of survival, healthy growth and development. As a consequence, prematurity and LBW are the predictive factors most strongly associated with mortality with a direct relation between the birth weight and perinatal mortality (Cruz *et al*., 2012). Therefore, the aim of this study is to prevalence and etiology of perinatal period mortality rates in Iran, Babol hospitals.

MATERIALS AND METHODS

This study was designed in an applied manner and has been surveyed with cross-sectional, descriptive and analytical method by using census obtained during a year from 20th March 2013 until 19th March 2014. Data collection tools were 2 series of questionnaires from national system of perinatal mortality care in department of infant health, the Ministry of Health and Medical Education. One of the questionnaire was related to neonatal mortality and the another one was pertained to contraceptive product death in operating room or emergency unit. The main cause of mortality was based on ICD-10 (International Statistical Classification of Diseases and Related Health Problems, Tenth Revision). All of hospitals were selected including 5 hospitals. Population study was all of fetus and neonatal who have been died during 22 completed weeks (154 days) of gestation and end 28 completed days after birth. Data analysis was conducted using a statistical software package of SPSS using Chi-square test (χ^2) and fisher exact test at significant level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

Results indicated that 8822 delivery have occurred during the study period from which 6531 cases were cesarean section (74.03%) and 2291 cases were normal vaginal delivery (25.97%). There were 153 cases of perinatal mortality and perinatal mortality ratio index was estimated 17.4 per 1000. From a total of 153 cases perinatal mortality, 87cases were male (57.2%) and 65 cases as female (42.8%) and one case as an ambiguous (1.7%).

The 103 cases (of a total number) have been stillbirth (67.3%) and 50 cases of mortality occurred after birth in which gender showed no significant difference with perinatal mortality ($p = 0.121$). From 8822 delivery, 6 cases have been ambiguous from which one case showed perinatal mortality. Hence, perinatal mortality had significant difference with ambiguous gender ($p = 0.012$). 56.6% of mortalities dedicated to urban areas while 43.4% were observed in rural. Table 1 presents specifications of mothers' age (year), gestational age (week) and weight of product (g).

Table 1: Frequency of mother's age, gestational age and weight of perinatal mortality at hospitals (2013-2014)

Frequency	Weight of product (g)	Frequency (%)	Gestational age (week)	Frequency (%)	Mother age (year)
71 (46.5)	W<1000	75 (49)	22≤G.A≤28	5 (3.3)	Age<18
25 (16.3)	1000≤W≤1499	27 (17.6)	28<G.A≤32	130 (85)	18≤Age≤35
23 (15)	1500≤W≤2499	27 (17.6)	32<G.A≤36	18 (11.7)	Age≥35
32 (20.9)	2500≤W≤4000	24 (15.8)	36<G.A≤42		
3 (1.3)	W>4000				

Table 2: Frequency of congenital malformations, deformations and chromosomal abnormalities in perinatal mortality at hospitals 2013-2014

Row	Congenital malformations, deformations and chromosomal abnormalities	Category	Frequency	Percentage
1	Congenital malformations of nervous system	Q00-Q07	8	16.34
2	Congenital malformations of circulatory system	Q20-Q28	11	22.46
3	Congenital malformations of the respiratory system	Q30-Q34	2	4.08
4	Other congenital malformations of digestive system	Q38-Q45	7	14.28
5	Congenital malformations and deformations of musculoskeletal system	Q65-Q79	5	10.20
6	Cleft lip and cleft palate	Q35-Q37	4	8.16
7	Congenital malformations of urinary system	Q60-Q64	3	6.12
8	Congenital malformation of eye, ear, face and neck	Q10-Q18	3	6.12
9	Other congenital malformations	Q80-Q89	3	6.12
10	Chromosomal abnormalities, not elsewhere classified	Q90-Q99	3	6.12
	Total	Q00-Q99	49	100.00

Table 3: Frequency of maternal underlying disease affecting fetus and newborn (in perinatal mortality) at hospitals during 2013-2014

Row	Maternal underlying disease	Category	Frequency	Percentage
1	Fetus and newborn affected by maternal hypertensive disorders	P00.0	7	22.58
2	Fetus and newborn affected by other maternal circulatory and respiratory diseases	P00.3	1	3.23
3	Fetus and newborn affected by maternal renal and urinary tract diseases	P00.1	1	3.23
4	Fetus and newborn affected by other maternal circulatory and respiratory diseases	P00.3	2	6.45
5	Maternal diabetes mellitus (pre-existing) affecting fetus or newborn	P70.1	11	35.48
6	Fetus and newborn affected by maternal use of addiction drugs	P04.4	2	6.45
7	Others	P00.8	7	22.58
	Total	P00,P70	31	100.00

According to Table 1, the most of perinatal mortality rates have been observed in mothers with the range of 18-35 years old and 49% of mortality has occurred between 22-28 weeks of gestation. The highest rate of perinatal mortality was 46.5% with product weight under 1000 g. Most mothers (90.7%) involved in this study had no history of perinatal whereas 9.3% had a history of perinatal. The 46.4% cases of perinatal mortality have been for the first child and 63.6% cases were for the second or more children (second or more gestation) that at 15% of these cases, the interval between pregnancies was upper 60 months, at 8.5% it ranged from 36-60 months, at 17% from 12-36 months and at 5.9% from 6-12 months. The 75.8% of perinatal were single, 17.7% were twins and 6.5% were triplet. Perinatal mortality had significant difference with the number of twins ($p<0.001$). The range of mother's age with perinatal mortality was from 15-45 years old with a mean of 27.39±6.09. The range of pregnancy weeks were from 22-41 with a mean of 29.64±5.94. The range of birth time weight was from 250-5500 g with a mean of 1447.81±1048.02.

In Table 2-5, mortality causes were separately surveyed according to ICD-10: congenital malformations, deformations and chromosomal abnormalities, maternal diseases, diseases with neonatal or caused neonatal mortality. According to the findings illustrated in Table 2, from 153 cases of perinatal mortality, 30 cases were diagnosed with congenital malformations, deformations and chromosomal abnormalities. Abnormalities of the circulatory system, digestive system, nervous system had the highest frequency, respectively. In some individuals, more than one form of abnormalities has been observed.

Total number of 49 abnormalities was observed in 30 individuals (fetus and newborn) that the contribution per person was 1.63 abnormalities. There was a significant difference between congenital abnormalities and perinatal mortality ($p<0.001$). The proportion of perinatal mortality risk to congenital malformations is about 30-fold. RR = 30.06 (CI 95%: 21.75-41.55).

Mortality causes associated with fetus or newborn with maternal underlying diseases based on ICD-10 are shown in Table 3.

Findings showed that from 153 cases of perinatal mortality, 28 cases have been diagnosed with one or more maternal underlying diseases. Diabetes and hypertension were mostly common, respectively. There is a significant difference between perinatal mortality and maternal underlying diseases ($p<0.001$) and the proportion of relative risk for perinatal mortality to maternal underlying disease is approximately 12-fold. RR = 11.68 (CI 95%: 7.99-17.07).

Table 4 shows conditions related to pregnancy leading to the death of fetus or newborn according to ICD-10. Based on these findings from 153 cases of

Table 4: Frequency of conditions related to pregnancy leading to death of fetus or newborn (in perinatal mortality) at hospitals during 2013-2014

Row	Conditions related to pregnancy	Category	Frequency	Percentage
1	Diabetes arising in pregnancy affecting fetus and newborn (syndrome of infant of mother with gestational diabetes)	P70.0	12	7.8
2	Fetus and newborn affected by maternal hypertensive (gestational hypertension)		4	2.6
3	Pre-eclampsia affecting fetus and newborn	P00.0	7	4.6
4	Pregnancy Eclampsia affecting fetus or newborn	P00.0	1	0.7
5	Small for gestational age (slow fetal growth and fetal malnutrition)	P05.1 (P05)	6	3.9
6	Abruption placenta affecting fetus and newborn	P02.1	11	7.2
7	Fetus and newborn affected by premature rupture of membranes	P01.1	22	14.4
8	Fetus and newborn affected by other specified complication of labor and delivery (premature delivery)	P03.8	73	47.7
9	Fetus and newborn affected by maternal renal and urinary tract diseases	P00.1	2	1.3
10	Fetus and newborn affected by polyhydramnios	P01.3	2	1.3
11	Fetus and newborn affected by oligohydramnios	P01.2	7	4.6
12	Fetus and newborn affected by other maternal conditions	P00.8	6	3.9
	Total	Poo, P70	153	100.0

Table 5: Frequency of diseases associated with infants diagnosed with perinatal mortality at hospitals during 2013-2014

Row	Diseases associated with infant	Category	Frequency	Percentage
1	Perinatal asphyxia	P20.9	14	7.25
2	Respiratory distress syndrome of newborn	P22.0	52	26.94
3	Neonatal aspiration of meconium	P24.0	13	6.73
4	Interstitial emphysema and related conditions originating in perinatal period	P25`	7	3.63
5	Pulmonary hemorrhage originating in perinatal period	P26	8	4.14
6	Infections specific to perinatal period	P36	17	8.81
7	Intracranial nontraumatic hemorrhage of fetus and newborn	P52	17	8.81
8	Hydropsfetalis NOS	P83.2	5	2.59
	Hydropsfetalis due to hemolytic disease	P56		
9	Disseminated intravascular coagulation of fetus and newborn	P60	8	4.14
10	Fetal distress	P20	1	0.52
11	Newborn sclerema	P83.0	1	0.52
12	Convulsions	P90	1	0.52
13	Congenital renal failure	P96.0	3	1.55
14	Fetal death of unspecified cause	P95	15	7.77
15	Other disorders originating in perinatal period	P90-P96	30	15.50
	Total	P20-P96	193	100.00

perinatal mortality, 117 cases have been diagnosed with conditions related to maternal diseases but 36 cases showed no signs of such conditions. The highest frequencies were revealed in preterm labor, premature rupture of membrane and gestational diabetes, respectively. There is a significant difference between perinatal mortality and maternal diseases ($p<0.001$). The proportion of relative risk for perinatal mortality to the pregnancy-related disease is about 94-fold: RR = 93.94 (CI 95%: 65.86-133.99).

Table 5 shows frequency of diseases associated with infants diagnosed with perinatal mortality at hospitals. Based on the obtained results from 153 cases of perinatal mortality, 193 cases had diseases associated with infant. However, no diseases have been diagnosed in 21 cases. Respiratory distress syndrome (26.94%) had the most frequency and after that other disorders originating in perinatal period were more common. Sepsis and intracranial haemorrhage were in the last grade.

According to our study, the most perinatal mortality ranged from 22-28 weeks of pregnancy with the weight under 1000 g and in male and the mortality of perinatal has significant relationships with congenital malformations, deformations and chromosomal abnormalities, maternal underlying diseases, certain condition related to pregnancy and diseases caused neonatal mortality. In this study, perinatal mortality in males is more prevalent than females. This is in agreement with finding reported by previous researchers either in the country or abroad (Matendo *et al*., 2011). The most perinatal mortality is dedicated to stillbirth that was in consistent with other studies (Jokhio *et al*., 2005). In the present research, the index of perinatal mortality rate was 17.4 per 1000 births. This index showed in other countries 23.7 per 1000, 28 per 1000 in the women under 35 years old and 47 per 1000 in women over 35 years old (Bracci *et al*., 2006), 33.4 per 1000, 61 per 1000 and 118 per 1000. So, it is likely that the factors such as accessibility to the medical care health services and the educations of perinatal period can have effective roles in mortality reduction. It is not worthy that this index in England is 10.3 per 1000 (Moser, 2008). In developed countries, the index is measured 10 per 1000 in the Persian Gulf countries like Qatar: 10.3 per 1000 (Salameh *et al*., 2009) and a varied range of 40-120 births in the Africa Sub-Saharan between (Hinderaker *et al*., 2003). In this survey, 2 cases were observed as quad and 5 cases as triplet and 121 cases as twins and the number of twins had significant difference

with perinatal mortality. The same results were obtained in other studies (Rudge *et al*., 2011; Bhatia *et al*., 1984). In the current study, the proportion of perinatal mortality risk with congenital malformation, deformations and chromosomal abnormalities is approximately, 30-fold more and perinatal mortality had significant relationships with congenital malformation, deformations and chromosomal abnormalities. In this regard, in a previous study performed in Iran, extreme prematurity, respiratory distress and congenital malformations have been expressed as the most common cause of infant mortality. Researchers in other studies within the country like as the Northern region of England (Rankin *et al*., 2005; Kelly *et al*., 2009) and Germany (Reeske *et al*., 2011) have claimed that there was a significant relationship between death and congenital malformations. Among mothers underlying diseases, the highest prevalence was allocated in diabetes and hypertension. So, the relative risk index of perinatal mortality in mother's underlying disease was about 12-fold. Further, researches in this field have been performed inside and outside the country (Cruz *et al*., 2012; Troude *et al*., 2008). This suggests that diabetes and hypertension of mothers are the most common underlying diseases associated with perinatal mortality. Hence, it seems that proper care and nutrition during pregnancy can significantly reduce the risk of death. The death of fetus or newborn affected by conditions related to pregnancy, the preterm labor, premature rupture of membrane and gestational diabetes had the highest proportion, respectively. The relative risk of perinatal mortality was about 94-fold. However, in other studies, the premature infants were expressed as the most common causes of death among the infant's that were born alive (Surkan *et al*., 2004). In diseases associated with infants death, respiratory distress syndrome, unspecified disorders, sepsis, infectious and unspecified intracranial hemorrhage had the largest proportion. In the studies in this area, the most common causes of death include respiratory infection asphyxia and meconium aspiration (Mamyrbayeva *et al*., 2015; Gould, 2006). Based on the results, numerous factors like as maternal underlying diseases, maternal conditions of pregnancy, diseases associated with infants are effective in perinatal mortality.

CONCLUSION

So, perinatal mortality can largely be prevented via screening/monitoring the high risk women and referring them to appropriate care centers, education and via counseling before, during and after pregnancy, rapid detection and appropriate time for termination of high-risk pregnancies, creating intensive care unit for high risk mothers and infants, appropriate equipment of units, providing expert medical team, including the specialists: Gynecologist, Dietitian, Geneticist, Pediatrician, Anesthesiologist and coordination among them.

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