Journal of Hematology & Thromboembolic Diseases

Alburke et al., J Hematol Thrombo Dis 2015, 3:2
DOI: 10.4172/2329-8790.1000194

Research Article Open Access

Neonatal and Perinatal Mortality Rates in Neonatal Intensive Care Unit of Misurata Teaching Hospital – Libya/2013

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Rec date: Jan 27, 2015, **Acc date:** Mar 7, 2015, **Pub date:** Mar 14, 2015

Abstract

Background: Neonatal mortality remains a major contributor to death among children younger than 5 years in developing countries. It accounts for approximately 40% of all childhood mortality in resource-poor countries. Each year, 7 million neonates globally are stillborn or dying within 30 days of birth (neonatal period). Reducing Neonatal mortality requires that interventions be readily accessible and available in the immediate perinatal period. Such countries have weak health metrics and systems, resulting in a paucity of perinatal and neonatal mortality information and a deficiency in quality of available data.

Objective: This study was undertaken to determine the neonatal mortality rate (NMR) and perinatal mortality rate (PMR), causes of death, and associated risk factors among hospital live births admitted to the NICU of Misurata teaching hospital in Libya. Methods: A descriptive, retrospective study based on hospital files records. From January 2013 to December 2013, information was collected from the registration book at labour room including operating theatre and newborn admitted in the neonatal intensive care unit of Misurata teaching hospital in Libya. The information collected include, history, clinical examination, investigation, treatment and outcome.

Results: The total number of delivery in Misurata hospital in 2013 were 6199 births, include 64 stillbirth and 6135 were live births. 610 babies out of the total live birth were admitted to neonatal ICU after delivery. 67 babies (10.9%) died in the first week of life and 46% (39) of the first week deaths died in the first 24 hours. The main reasons of admission to neonatal unit were preterm delivery, sepsis, meconium delivery, birth asphyxia, and congenital malformation. Perinatal mortality rate was 21.1/1000 total births (51% death in the first week of life and 49% still birth). The main causes of early neonatal deaths were RDS 48%, congenital malformation 22%, neonatal sepsis 12%, CHD 12% and birth asphyxia 4%. While, the main causes of late neonatal deaths were neonatal sepsis 59%, congenital malformation 17%, birth asphyxia 12%, CHD 6% and Intravascular hemorrhage 6%. About 24 (29%) of death were full term and 60 (71%) were PT, 29% of these PT between 32-36 weeks gestation, 21% between 24-28 weeks and 14% between 28-32 weeks gestation. Regarding birth weights, 37% of death their weight <1.5 Kg, 13% more than 3 Kg, 21% between 1.5-2 Kg, 9% between 2-2.5 Kg and 20% were between 2.5-3 Kg.

Conclusion: Our PNMR is still high in comparison with developed countries. The vast majority of perinatal mortality is secondary to preterm delivery, Low birth weight, birth asphyxia, sepsis and congenital anomalies, which usually increased in presence of maternal risk factor. Recommendation: Prevention, early recognition and management of birth asphyxia, infection and LBW infants with development of indicators and simple management tools (Guidelines) for assessing and monitoring health system performance for perinatal and newborn care at national level.

Keywords: Perinatal mortality; Still birth; Neonate; Infant death

Abbreviations

ANC: Antenatal Care; CDC: Center of Disease Control; CS: Cesarean Section; CXR: Chest X Ray; CHD: Congenital Heart Disease; CRP: C Reactive Protein; ELBW: Extreme Low Birth Weight; LBW: Low Birth Weight; MDG: Millennium Developmental Goal; NICU: Neonatal Intensive Care Unit; NMR: Neonatal Mortality Rate; NVD: Normal Vaginal Delivery; N: Number; PMR : Perinatal Mortality Rate; PT: Preterm; RDS: Respiratory Distress Syndrome; WBC: White Blood Cells

Introduction

Neonatal mortality accounts for approximately 40% of all childhood mortality in resource-poor countries. The first 28 days of life are a vulnerable period when infants are highly susceptible to illness and death [1].

Almost all (99%) of the neonatal deaths occur in developing countries, with two thirds occurring in Africa and South East Asia because of poverty and poor access to health services. However, is that the causes of most neonatal deaths are largely preventable [2].

In many Western societies the death of a child is a rare event, mostly occurring in hospital, and usually in an intensive care setting [3].

Regarding the main causes of stillbirth and neonatal mortality and morbidity, the main direct causes for the deaths of infants under 1 month old are pregnancy-related complications (e.g., complications of prematurity, congenital anomalies), delivery-related complications (e.g., asphyxia, birth injury) and infectious diseases [4].

Each of these complications causes about one-third of neonatal deaths. The most important underlying cause of neonatal mortality and morbidity is low birth weight (LBW) [5]. Forty to 80% of neonatal deaths occur among LBW babies [4].

Among the major causes of neonatal death, attention has focused on birth asphyxia, and sepsis. Reducing deaths from these causes requires that interventions be readily accessible and, for asphyxia, available in the immediate perinatal period [1].

In the 2000 United Nations Millennium Summit the international community committed to reducing the child, newborn and maternal mortality as part of the Millennium Development Goals (MDGs). The fourth goal (MDG4) sets to reduce deaths of children under age 5 by 66% by 2015 [4].

Millennium Development Goal [4] has encouraged efforts to reduce child mortality. Substantial decreases in deaths in children younger than 5 years old have been due to reductions in postneonatal mortality. No similar progress has been made in the reduction of neonatal mortality. The most effective interventions for reducing neonatal mortality are well established and consensus has been reached for the scaling-up of the continuum of care [6].

Most of the neonatal deaths in developing countries are not recorded in formal vital registration systems; hence, data mostly reported in published literature and technical reports are estimates from national demographic surveys [2].

Neonatal outcome is important indicator of obstetrics and health care. It is estimated that effective implementation and high coverage of interventions could prevent up to 70% of neonatal deaths globally [7].

PNMR are used as indicator of quality of antenatal and perinatal care. Yet uncritical application of this indicator in international comparison can be misleading. The perinatal mortality rate depends on number of factors and important determinant that need to be assessed separately before reaching conclusions about quality of care issues [7].

In Libya, available data on neonatal mortality are scanty; so this retrospective study was, therefore, undertaken to assess the magnitude of the problem and identify associated factors and causes. The data generated may inform the formulation of appropriate preventive measures and policies to reduce NMR and consequently give support to decision makers.

Patient and Methods

A descriptive, retrospective study based on hospital files records. From January 2013 to December 2013, information was collected from admitted newborn in neonatal unit and the registration records at labour room including operating theatre. The information collected include, history, clinical examination, investigation, treatment and outcome.

Criteria of admission in neonate department of Misurata Central Hospital.

- Presence of respiratory distress signs whatever the birth weight or gestational age or audible respiratory sounds as congenital stridor.
- Birth weight equal or less than 2 KG.
- Temperature instability.
- Reluctant to feed or persistent vomiting
- Major congenital malformation.
- Symptomatic congenital heart diseases.
- Infant of diabetic mother.
- Pathological jaundice or positive family history of exchange transfusion.
- Clear evidence of chorioimmunitis (laboratory or clinically).
- Birth Asphyxia (a 5-minutes apgar score of 0-3, hypoxic ischemic encephalopathy (altered tone, depressed level of consciousness).

In our study the following definitions were adapted

Live birth is the complete expulsion or extraction from its mothers of a product of conception, irrespective of the duration of the pregnancy, which, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered liveborn.

Stillbirth is death prior to the complete expulsion or extraction from its mother of a product of conception, after 22-24 completed weeks of gestation; the death is indicated by the fact that after such separation the fetus does not breathe or show any other evidence of life, such as beating of the heart, pulsation of the umbilical cord or definite movement of voluntary muscles.

The perinatal period commences at 22 completed weeks of gestation and ends seven completed days after birth.

The neonatal period begins with birth and ends 28 complete days after birth. Neonatal deaths may be subdivided into early neonatal deaths, occurring during the first seven days of life (0-6 days).

The Preterm baby born before 37 weeks gestation.

The Low birth weight (LBW) baby born with weight less than 2.5 kg.

Statistical analysis: The collected data was analyzed using (SPSS) statistical software program (Version 18), and displayed in appropriate tables and graphs. Data was summarized and expressed as frequency and percentage. Significance of difference was tested by chi-square test and the results is considered significant when $P \leq 0.05$ (Figure 1).

Results

Gestational age(Weeks) *	Number of deaths	% from total death	Weight (Grams) **	Number of deaths	% from total death
22----24 weeks	6	7%	<1000 grams	17	20%
-------28 weeks	18	21%	------1500 grams	14	17%
------32 weeks	12	14%	-------2000 grams	18	21%

-------36 weeks	24	29%	-------2500 grams	7	9%
>37 weeks	24	29%	-------3000 grams	17	20%
Total	84	100%	>3000 grams	11	13%
			Total	84	100%

Table 1: Neonatal deaths according to their gestational age and birth weight.* Chi Square=10.6. p<0.01 (Significant), ** Chi Square=13.7 p<0.001 (Highly Significant).

	Maternal risk	No. of total admission	% from total admission	No. of deaths	% of deaths from same risk group	% from total death
1	Diabetes mellitus(DM)	81	9%	7	9%	8%
2	Gestational hypertension	65	7%	3	5%	4%
3	Chorioimmunitis	72	8%	2	3%	3%
4	Antipartum hemorrhage	64	7%	8	13%	10%
5	Poly hydramnios	32	4%	4	13%	5%
	Total	314/880	35%	24	43%	30%

Table 2: Neonatal deaths according to presence of maternal risk factors. Chi Square=2.9, p>0.05 (Non Significant).

	Sex	No. of total admission	Number of deaths	% from total death
1	Male	535	49	58%
2	Female	343	34	41%
3	Ambiguous genitalia	2	1	1%
	Total	880	84	100%

Table 3: Neonatal deaths according to sex. Chi Square=1. p=0.14 (Non Significant).

	Mode of delivery	No. of total admission	Number of deaths	% from total death
1	Normal vaginal delivery	483	44	52%
2	Cesarean section	397	40	48%
	Total	880	84	100%

Table 4: Neonatal deaths according to mode of delivery.

	Apgar score	Total admission	Number of deaths	% from total deaths
1	Less than 7	89	47	56%
2	More than 7	791	37	44%
	Total	880	84	100%

Table 5: Neonatal deaths according to apgar score in first minute of life, Chi Square=0.09 p=0.38 (Non Significant).

	Postnatal age	Number of deaths	% from total deaths
1	< 24 hours	39	46%
2	1 day-1 week	28	33%
3	>1 week	17	21%
	Total no.	84	100%

Table 6: Neonatal deaths according to postnatal age.

	Cause of admission	Number of deaths	% from total death
1	Respiratory distress syndrome	32	48%
2	Congenital anomalies	15	22%
3	Birth asphyxia	3	4%
4	Heart disease	8	12%
5	Neonatal sepsis	8	12%
6	Hydrops fetalis	1	2%
	Total	67	100%

Table 7: Main causes of death in early neonatal life ***. Chi Square=24.7, p<0.001 (Highly Significant).

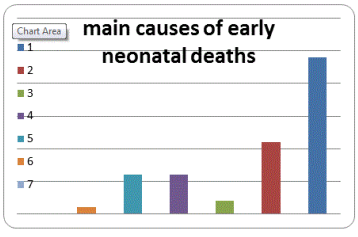

Figure 1: The confirmatory diagnosis by chest x ray in RDS, arterial blood gas in birth asphyxia, echocardiography in cardiac disorders, inflammatory indices (CRP, total WBC and differential, blood culture in neonatal sepsis in addition to high clinical suspicion in all patients.

	Cause of admission	Number of deaths	% from total death
1	Neonatal sepsis	10	59%
2	Congenital anomalies	3	17%
3	Birth asphyxia	2	12%
4	Heart disease	1	6%
5	Intravascular hemorrhage	1	6%
	Total	17	100%

Table 8: Main causes of death in late neonatal life. Chi Square=2.5, p=0.76 (Non Significant).

Calculated rates	N/Total	Rate (per thousand)
Still birth (Still birth/Total birth)	64/6199	10.3
Early neonatal mortality in NICU Neonatal deaths in 1st week of life/Total live birth	67/6135	10.9
Late neonatal mortality in NICU Neonatal deaths in 2nd, 3rd, 4th weeks of life/Total live birth	17/6135	2.8
Neonatal mortality in NICU Neonatal deaths in 1st month of life/Total live birth	84/6135	13.7
Perinatal mortality (Still birth+Neonatal deaths in 1st week of life/Total birth)	131/6616	21.1

Table 9: Perinatal mortality and Neonatal mortality rates among neonates admitted to NICU of misurata hospital.

Regarding birth weights, 37% of death their weight <1.5 Kg, 13% more than 3 Kg, 21% between 1.5-2 Kg, 9% between 2-2.5 Kg and 20% were between 2.5-3 Kg (Table 1).

The total number of delivery in Misurata hospital in 2013 were 6199 births, include 64 stillbirth and 6135 were live births. 67 babies died in the first week of life and 46% (39) of the first week deaths died in the first 24 hours.

The main reasons of admission to neonatal unit were preterm delivery, sepsis, meconium delivery, birth asphyxia, and congenital malformation.

24 (29%) of death were full term and 60 (71%) were PT, 29% of these PT between 32-36 weeks gestation, 21% between 24-28 weeks and 14% between 28-32 weeks gestation (Table 1).

Regarding the presence of maternal risk factors associated with neonatal death, there are higher neonatal deaths among neonates borne to mothers with antipartum hemorrhage and diabetic mothers (10% and 8%) respectively (Table 2).

Results of our study showed that 58% of neonatal deaths were males, 41% were females and 1% was with ambiguous genitalia (Tables 3 and 4). And regarding to delivery method, 52% of neonatal deaths were delivered by normal vaginal delivery, while, 48% were delivered by cesarean section (Table 5). 56% of neonatal deaths were with apgar score less than 7, while, 44% were with apgar score more than 7 (Table 6).

Perinatal mortality rate was 21.1/1000 total births (51% death in the first week of life and 49% still birth). The main causes of early neonatal deaths were RDS 48%, congenital malformation 22%, neonatal sepsis 12%, CHD 12% and birth asphyxia 4%. While, the main causes of late neonatal deaths were neonatal sepsis 59%, congenital malformation 17%, birth asphyxia 12%, CHD 6% and Intravascular hemorrhage 6% (Tables 7-9).

The ratio of nurse to newborn was 1:4.

Discussion

Neonatal mortality continues to be a significant public health burden. Over the last 2 decades, improvements in perinatal and neonatal care have led to great success in the survival of the smallest infants. Despite these advances, it is important that we continue to identify characteristics associated with perinatal and neonatal mortality as well as to develop a proper interventions [8].

This study was carried out as a retrospective record based study to determine the burden and factors associated with an increased risk for perinatal mortality and neonatal mortality among neonates admitted to NICU of Misurata teaching hospital in Libya 2013.

In our study, the estimated PMR and NMR is 21.1 and 13.7 per 1000 live births respectively. This is similar to the 20 per 1000 live births reported by (Xing LF, Sufang G, David H, Jun Z, Lingli Z, Song L, Qing Y, Yan G and Carine R). in their population-based epidemiological study of China's National Maternal and Child Mortality Surveillance System [6]; however, the rate is lower than the

37.6 reported by (Lawn JE, Cousens S, Zupan J. 4 Million neonatal deaths: when? Where? Why? Lancet 2005). in a 5-year study based in a rural community in Nigeria and is within the regional range for sub-Saharan Africa [9] the national estimate of 48 per 1000 live births for Nigeria [10] and estimates from other developing countries, such as Kenya [11], The Gambia, [12] Bangladesh [13] and India [14] (37.4, 65, 53.5 and 41 per 1000 live births respectively)

While the lowest rates occur in countries that have widespread access to modern obstetrics; Perinatal mortality rate (per 1000) for Denmark, Finland, France, Germany, Japan, Netherlands, United kingdom and United states are (8, 6, 7, 6, 7, 8, 8 and 7 per 1000) respectively [15].

The disparity in PMR and NMR across countries had always existed and had been attributed to lack of equity in the distribution of health care facilities [16] Not surprisingly, third world nations have the highest rates of perinatal mortality. The Ivory Coast has the dubious distinction of the highest perinatal mortality rate at 96/1000.

Contrary to the well-documented survival advantage of female babies over males, this study showed no significant sex difference in mortality. Studies from different countries, however, showed variations in sex difference in mortality [17,18] These discrepancies suggest that health-seeking behavior may differ according to local cultural factors and highlight the importance of designing interventions based on the understanding of local customs and attitudes toward the newborn.

More than half (66%) of the neonatal deaths in this study occurred among LBW infants <2.5 kg with a higher risk of death among preterm <37 week gestational (about 71%) compared with term babies, which corresponds to the findings from studies in Nigeria [17,18] and sub-Saharan Africa [19,20]. Although numerically small, ELBW infants represent nearly 50% of all perinatal mortality. 8 Globally, each year, an estimated 13 million infants are born before 37 completed weeks of gestation. Complications from these preterm births are the leading direct cause and major risk factor for neonatal mortality [21].

Improving survival of LBW infants and preterm may be readily achieved even at the community level by low technology essential newborn care interventions aimed at providing warmth, adequate nutrition, and prevention of infection. These strategies have been shown to successfully reduce newborn deaths in other developing countries with weak health care systems and low health care service utilization [22,23].

Also in our study, there is higher neonatal deaths among neonates borne to mothers with antipartum hemorrhage, diabetic mothers and Poly hydramnios (10%, 8% and 5%) respectively, while this increased rate is not statistically significant. These factors predispose the newborn to significant risk of neonatal deaths globally [9]. Lack of ANC may be an important factor associated with neonatal death as poor supervision of pregnancy and failure to prevent, detect, and treat maternal illnesses increase the risk to the baby. It is, therefore, crucial to identify and address the factors militating against proper utilization of the few available health facilities to significantly reduce neonatal mortality.

The need for an improvement in the obstetric care of mothers and neonatal resuscitation skills in this environment is very important as Respiratory distress syndrome and Neonatal sepsis continues to be a leading cause of death in early neonatal life (48% and 12%) respectively.

In our study, about 22% of neonatal deaths occur in infants with congenital anomalies, our finding is consistent with Druschel C, Hughes JP, Olsen C [8,24] who reviled that infants born with severe congenital anomalies were at highest risk for neonatal death [20]. According to the Center of Disease Control (CDC) report from 1986, In all developed countries, congenital anomalies and prematurity are the leading causes for neonatal mortality (20.5% and 17.5%, respectively) [25].

Regarding to the mode of delivery, our study showed no statistical significant difference in the neonatal deaths among those delivered by normal vaginal delivery and those delivered by Cesarean section. However, prior population-based studies have found a significant association between vaginal delivery and neonatal mortality [26,27]. Redman and Gonik [20] reported significantly lower mortality rates in 22- and 23-week infants delivered by cesarean section, compared with vaginal delivery. The risk of neonatal mortality may not actually be due to mode of delivery but rather related to physicians' unwillingness to intervene aggressively on behalf of the fetus, such as classic cesarean section, antenatal steroids, neonatal resuscitation, and other therapeutic modalities, especially if they perceive the infant to be too young or too small to survive [26,28]

This study provides a reliable indication of where efforts and additional resources should be deployed for maximum impact on reducing NMR. These include good ANC coverage, prevention of perinatal asphyxia, and training on the care of preterm as well as LBW deliveries. Training in neonatal resuscitation skills and provision of basic resuscitation equipment, as well as implementation of roll policies to reduce preterm and LBW deliveries are all feasible within the existing framework of even primary health care delivery.

Further studies are also suggested to identify the factors responsible for increased the risk of neonatal death.

Conclusion

In conclusion, neonatal mortality remains high in this environment because of the lack of ANC, intrapartum complications, asphyxia, prematurity, LBW, neonatal sepsis and congenital anomalies. Targetting these causes of perinatal mortality is very important issues to reduce the perinatal mortality rate. Appropriate perinatal and neonatal care requires an integrated and holistic program of intervention at various levels. Interventions must not only include health-related measures that have a direct bearing on perinatal and/or neonatal outcomes but several other ancillary measures of equal importance. These measures include poverty alleviation; improved opportunities for female education. Introduction of community/ home-based care for pregnant mothers and newborns within the existing health care setup as well as immediate scaling up and the uptake of the integrated maternal newborn and child health care strategy is needed. The results of this study emphasize the importance of health systems research and also may facilitate dialogue with policy makers about the importance of investing in neonatal health.

Recommendations

1. Improving health systems' capacity for providing essential preventive and special curative neonatal health care.

2. Preventing and improving recognition and management of birth asphyxia.

3. Preventing and improving recognition and management of infections:

4. There is an urgent need to identify how the burden and severity of maternal infections relate to perinatal outcomes.

5. Preventing and improving care for LBW infants.

6. Improving information on the magnitude and causes of neonatal mortality.

7. Development of indicators and simple management tools (Guidelines) for assessing and monitoring health system performance for perinatal and newborn care at the national level.

8. Encourage policy makers (e.g hospital directors) commitment to newborn health at the regional, national, and local levels.

9. Tools for rapidly assessing the situation, prioritizing program activities, and accurately monitoring and documenting program effectiveness are urgently needed.

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