

Original article

Neonatal Mortality among Neonates Admitted to the Neonatal Intensive Care Unit at Benghazi Children Hospital, Libya: A Retrospective Hospital-Based Study

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Abstract

Neonatal mortality remains an important indicator of maternal, newborn and health system performance. This study aimed to determine the magnitude, causes and clinical characteristics of neonatal mortality among infants admitted to the Neonatal Intensive Care Unit (NICU) of Benghazi Children Hospital, Libya, during 2016. A retrospective hospital-based descriptive study was conducted using NICU admission records and death certificates for neonates admitted between 1 January and 31 December 2016. Sociodemographic and clinical characteristics, such as birth weight, age at death, admission diagnoses, and causes of death, were reviewed. Data were analysed using SPSS version 17 with descriptive statistics. Among 1,686 NICU admissions, 147 neonates died, yielding a NICU mortality proportion of 8.7%. Males accounted for 55.8% of deaths, and 91.8% of them were residents of Benghazi. The mean age at death was 8.72 ± 10.7 days, and 58.5% of deaths occurred during the first week of life. Low birth weight (<2,500 g) was recorded in 40.8% of deceased neonates. The most frequent admission diagnoses were respiratory disorders (25.8%), prematurity (21.1%), neonatal sepsis (18.4%), congenital heart disease (13.6%), and multiple congenital anomalies (12.9%). The leading recorded causes of death were respiratory disorders (25.9%), prematurity (21.1%), neonatal sepsis (18.4%), congenital heart disease (13.6%) and multiple congenital anomalies (12.9%). Neonatal mortality in this NICU was substantial, with most deaths occurring during the first week of life. Strengthening antenatal, perinatal, respiratory-support, infection-prevention, and neonatal intensive care services may contribute to improved survival.

Keywords. Neonatal Mortality, Neonatal Intensive Care Units, Premature Birth, Respiratory Distress Syndrome.

Introduction

Neonatal mortality is a major public health concern, particularly in low- and middle-income countries where timely access to high-quality maternal and newborn care remains uneven. The neonatal period comprises the first 28 days of life and is the most vulnerable period for child survival. Neonatal mortality is defined as death during the first 28 completed days of life per 1,000 live births in a given year. It is an important indicator of maternal and newborn health and of health-system performance [1]. Global neonatal mortality has declined substantially over recent decades, but progress has been slower than for deaths among older children. In 2024, an estimated 2.3 million children died during the neonatal period worldwide, representing approximately 47% of all deaths among children younger than five years. Prematurity, respiratory complications, infections, and congenital anomalies remain major contributors to neonatal mortality [2]. The burden of NICU mortality varies between settings according to referral patterns, severity of illness, birth weight, gestational age, and the availability of specialised neonatal services. Studies from different low- and middle-income settings have reported important contributions from prematurity, respiratory disorders, sepsis and low birth weight [3].

In Libya, hospital-based evidence on neonatal mortality remains limited. Local studies are particularly important because the pattern of neonatal deaths may reflect the organisation of referral services, the availability of respiratory support and infection-control measures, and the characteristics of the population served. The present study therefore aimed to determine the magnitude and causes of neonatal mortality among neonates admitted to the NICU at Benghazi Children Hospital during 2016, with particular attention to age at death, gender, residence, birth weight, admission diagnoses, and causes of death [4].

Methods

Study design and setting

A retrospective hospital-based descriptive study was conducted at the Neonatal Intensive Care Unit (NICU) of Benghazi Children Hospital, a major referral pediatric hospital in Benghazi, Libya. The study covered the period from 1 January to 31 December 2016.

Study Population and Data Sources

The study population comprised neonates admitted to the NICU within the first 28 days of life during the study period for whom sufficient information was available for the variables analysed. NICU admission records and death certificates held by the hospital statistical department were reviewed. A total of 1,686 neonatal admissions were identified, including 147 deaths.

Study variables

The primary outcome was death before discharge from the NICU. Variables extracted from records included age at death, sex, residence, birth weight, admission diagnosis and recorded cause of death. Birth weight <2,500 g was classified as low

birth weight and $\geq 2,500$ g as normal birth weight. Admission diagnoses included respiratory disorders, prematurity, neonatal sepsis, congenital heart disease, multiple congenital anomalies, convulsions, meningitis, hypoglycemia, diaphragmatic hernia and dehydration. Recorded causes of death included respiratory disorders, prematurity, neonatal sepsis, congenital heart disease, multiple congenital anomalies, intraventricular haemorrhage, meningitis, metabolic disorders, renal failure, and necrotising enterocolitis.

Statistical Analysis

Data were entered and analysed using Statistical Package for the Social Sciences (SPSS), version 17. Continuous variables were summarised using means and standard deviations, while categorical variables were presented as frequencies and percentages. No inferential or multivariable analysis was performed; therefore, the findings describe the distribution of characteristics and causes of death rather than independent risk factors.

Results

During 2016, 1,686 neonates were admitted to the NICU. Of these, 147 died, and 1,539 were discharged after improvement, corresponding to a NICU mortality proportion of 8.7%. Males accounted for 55.8% of deaths and females for 44.2%, giving a male-to-female ratio of approximately 1.3:1.

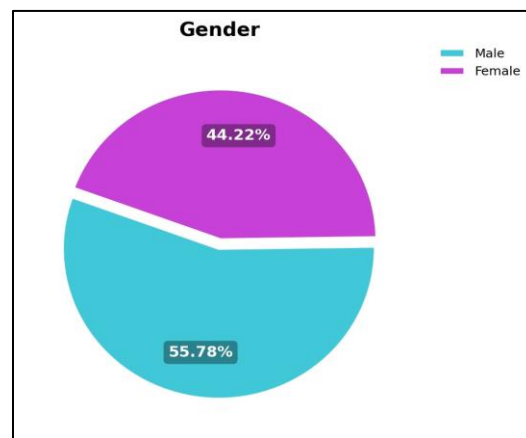


Figure 1. Sex distribution of neonatal deaths in the NICU at Benghazi Children Hospital, 2016.

Most deceased neonates were residents of Benghazi (91.8%), while 8.2% came from outside Benghazi. The mean age at death was 8.72 ± 10.7 days. Most deaths (58.5%) occurred between 1 day and less than 1 week of age, followed by 17.0% during the second week, 15.6% during the third week, and 8.9% at 3 weeks or later.

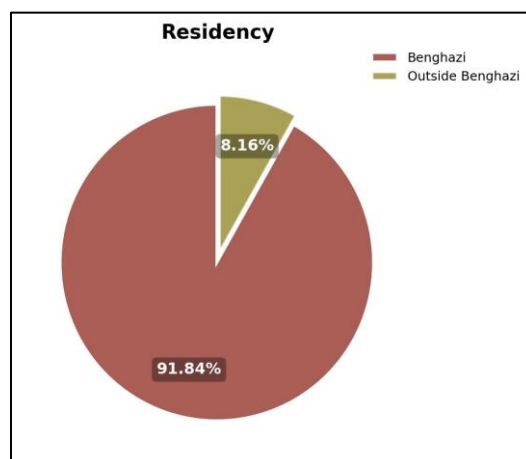


Figure 2. Distribution of neonatal deaths according to residence, Benghazi Children Hospital, 2016.

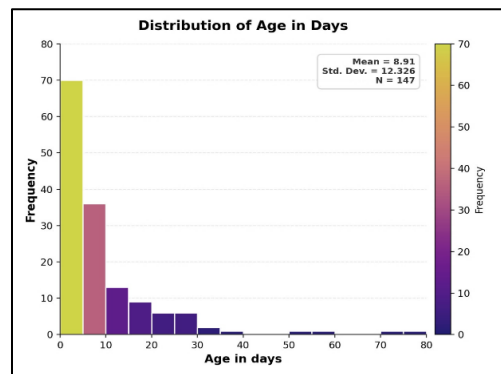


Figure 3. Age at death among neonates in the NICU, Benghazi Children Hospital, 2016.

Table 1. Age distribution of neonatal deaths in the NICU at Benghazi Children Hospital, 2016.

Age group	n (%)
1 day - <1 week	86 (58.5)
1 week - <2 weeks	25 (17.0)
2 weeks - <3 weeks	23 (15.6)
3 weeks or more	13 (8.9)
Total	147 (100)

Table 2. Birth-weight distribution of neonatal deaths in the NICU at Benghazi Children Hospital, 2016.

Birth weight	n (%)
0.5 kg - <1.5 kg	24 (16.3)
1.5 kg - <2.5 kg	36 (24.5)
2.5 kg - <3.5 kg	78 (53.1)
3.5 kg or more	9 (6.1)
Total	147 (100)

Birth weight ranged from 0.5 to 4.1 kg. Low birth weight (<2,500 g) was recorded in 40.8% of deceased neonates, while 53.1% had a birth weight of 2.5 to <3.5 kg.

Table 3. Causes for admission among neonates who subsequently died, Benghazi Children Hospital, 2016.

Causes for admission	n (%)
Respiratory disorders	38 (25.8)
Prematurity	31 (21.1)
Neonatal sepsis	27 (18.4)
Congenital heart disease	20 (13.6)
Multiple congenital anomalies	19 (12.9)
Convulsion	4 (2.7)
Meningitis	3 (2.0)
Hypoglycaemia	2 (1.4)
Diaphragmatic hernia	2 (1.4)
Dehydration	1 (0.7)
Total	147 (100)

Table 4. Recorded causes of death among neonates in the NICU, Benghazi Children Hospital, 2016.

Causes of death	n (%)
Respiratory disorders	38 (25.9)
Prematurity	31 (21.1)
Neonatal sepsis	27 (18.4)
Congenital heart disease	20 (13.6)
Multiple congenital anomalies	19 (12.9)
Intraventricular hemorrhage	4 (2.7)
Meningitis	3 (2.0)
Metabolic disorders	2 (1.4)
Renal failure	2 (1.4)
Necrotizing enterocolitis	1 (0.7)
Total	147 (100)

Respiratory disorders and prematurity were the most frequent admission diagnoses and recorded causes of death. In the respiratory-disorder category, the original records included respiratory distress syndrome/hyaline membrane disease, pneumothorax, pulmonary haemorrhage, aspiration pneumonia and congenital pneumonia.

Discussion

This study found a NICU mortality proportion of 8.7% among 1,686 admissions at Benghazi Children Hospital in 2016. This figure represents mortality among a hospitalised high-risk neonatal population and should not be interpreted as a population neonatal mortality rate. NICU mortality varies substantially between settings according to referral patterns, illness severity, gestational age and availability of specialised neonatal care [5]. Male neonates represented 55.8% of deaths. A male disadvantage in neonatal survival has been described, especially among preterm and very-low-birth-weight infants, although the magnitude of the association varies between populations. The male predominance observed here may therefore reflect both biological vulnerability and the characteristics of infants admitted to the NICU [6]. More than half of all deaths occurred during the first week of life. This finding is consistent with the recognised concentration of neonatal deaths in the early neonatal period when complications related to prematurity, respiratory disease, infection, and birth-related conditions are most likely to become fatal. The high proportion of early deaths emphasises the importance of skilled care at birth, early recognition of deterioration, timely referral and adequate respiratory and infection-management capacity [7].

Low birth weight was documented in 40.8% of deceased neonates. Low birth weight and prematurity are established markers of neonatal vulnerability because of immature organ function and increased susceptibility to respiratory, thermal, metabolic and infectious complications. However, because this study did not compare deceased neonates with survivors according to birth weight, the present finding describes the distribution of low birth weight among deaths rather than an independently estimated risk effect [8]. Respiratory disorders were the leading admission diagnosis and recorded cause of death, followed by prematurity and neonatal sepsis. Similar patterns have been reported from NICUs in low- and middle-income settings, including Libya, where prematurity, respiratory disease, and infection constitute important components of neonatal morbidity and mortality. These findings support strengthening prevention of preterm birth, neonatal resuscitation, early respiratory support including CPAP and surfactant when indicated, thermal care and infection prevention and treatment [9].

Congenital heart disease and multiple congenital anomalies together accounted for 26.5% of the recorded causes of death. These conditions require early recognition, stabilisation, appropriate diagnostic assessment, and effective referral pathways. The prominence of conditions that may be preventable, treatable, or amenable to early intervention suggests opportunities to improve survival through a stronger continuity of maternal and newborn care [10] [12-14]. The study has important implications for neonatal services in Benghazi. Interventions should focus on the period immediately before and after birth, including high-quality antenatal care, prevention and management of preterm birth, neonatal resuscitation, respiratory support, infection control, thermal care, appropriate nutrition, and efficient neonatal referral and transport. Strengthening these components is particularly relevant because the majority of deaths occurred during the first week of life [11] [15-17].

Conclusion

Neonatal mortality accounted for 8.7% of NICU admissions at Benghazi Children Hospital in 2016. Most deaths occurred during the first week of life, and the leading recorded causes were respiratory disorders, prematurity, neonatal sepsis, congenital heart disease, and multiple congenital anomalies. The findings emphasise the need for high-quality antenatal, intrapartum, early neonatal, and intensive care services to reduce preventable neonatal deaths.

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Conflict of Interest

The authors declare no conflict of interest.

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