An Analysis of Five years Neonatal Mortality in NICU of a Tertiary Care Hospital of Rawalpindi 2014-2019

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1,2,3,4,5 Conception of study  
1,2,3,4,5 Experimentation/Study conduction  
1,2,3,4,5 Analysis/Interpretation/Discussion  
1,2,3,4,5 Manuscript Writing  
1,2,3,4,5 Critical Review  
1,2,3,4,5 Facilitation and Material analysis

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Abstract

Objective: This study was done to find out the main causes and magnitude of neonatal mortality in the neonatal intensive care unit (NICU) of Benazir Bhutto Hospital, Rawalpindi over a period of five years.

Material and Methods: A hospital-based cross-sectional study was done from June 2014 to July 2019. The registration book of admitted neonates was reviewed by using a checklist to collect data. Data was analyzed in SPSS 24 for descriptive and bi-variate analysis applying the chi-square test and presented in text, frequencies, tables, and percentages.

Results: The study assessed a total of 24,459 neonates admitted to the NICU at Benazir Bhutto Hospital over a span of five years (June 2014 to July 2019). The mean birth weight was 2432 grams ± 740 g (range: Between 800 and 6000 g). Male neonates accounted for 59.8% with male to female ratio of 1.5:1. Overall 19,832 neonates (81.1%) were discharged, while 4636 (18.9%) died, making a Neonatal Mortality Rate of 18.9% (189 per 1000 admissions). 67.5% male neonates and 32.5% female neonates expired. 86.21% of these deaths were early neonatal that occurred in the first week of life. The causes of death were pre-maturity/ low birth weight (LBW), suspected sepsis, birth asphyxia, neonatal jaundice, and meconium aspiration syndrome, accounting for 32%, 31%, 30%, 4%, and 3% respectively.

Conclusion: In our NICU the neonatal mortality is high with prematurity/low birth weight (LBW), birth asphyxia (BA), neonatal jaundice (NNJ), and meconium aspiration syndrome (MAS) accounting for most of the deaths. These deaths are largely preventable with better antenatal, perinatal, and neonatal care.

Keywords: Neonatal Mortality, Neonatal Intensive Care Unit.
Introduction

The neonatal period accounts for more than 40% of all deaths in children less than 5 years of age. The vision of the new Global initiative by the World Health Organisation is to end preventable deaths of newborns and children less than 5 years of age by 2030. In this Target 3.2 of Sustainable Development goals (SDGs) the aim is to reduce neonatal mortality to as low as 12 per 1000 live births and less than five years old mortality to as low as 25 per 1000 live births by all member states of the United Nations, with the achievement of this SDGs between 2016-2030.2

Between 1990 and 2017 the estimated number of neonatal deaths was reduced from 5 million deaths in 1990 to 2.5 million deaths in 2017.3 The latest nationwide survey of Pakistan showed that considerable progress has been made towards reducing all childhood mortality indicators except neonatal mortality.4 Pakistan has the highest neonatal mortality rate in low to middle-income countries with Argentina the lowest.5 A high Infant and neonatal mortality rate of 47 per 1000 live births with the highest mortality of 70 per 1000 live births in the early neonatal period has been reported in urban Pakistan.6 The major causes of neonatal deaths reported worldwide are infections, prematurity, intrapartum complications, and birth asphyxia.7 Neonatal sepsis is a significant cause of neonatal mortality, however, the disease burden is different in low-income countries compared with middle-income countries.8 Neonatal mortality of 33.1% is due to infection in poor countries.9

We conducted this study to find out the main causes and magnitude of the mortality in the neonates who were admitted to the Neonatal Intensive Care Unit of Benazir Bhutto Hospital so that the extent of preventable causes can be identified which in turn will help in making strategy to reduce neonatal mortality.

Materials and Methods

Study area: This study was done at the Neonatal Intensive Care Unit (NICU) in Benazir Bhutto Hospital, Rawalpindi.

Study duration: The study was conducted from 5th of Aug to 5th of September, 2019.

Study design: A five years hospital-based retrospective cohort was used to review new-borns admitted in the NICU of Benazir Bhutto Hospital, from June 2014 to July 2019.

Methods of data analysis: The raw data were entered into excel and checked for incomplete and inconsistent data, then missing values were excluded before exporting to SPSS version 24. Cross-tabulation of admission and death events and graphs were used to summarize and present the data. "Neonatal mortality rate was calculated using the total neonatal deaths recorded at the NICU divided by the total number of new-borns admitted at the NICU in the five years reviewed". The causes of death were analysed by socio-demographic and new-born characteristics. The level of significance was set at P<0.05. A bi-variate analysis using the Chi-square test or Fisher exact test, where appropriate, was performed to determine predictors of neonatal hospital mortality pertaining to neonatal characteristics for each variable one at a time.

Data quality assurance: Data was extracted and collected by the research cell of the paediatrics department at Benazir Bhutto Hospital. Cross-checking with the source registration book was applied for any observed incompleteness, error, and/ambiguities in the recording.

Study variables:

Dependent variable: Neonatal outcome (Survived, Died)

Independent variables: Socio-demography/ Neonatal factors.

Results

This study assessed a total of 24,459 Neonates, who were admitted to the NICU at Benazir Bhutto Hospital over a span of five years (June 2014 to July 2019). The mean birth weight was 2432 grams ± 740 g (range: Between 800 and 6000 g). Male neonates accounted for 59.8% with male to female ratio of 1.5:1. 67.5% of the...
male neonates expired compared to 32.5% mortality in females. Overall 19,832 new-borns (81.1%) were discharged while 4636 (18.9%) died, making a Neonatal Mortality Rate of 18.9 (189 per 1000 admissions). 86.21% of these deaths were early neonatal that occurred in the first week of life.

Table 1: Neonatal Demographic Variables

<table>
<thead>
<tr>
<th>Newborn variables</th>
<th>TOTAL (%)</th>
<th>Died (%)</th>
<th>Survived (%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n=24459</td>
<td>n=4636</td>
<td>n=19,823</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Freq</td>
<td>%</td>
<td>Freq</td>
<td>%</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>14626</td>
<td>59.8</td>
<td>3128</td>
<td>21.3</td>
</tr>
<tr>
<td>Females</td>
<td>9832</td>
<td>40.2</td>
<td>1508</td>
<td>15.3</td>
</tr>
<tr>
<td>Birth weight(grams)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1500</td>
<td>1200</td>
<td>4.9</td>
<td>488</td>
<td>40.6</td>
</tr>
<tr>
<td>1501-2499</td>
<td>7206</td>
<td>29.5</td>
<td>1445</td>
<td>20.0</td>
</tr>
<tr>
<td>2500-3999</td>
<td>15226</td>
<td>62.3</td>
<td>2583</td>
<td>17.0</td>
</tr>
<tr>
<td>4000+</td>
<td>827</td>
<td>3.4</td>
<td>120</td>
<td>14.5</td>
</tr>
<tr>
<td>Age at admission</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤6</td>
<td>20,562</td>
<td>84.1</td>
<td>3997</td>
<td>19.4</td>
</tr>
<tr>
<td>≥7</td>
<td>3897</td>
<td>15.9</td>
<td>639</td>
<td>16.4</td>
</tr>
<tr>
<td>Pre-maturity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>19,783</td>
<td>80.9</td>
<td>3478</td>
<td>18.5</td>
</tr>
<tr>
<td>Yes</td>
<td>4676</td>
<td>19.1</td>
<td>1158</td>
<td>24.8</td>
</tr>
<tr>
<td>Feeding</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Human Milk</td>
<td>20465</td>
<td>83.7</td>
<td>3742</td>
<td>18.3</td>
</tr>
<tr>
<td>Mixed</td>
<td>3136</td>
<td>12.8</td>
<td>663</td>
<td>21.1</td>
</tr>
<tr>
<td>Other</td>
<td>858</td>
<td>3.5</td>
<td>231</td>
<td>26.9</td>
</tr>
<tr>
<td>Mode of delivery</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assisted Vaginal</td>
<td>2445</td>
<td>10.0</td>
<td>187</td>
<td>7.6</td>
</tr>
<tr>
<td>C-Section</td>
<td>7337</td>
<td>30.0</td>
<td>1314</td>
<td>17.9</td>
</tr>
<tr>
<td>SVD</td>
<td>14,677</td>
<td>60.0</td>
<td>3135</td>
<td>21.4</td>
</tr>
</tbody>
</table>

There are an increasing number of patients in our NICU both because of a high number of referrals from within the twin cities of Rawalpindi and Islamabad and from other districts. Most of these referrals were of very sick and pre-term neonates and this contributed to high mortality in our NICU.
The main causes of admission were: pre-maturity, neonatal sepsis, birth asphyxia, neonatal jaundice, and meconium aspiration syndrome which accounted for 32%, 31%, 30%, 4%, and 3% respectively.

Figure 1: Trends of Neonatal admission and mortality in NICU of Benazir Bhutto Hospital 2014-2019

The main causes of death were prematurity/LBW, Neonatal sepsis, birth asphyxia, neonatal jaundice, and meconium aspiration syndrome which accounted for 32%, 31%, 30%, 4%, and 3% respectively.

Figure 2: Seasonal Trends of Neonatal admission and mortality in NICU of Benazir Bhutto Hospital 2014-2019

Figure 3(a): Top five causes of mortality in NICU of Benazir Bhutto Hospital Rawalpindi June, 2014-July 2019

Figure 3(b): Top five causes of mortality in NICU of Benazir Bhutto Hospital Rawalpindi June, 2014-July 2019

Discussion

We found the results of our study consistent with regional and international studies though with some differences. This study showed male preponderance both in admitted and deceased neonates. It is consistent with other studies by Ugwu GiMG.11 (54.3% male versus 45.7% female) with a male to female ratio
of 1.2:1. A male preponderance is also reported by Rubina Zulfiqar, et al.12, Manzar et al.13, Haider Sherazi et al.14 (54% male and 46% female) Kumar et al.15 (1.16:1).

The mortality rate in our study is 18.90%. In one study from Ghana the neonatal mortality of 20.2% has been reported.10 Rubina, et al.13 reported mortality of 23.48% while Johanna17 reported an overall neonatal mortality of 13.5%. The neonatal mortality in other studies in Islam18 20.6%, Shirazi, et al.14 22.4%, Ugwu GiMG11 20.3%, Kumar et al.15 11%. This variation may be due to sampling nature and facilities available in the neonatal unit because the survival of neonates also depends upon care provided to them.

Case fatality in our study for prematurity/LBW is 41.6% which is high when it is compared to 27.8% from Nigeria11 and 38.6% from India.15 These variations might be due to the availability of modern facilities like ventilation and surfactant used in these neonatal units.

Our case fatality for birth asphyxia is 30%. A study reported the case fatality from birth asphyxia at 18%.20 While Rubina, et al.12 has reported mortality from birth asphyxia at 43.8%. It is however comparable to 24.1% reported by Ugwu et al from Nigeria11, 38, 9% by Islam et al from Bangladesh18, and 31% from India.15 but a very low figure of 9.2% in yet another study.17 However it is lowest (4%) reported from Nepal where its incidence is 2-9/1000 live births.21 Reason for these variations are related to the standard of perinatal care. Case Fatality for sepsis in our study is high at 31%. Other studies have reported sepsis mortality of 30.7%,22, 8.06%,23, 38.24%,24, and 49.7%.17 Neonatal sepsis is related to a lack of antiseptic measure practices in neonatal units and during birth. Antiseptic measures and practices have changed over time and places have contributed to these differences.

Case fatality for NNJ is 4% as compared to a previous study in Rawalpindi where it was 10.27%.12 Again this low incidence might be due to differences in neonatal condition at admission, public awareness of the disease, and local practices.

**Conclusion**

Neonatal mortality is very high in our study. Sepsis, birth asphyxia, and LBW or prematurity are the main causes of this mortality. All these causes can be prevented by the improvement of antenatal, and neonatal care.

**References**

2. Sustainable Development Goal 3. Ensure healthy lives and promote well-being for all at all ages Available at website https://sustainabledevelopment.un.org/sdg3 accessed 03.09.2019


