Pattern of Disease Admissions and Their Outcome of Neonates Admitted In Neonatal Intensive Care Unit of A Tertiary Care Hospital in Quetta

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ABSTRACT

Objective: to determine the admission pattern and outcomes of neonatal admissions to a neonatal intensive care unit (NICU) in a tertiary care hospital of Quetta Pakistan.

Study Design: Prospective longitudinal study.

Place and Duration of Study: Neonatal Intensive Care Unit, Combined Military Hospital Quetta Pakistan from Jan to Dec 2020

Methodology: All neonates admitted to the NICU Indoor or Outdoor Department during study duration were included. The disease pattern of the admission was noted, along with information regarding gender, gestational age, birth weight, diagnosis, duration of NICU stay, and outcome.

Results: Of 424 neonates, respiratory-related disorders were predominantly higher 185 (43.6%) followed by infection/ sepsis-related disorders 105 (24.8%), care of prematurity 81 (19.1%), whereas 53(12.5%) had miscellaneous disorders. The overall mortality rate was observed in 34(8.0%) babies. A significant mean difference in gestational age ($p<0.001$), birth weight ($p<0.001$), and duration of stay ($p=0.003$) was observed for reasons for admissions. Furthermore, a significant association of reasons for admission was observed with gender ($p=0.013$), route of admission ($p<0.001$), and respiratory support ($p<0.001$).

Conclusion: The pattern of the disease admission showed that respiratory-related disorders were predominantly higher, followed by infection/sepsis-related disorders and care of prematurity. Though the mortality rate was low, however, low birth weight, prematurity and caesarean delivery are common risk factors.

Keywords: Caesarean section, Intensive Care Unit, Mortality, Neonates.

INTRODUCTION

The neonatal period is the most vulnerable period of a child's life. Mortality in the neonatal period accounts for nearly two-thirds of infant mortality rates all over the world, particularly in low and middle-income countries.[1] Increased efforts are needed to improve progress to achieve the sustainable development goal target by 2030.[2,3]

According to the World Health Organization, Pakistan is currently third among the countries with the highest mortality rate.[4] A study reported neonatal mortality in 49.4 per thousand live births in Pakistan.[5] Even though there has been much work done to date to improve maternal and child health in Pakistan, over half of baby fatalities still happen during the first 28 days of life.[6] The under-lying illness's severity, treatment, and the neonates' prognosis are all important factors. Previously published studies have reported various causes of neonatal deaths in Pakistan. It may be due to the presence of prematurity, asphyxia or other health issues.[7,8]

It is important to have an insight into the characteristics of the neonates who are at risk of hospitalization, particularly those who are more at risk of mortality. A thorough knowledge of the patterns of admission in a tertiary care hospital, their causes and their outcome will help us to establish the most common causes of mortality and morbidity in our region, which will help us to formulate future planning and steps towards reducing the neonatal mortality rate in our region.

METHODOLOGY

The prospective longitudinal study was conducted at the Neonatal Intensive Care Unit, Combined Military Hospital, Quetta Pakistan, from January to December 2020, after obtaining approval from the Ethical Committee (CMH QTA-IRB/036). The sample size was calculated using the Epi Info sample size calculator with the reported frequency of newborn jaundice (11.3%).[9]

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Inclusion Criteria: All neonates admitted to the NICU, Indoor or Outdoor Departments, during study period were included.

Exclusion Criteria: Neonates with incomplete data, kept in NICU for less than 24 hours for observation or left against medical advice were excluded.

Hospital offers 24-hour emergency ser-vice for indoor and outdoor-born neonates. The NICU has 15 incubators, four warmers, four phototherapy radiants, three continuous positive airway pressure (CPAP) machines, three ventilators, exchange trans-fusion, and a laboratory available 24/7.

Signed informed consent was obtained from the guardians/parents of all neonates before the study enrollment. Information regarding gender, gestational age, birth weight, diagnosis, duration of NICU stay, and discharge status were recorded. Neonates are defined as babies less than 28 days of life. Newborns less than complete 37 weeks of gestation were defined as preterm (PT), birth weight <2500 g was defined as low birth weight (LBW), neonatal sepsis (NNS) was diagnosed based on the history and examination along with positive blood culture specimen report, elevated C reactive protein (CRP) or thrombocytopenia. Neo-natal jaundice was defined according to gestational age and day of life, and an appropriate centile chart was used for total bilirubin level. Respiratory distress syndrome (RDS) was defined based on radiological evidence. Premature rupture of membrane (PROM) >18 hours was considered significant for admission. Hypoxic Ischemic Injury was defined based on preceding history and elevated cord blood lactate and acidosis. Intrauterine Growth Restriction (IUGR) was an anthropometry measurement <10th centile.[10,11]

All data was analyzed using SPSS v 24. Quali-tative variables were presented as frequencies and per-centages. Mean and standard deviation were compu-ted for quantitative variables normally distributed, whereas median and inter-quartile range (IQR) were computed for quantitative variables with non-normal distribution. Inferential statistics were explored using an independent t-test, Mann-Whitney U-test, and Kruskal-Wallis test for mean/median comparison. In contrast, Chi-square/ Fisher-Exact was used to com-pare the outcome with qualitative variables. The *p*-value of ≤0.05 was considered significant.

RESULTS

A total of 424 neonates were included. The mean gestational age was 36.54±3.65 weeks. There were 243 (57.3%) males and 181(42.7%) females. Among them, 310(73.1%) newborns were admitted indoors, whereas 114(26.9%) were admitted outdoors and were either referred from peripheries or presented through OPD.

A total of 338(80.0%) babies were delivered via LSCS, and 85(20.0%) were delivered via SVD. A total of 8(1.9%) babies were extremely low birth weight, i.e., < 1000 g, 21(5.0%) had very low birth weight between, i.e., 1001 to 1500 g, 145(34.2%) had low birth weight between, i.e., 1501 to 2500g and 250(59.0%) were >2500 g. A total of 7(1.7%) were extremely preterm, 23 (5.4%) were very preterm, 181(42.7%) were preterm, and 213 (50.2%) were term babies. Neonatal sepsis 105 (24.8%) was observed in majority followed by TTN 87 (20.5), prematurity 58(13.7%), MAS/HIE 78(18.39%), NNJ 22(5.2%), RDS 20(4.7%) PROM 15(3.5%) other cause includes syndromic babies 10(2.4%), surgical babies 11(2.6%), IUGR 8(1.9%) GDM 6(1.4%) and inborn error of metabolism 4(0.9%). Forty-three new-borns (10.1%) were ventilated, of which 27 (62.79%) expired, and 16(37.21%) were discharged home. One hundred forty-seven (34.7%) required CPAP support, of which only 3(2.04%) expired; the rest were discharged home. The overall mortality rate was observed in 34(8.0%) babies.

The median duration of NICU stay was 3(2-6) days. NICU admission lasted a minimum of 1 day and a maximum of 35 days. The pattern of the disease admission showed that respiratory-related disorders were predominantly higher, 185(43.6%), followed by infection/sepsis-related disorders 105 (24.8%), care of prematurity 81(19.1%), whereas 53(12.5%) had miscellaneous disorders. (Table-I)

Table-I: Pattern of Disease Admissions (n=424)

Pattern of the Disease admissions	n (%)
Respiratory related disorder (n=185)	
TTN	87(47.0)
RDS	20(10.8)
MAS/HIE	78(42.2)
Infection/Sepsis related issues (n=105)	
NNS	105(100)
Care of prematurity (n=81)	
IUGR	8(9.9)
PT/LBW	58(71.6)
PROM	15(18.5)
Miscellaneous (n=53)	
NNJ	22(41.5)
Syndromic	10(18.9)
Surgical	11(20.8)
GDM	6(11.3)
IEM	4(7.5)

n: number, GDM: Gestational Diabetes Mellitus, HIE: Hypoxic-Ischemic Encephalopathy, IEM: Inborn Errors of Metabolism, IUGR: Intrauterine Growth Hormone, LBW: Low Birth Weight, MAS: Meconium Aspiration Syndrome, NNS: Neonatal Surgery, PROM: Premature Rupture of Membrane, RDS: Respiratory Distress Syndrome, TTN: Transient Tachypnea of the Newborn

The significant mean difference in gestational age ($p<0.001$), birth weight ($p<0.001$), and duration of stay ($p=0.003$) was observed for reasons for admis-sions. Furthermore, a significant association of reasons for admission was observed with gender ($p=0.013$), route of admission ($p<0.001$), and respiratory support (p <0.001). (Table-II). As far as mortality was considered, a significant mean difference in gestational age (p 0.003), birth weight ($p<0.001$), and duration of stay (p 0.001) were observed for mortality. Furthermore, mortality was significantly associated with mode of delivery (p 0.021) (Table-III).

Table-II: Comparison of Reasons of Admission with Baseline Characteristics of the Patients (n=424)

Variables	Reasons of Admission				*p*-value
	Respiratory Related Problem (n=185)	Infection/Sepsis Related Issues (n=105)	Care of Prematurity (n=81)	Others (n=53)	
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	
Gestational Age, weeks	36.70±3.35	37.81±3.04	33.84±3.89	37.63±3.32	<0.001α
Birth Weight, Kg	2.46±0.51	2.44±0.45	1.96±0.58	2.49±0.54	<0.001α
Duration of Stay, days [median (IQR)]	3(2-5)	3(2-5)	4(2-9)	2(1-6)	0.003β
	n (%)	n(%)	n(%)	n(%)	
Gender					
Male	114(46.9)	60(24.7)	34(14.0)	35(14.4)	0.013¥
Female	71(39.2)	45(24.9)	47(26.0)	18(9.9)	
Route of admission					
Indoor	157(50.6)	51(16.5)	74(23.9)	28(9.0)	<0.001¥
Outdoor	28(24.6)	54(47.4)	7(6.1)	25(21.9)	
Mode of delivery					
LSCS	148(43.7)	81(23.9)	70(20.6)	40(11.8)	0.348¥
SVD	37(43.5)	24(28.2)	11(12.9)	13(15.3)	
Respiratory Support					
Oxygen Inhalation	12(8.6)	73(52.5)	18(12.9)	36(25.9)	<0.001¥
CPAP	60(63.2)	15(15.8)	12(12.6)	8(8.4)	
Ventilator	89(60.5)	10(6.8)	44(29.9)	4(2.7)	
None	24(55.8)	7(16.3)	7(16.3)	5(11.6)	

n: number, GDM: Gestational Diabetes Mellitus, HIE: Hypoxic-Ischemic Encephalopathy, IEM: Inborn Errors of Metabolism, IUGR: Intrauterine Growth Hormone, LBW: Low Birth Weight, MAS: Meconium Aspiration Syndrome, NNS: Neonatal Surgery, PROM: Premature Rupture of Membrane, RDS: Respiratory Distress Syndrome, TTN: Transient Tachypnea of the Newborn

αOne-Way ANOVA test applied, βKruskal-Wallis test applied, ¥Chi-square test applied, p-value ≤0.05 considered as significant

Table-III: Comparison of mortality with baseline and clinical characteristics (n=424)

Variables	Mortality		*p*-value
	Yes (n=34)	No, (n=390)	
	Mean±SD	Mean ±SD	
Gestational Age, weeks	34.74±4.77	36.70±3.50	0.003α
Birth Weight, Kg	1.82±0.64	2.39±0.51	<0.001α
Duration of stay, days [median (IQR)]	2(1-3)	3(2-6)	0.001β
	n (%)	n (%)	
Gender			
Male	14(7.7)	167(92.3)	0.853¥
Female	20(8.2)	223(91.8)	
Route of Admission			
Indoor	21(6.8)	289(93.2)	0.120¥
Outdoor	13(11.4)	101(88.6)	
Mode of Delivery			
LSCS	22(6.5)	317(93.5)	0.021¥
SVD	12(14.1)	73(85.9)	
Reasons of Admission			
Respiratory related disorder	15(8.1)	170(91.9)	0.663¥
Infection/sepsis related disorder	6(5.7)	99(94.3)	
Care of prematurity	7(8.6)	74(91.4)	
Others	6(11.3)	47(88.7)	

LSCS: Lower Segment Caesarean Section, n: number, SVD: Spontaneous Vaginal Delivery

αIndependent-t test applied, βMann-Whitney U test applied, ¥Chi-square test applied, p-value ≤0.05 considered as significant

DISCUSSION

The findings of the current study showed that the pattern of disease admission showed that respiratory-related disorders were predominantly higher, followed by infection/sepsis-related disorders and care of prematurity, whereas had miscellaneous disorders. Some similar findings were reported in previous studies as well. Fadul *et al.* from Sudan have reported prematurity and respiratory distress syndrome as the most common cause of admission.[9] A study conducted in Ethiopia has reported respiratory distress, low birth weight, and preterm and perinatal asphyxia as the reason for admission to neonatal ICU.[10] Prematurity and infection were cited in a study as the leading causes of hospitalization, which were then followed by birth asphyxia and newborn jaundice. [11]

Neonatal sepsis was the only reason for infection in all neonates with infection in the current study. In earlier research, sepsis, pneumonia, and acute gastro-enteritis were the main causes of infections.[12] This study observed a considerable mean difference in gestational age, birth weight, and duration of stay for reasons for admissions. In addition, a significant association of reasons for admission was observed with gender, route of admission, and respiratory support. Toru *et al.* reported that maternal medical condition during pregnancy, maternal mid-arm circumference less than 23 cm, and birth interval of 2 years or less are the major factors for admission in neonatal ICU.[13] Mortality in neonates in the current study was found to be eight per cent. Similar to our study findings, a previous study reported mortality in 6.8% of the neonates admitted to NICU.[14]

According to the current study findings, a considerable mean difference in gestational age, birth weight, and duration of stay was observed for mortality. In addition, a considerable association of mortality was observed with the mode of delivery. In their study, Liang *et al.* found that the most frequent factors related to mortality were neonatal mortality, preterm, low birth weight, and early age at presentation.[1] Thus, these findings suggest a need to carefully prevent prematurity and low birth weight in neonates to reduce hospitalization among ne-onates.[15,16] Moreover, prematurity and low birth weight are factors that may also cause health-related issues later in life. Particularly, studies have reported that these individuals are at risk of certain health problems till the fifth years of their lives.[17,18] Cesarean section was the predominant mode of delivery in neonates of the current study. The possible reason for more cesarean admission may be due to maternal fac-tors, which lead to the emergency section, ultimately leading to NICU admission of newborns.

This study is important as it was conducted in a tertiary care hospital in Quetta that facilitates the most vulnerable populations. Secondly, studies reporting the findings from these areas are scarce. Previously, studies reported the pattern and outcome of neonatal outcomes from Karachi, Hyderabad, Lahore, and other areas of Pakistan. However, findings from Quetta still needed to be included.[7,11,16-21] So, this study is an important effort as it has reported the findings from one big city in Pakistan, where the data was not previously reported. The current study findings will help healthcare providers identify at-risk neonates. Further studies are required on a larger scale that report the admission outcome on a longer duration and include other important neonatal and maternal characteristics. Due to the time and financial limitations, the current study did not report the long-term follow-up of the neonates and some important confounding variables.

CONCLUSION

The pattern of the disease admission showed that respiratory-related disorders were predominantly higher, followed by infection/sepsis-related disorders and care of prematurity. Though the mortality rate was low, however, low birth weight, prematurity, and caesarean delivery are common risk factors.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

HJ & AK: Conception, study design, drafting the manuscript, approval of the final version to be published.

KAB & RT: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

FJ & S: Data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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