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Morbidity profile of admitted neonates and their outcome in Neonatal Intensive Care Units (NICUs) of urban Allahabad

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Abstract
Background: India faces a daunting challenge of newborn survival. Four out of five newborn deaths result from three treatable conditions: complications during childbirth (including birth asphyxia), newborn infections, and complications from prematurity. The facility-based research is lagging behind. This study was conducted to assess the morbidity profile of the admitted neonates & their outcome in government & private neonatal intensive care units of urban Allahabad.
Methods: The present study was conducted in the Neonatal Intensive Care Units of Government and Private settings of urban Allahabad, Uttar Pradesh during the year 2015-2016. This was a time-bound study. All the sick neonates admitted during the study period at SNCH and private NICU of urban Allahabad were included in the study. There were 1,442 neonates who were admitted in both the government and the private newborn care units during the study period. Out of these, only 1,409 neonates were included in the study.
Results: In the Government sector, Neonatal sepsis accounted for the maximum number of admission, 26.69% followed by Prematurity 22.17%, Birth Asphyxia 13.54%, Neonatal Jaundice 13.01%, RDS 12.48% and MAS 4.51%. In contrast to this, Prematurity 135 (20.57%) caused maximum number of admissions in the Private sector. The outcome was the best for RDS in government while neonatal jaundice in private sector.
Conclusion: The maximum admission in the Neonatal Intensive Care Units of urban Allahabad was caused because of Prematurity followed by Neonatal Sepsis.

Keywords: Morbidity profile, outcome, NICUs, Allahabad

Introduction

Survival of a newborn during the first week of life is determined by the stresses of intrauterine life and birth process as well as by the adjustment to a new environment, nutrition and infection. Therefore, the early neonatal period (birth to 7 days of life) is the most critical period of life [1]. Almost half of Under-5 deaths occur in infancy. Of the infant deaths, about two third occur in neonatal period. One third of all neonatal deaths occur on the first day of life, almost half within three days and nearly three quarters within the first week of life [2].

Out of 130 million neonates born each year globally, 4 million die in first four week with more than 10,000 deaths a day of which virtually all deaths nearly 99% occur in low and middle income countries like South East Asia and Africa [3]. Major causes of neonatal death are pre-term birth (27%), sepsis (26%), birth asphyxia (23%) along with some others like tetanus(7%), congenital anomalies(7%) and diarrhoeal diseases (3%) and others (7%)-(CHERG,2012) [4].

India faces a daunting challenge of newborn survival. The neonatal mortality varies considerably between the states and regions [5]. The causes of neonatal deaths in India according to a statistical report are preterm birth (35%), birth asphyxia (20%), pneumonia (16%), sepsis (15%), malformations (9%), diarrhoea (2%), others (3%) [6]. Four out of five newborn deaths result from three treatable conditions: complications during childbirth (including birth asphyxia), newborn infections, and complications from prematurity. The largest state, Uttar Pradesh accounts for a quarter of all newborn deaths in India and 8% worldwide [7].

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Every year 70% of neonatal deaths take place because simple yet effective interventions do not reach those who need them the most. Coverage of interventions is low, progress in scaling up is slow, and inequity is high [8]. This gap is due to poor coverage within the health system, shortage of health care providers, and issues related to access to referral services. While community-based research is receiving attention and investment, rigorous evaluation and research on facility-based interventions is lagging behind [9]. It is understood that very high-risk babies should get the highest level of care but it is imperative to know the patients' profile in newborn health facilities. This study was assessed the morbidity & mortality profile of the admitted neonates in government & private neonatal intensive care units of urban Allahabad.

Material and Method
The present study was conducted in the Newborn Intensive Care Units of Government (Sarojini Naidu Children Hospital, Allahabad) and Private settings of urban Allahabad, Uttar Pradesh during the year 2015-2016. This was a time-bound study. All the sick neonates admitted during the study period at SNCH and private NICU of urban Allahabad were included in the study. There were 1,442 neonates who were admitted in both the government and the private newborn care units during the study period. Out of these, only 1,409 neonates were included in the study. The remaining 33 neonates were excluded as their diagnosis was unclear.

In the beginning, the permission of NICU In-charge of the respective hospitals was obtained to analyze the medical records, maintaining the confidentiality. The ethical clearance was taken from institutional ethical committee. After obtaining the consent, the pre-designed and pre-tested questionnaire was filled from medical records.

The collected data were entered in the Microsoft excel data sheet and analyzed using statistical software, SPSS Version 18.0. Z test of proportion was used to test the difference in the outcome of different variables under study between the Government and Private NICUs.

Definitions and terms used in the study
Morbidity Profile [5]:
Birth Asphyxia: Presence of any one of the following:
1. Delayed cry
2. Need for assisted ventilation at birth
3. Apgar <3 at 1 minute
4. Apgar < 5 at 5 minute

Moderate-severe perinatal asphyxia/Hypoxic Ischaemic Encephalopathy
Baby with birth asphyxia has encephalopathy if one or more of the following are present:
1. Altered sensorium
2. Inability to feed
3. Convulsions.

Neonatal Sepsis: In a newborn having clinical picture suggestive of septicaemia (poor feeding, lethargy, poor reflexes, hypo or hyperthermia, abdominal distension etc.) and presence of any one of the following criteria is enough for assigning probable diagnosis of infection:
1. Existence of pre-disposing factors: maternal fever or foul smelling liquor or prolonged rupture of membranes

(>24 hour) or gastric polymorphs (> 5 per hpf)
2. Positive septic screen (two of the four parameters (TLC <5000/mm, band to total polymorph ratio of >0.2, absolute neutrophil count less than 1800/cmm, CRP >1 mg/dl and micro ESR > 10 mm 1st hour).
3. Radiological evidences of pneumonia.
4. Positive blood culture.

Meningitis: In a baby with sepsis, if there is any one of the following
1. Altered sensorium
2. Convulsions
3. Bulging fontanelle
4. Cerebrospinal fluid (CSF) culture is positive, or CSF microscopy and biochemistry are suggestive.

Respiratory Distress
Presence of any one of the following criteria
Respiratory rate =>60 per minute
Subcostal/intercostal recessions
Expiratory grunt/groaning

Hyaline Membrane Disease/RDS
A. Presence of the following criteria
   a. Pre-term neonate
   b. Respiratory distress having onset within 6 hour of birth
B. Supportive evidence (Desirable)
   a. Skiagram of chest showing poor expansion with air bronchogram/reticulo-granular pattern/ground glass opacity.

Prematurity: is defined as newborns having birth weight of less than 1000 g or < 28 week of gestation with no asphyxia, sepsis, RDS or major malformations.

Meconium aspiration syndrome
a. Presence of the following: Respiratory distress within one hour of birth in a term baby with meconium staining of liquor, staining of nails, umbilical cord or skin.
b. Supportive evidence (Desirable): Radiological evidence of aspiration pneumonitis (atelectasis, and or hyperinflation)

Neonatal Jaundice: Jaundice requiring phototherapy.
Others: include major congenital malformations, metabolic disorders, cause not established etc.

Outcome
Good: The neonates who were alive and improved at the time of discharge were assumed to have good outcome.
Poor: The neonates who died or left the hospital against medical advice (LAMA) or referred were considered poor.

Results
Table 1 depicts the morbidity profile of the admitted sick neonates in both the government and private NICUs. In the Government sector, it can be observed that the Neonatal sepsis accounted for the maximum number of admission, 201(26.69%) followed by Prematurity 167 (22.17%), Birth Asphyxia 102 (13.54%), Neonatal Jaundice 98 (13.01%),

Respiratory Distress Syndrome (RDS) 94 (12.48%) and Meconium Aspiration Syndrome (MAS) 34 (4.51%). The other morbidities were 57 (17.56%) which included major congenital malformations, metabolic disorders, necrotizing enterocolitis etc. In contrast to this, Prematurity 135 (20.57%) caused maximum number of admissions in the Private sector. The other morbidities were Neonatal Jaundice 130 (19.81%), RDS 110 (16.76%), Birth Asphyxia 100 (15.24%), Neonatal sepsis 71 (10.82%) and MAS 75 (11.43%). The other morbidities in Private hospital constituted 92 (14.02%). The morbidities categorized as "others" had almost similar pattern in both the Government and Private NICUs. The unmanageable patients were referred to super-speciality centres.

Table 1: Morbidity profile of the admitted neonates of government & private NICUs

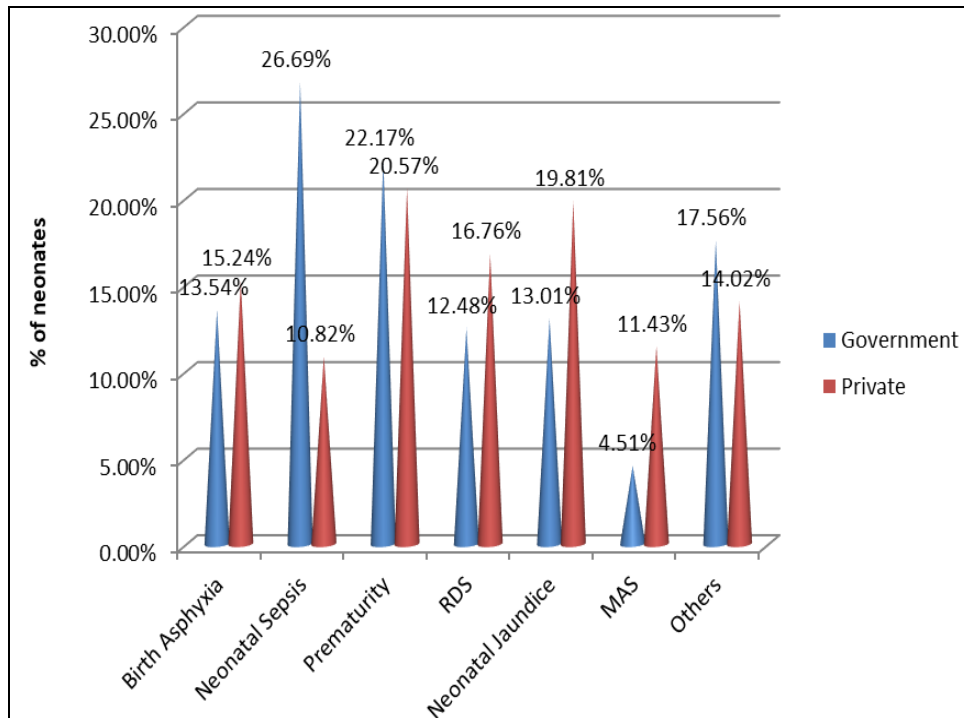| Morbidity Profile				
	Government	%	Private	%
Birth Asphyxia	102	13.54	100	15.24
Neonatal Sepsis	201	26.69	71	10.82
Prematurity	167	22.17	135	20.57
RDS	94	12.48	110	16.76
Neonatal Jaundice	98	13.01	130	19.81
MAS	34	4.51	75	11.43
Others	57	17.56	92	14.02

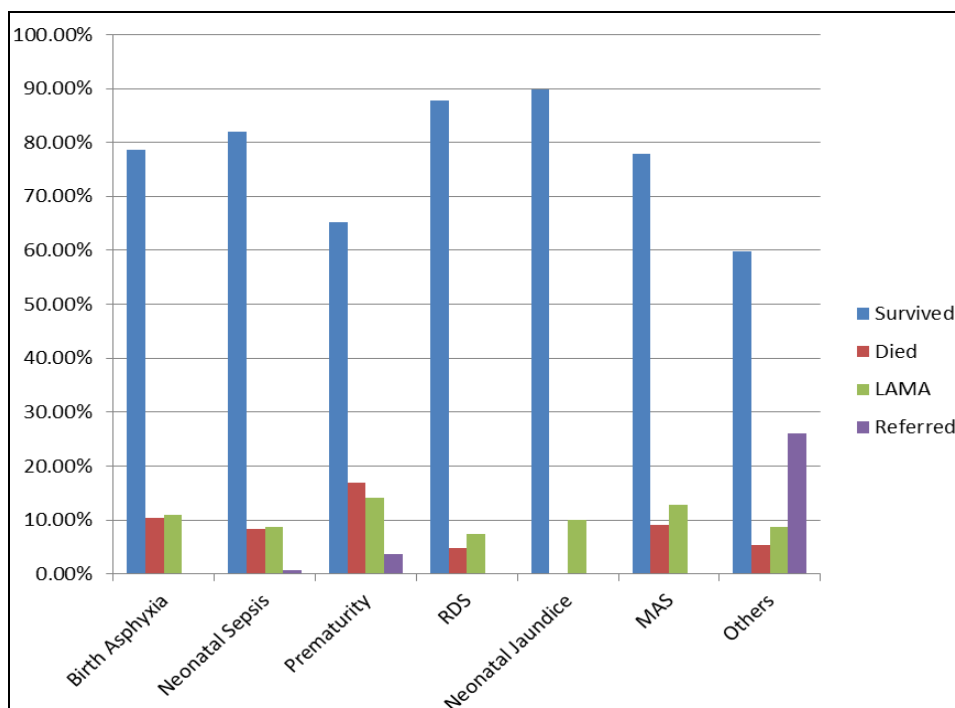**Fig 1:** Distribution of sick neonates according to the morbidity profile

Fig 2: Morbidity profile of the admitted neonates and their outcome

Table 2: Relationship between the morbidity of the admitted neonates & their outcome

Outcome	Birth Asphyxia		Test statistics	
	Government	Private	Z score	P value
Good	73 (71.56%)	85 (85%)	2.31	<0.05
Poor	29 (28.43%)	15 (15%)		
Outcome	**Neonatal Sepsis**		Test statistics	
	Government	Private	Z score	P value
Good	162 (81.81%)	56 (78.87%)	0.54	>0.05
Poor	36 (18.18%)	13 (21.12%)		
Outcome	**Prematurity**		Test statistics	
	Government	Private	Z score	P value
Good	84 (52.83%)	105 (77.78%)	4.44	<0.05
Poor	75 (47.16%)	30 (22.22%)		
Outcome	**RDS**		Test statistics	
	Government	Private	Z score	P value
Good	79 (84.04%)	100 (90.90%)	1.49	>0.05
Poor	15 (15.96%)	10 (10.10%)		
Outcome	**Neonatal Jaundice**		Test statistics	
	Government	Private	Z score	P value
Good	71 (72.44%)	130 (100%)	6.37	<0.05
Poor	27 (27.55%)	0		
Outcome	**MAS**		Test statistics	
	Government	Private	Z score	P value
Good	24 (70.58%)	60 (80%)	1.08	>0.05
Poor	10 (29.42%)	15 (20%)		
Outcome	**Others**		Test statistics	
	Government	Private	Z score	P value
Good	22	30	4.20	<0.05
Poor	32	5		

Table 2 shows the outcome of sick neonates admitted with various morbidities in Government and Private NICUs.

Discussion

This study was carried out in the Government and Private Neonatal Intensive Care units (NICUs) of urban Allahabad on 1409 sick neonates admitted during the study period. There were 753 neonates in Government and 656 neonates in Private Neonatal Intensive Care Units included in the study.

In this study, the maximum admissions (21.4%) in the NICUs were caused because of Prematurity followed by Neonatal Sepsis (19.3%). Neonatal jaundice accounted for 16.2%, Respiratory Distress Syndrome (RDS) 14.5%, Birth Asphyxia and Hypoxic Ischemic Encephalopathy (HIE) 14.3%, Meconium Aspiration Syndrome (MAS) 7.7% and the remaining 6.5%. When observed separately in Government and Private hospitals, it was observed that most common morbidity in Government sector was Neonatal Sepsis (26.69%) and in Private set ups, the most common was Prematurity (20.57%). In Government NICU, Neonatal Sepsis was followed by Prematurity (22.17%), Birth Asphyxia (13.54%), Neonatal Jaundice (13.01%), RDS (12.48%) and MAS (4.51%). In Private NICU, Prematurity was followed by other morbidities. Neonatal Jaundice accounted for 19.81%, RDS (16.76%), Birth Asphyxia/HIE (15.24%), MAS (11.43%) and Neonatal Sepsis (10.82%). This type of variation in the morbidity profile of Government and Private NICU could be because the Government NICU received babies delivered at lower centres and the neonates requiring urgent referral were referred to tertiary centre without stabilizing the baby and without maintaining the asepsis so the child presented with the complicated sepsis while in Private NICU, the inborn

deliveries were common so the infections could be controlled and the babies presented with the other morbidities, the most common being the Prematurity. The morbidities other than Neonatal Sepsis had a comparable numbers in both the NICUs except MAS which is relatively higher in Private NICU than Government NICU.

Syed R Ali et al. [10] reported majority (27.9%) Prematurity and Neonatal Sepsis (20.35%), Birth Asphyxia (13%) and Neonatal Jaundice (11.3%) in a study on the disease pattern and outcome of patients admitted in NICU of urban Pakistan. Tallat Seyal et al. [11] observed 23.5% Prematurity cases followed by 21.9% Neonatal Sepsis and 18% Birth Asphyxia cases in their study done at neonatal unit of Sir Gangaram Hospital, Lahore which is similar to the Private NICU of this study. Similar to the Government NICU of this study, Imoudu IA et al. [12] described the morbidity and mortality pattern of inpatients admitted in Sick Baby Care Unit of Federal Medical Centre, Azare, Nigeria and found that Neonatal Sepsis (32.9%) was the most common morbidity followed by Prematurity (23.8%). PV Sridhar et al. [13] found that the Neonatal Sepsis (28.8%) was the most cause of admission in NICU of Mandya Institute of Medical Sciences, Mandya. Veena Prasad et al. [14] conducted a study in NICU, Kumaun, Uttarakhand and found prematurity (20.8%) was the most common cause of admission followed by Neonatal Jaundice (19.84%) and supports the findings of Private NICU of urban Allahabad where prematurity accounts for 20.57% followed by Neonatal Jaundice (19.81%). Lalita T Chinte et al. [15] found in the hospitalized neonates at Government Medical College, Latur that Prematurity was 52.11% and Neonatal Sepsis was 43.66%. Elhassan M et al. [16] reported LBW (25.4%) was the most common cause of admission followed by infections (24.8%). Naeem Akram Butt et al. [17] reported LBW (40.54%) as the most common morbidity followed by Birth Asphyxia (24.3%), Neonatal Jaundice (17.9%), Prematurity (16.5%), Neonatal Sepsis (16%) and MAS (6%). Mostafa A Arafa et al. [18] found Prematurity with respiratory problems (31%) to be the most common cause of admission followed by RDS (27%) and Birth Asphyxia (7.6%).Contrary to these studies, Begum NN et al. [19] found Birth Asphyxia (52.1%) to be the most common cause for admission. Other causes for admission were Prematurity (30.6%), Neonatal Jaundice (23.6%) and Neonatal Sepsis (15.8%). Mani Kant Kumar et al. [20] reported the morbidity pattern of neonates at NICU, Rohtas, Bihar as Prematurity (38.6%), Neonatal Sepsis (23.3%), Neonatal Jaundice (20.4%) and Birth Asphyxia (18.2%).

In the present study, the outcome of admitted neonates was statistically significant in Birth Asphyxia, Prematurity, Neonatal jaundice and Others across both the sectors. The outcome could vary because the severity of illness varied in both the NICUs, which could not be graded.

Conclusion

- In this study, the maximum admission in the NICUs was caused because of Prematurity followed by Neonatal Sepsis. It was observed that the most common morbidity in Government settings was Neonatal Sepsis followed by Prematurity, Birth Asphyxia, Neonatal Jaundice, RDS and MAS. In Private sector, Prematurity was the most common followed by other morbidities. The outcome was the best for RDS & the worst for Prematurity in Government sector while the best

outcome in Private sector was with Neonatal Jaundice & the worst for Prematurity.

Recommendations
It is recommended to promote institutional deliveries, timely initiation of effective life saving interventions & appropriate referral which would reduce the chances of succumbing to death.

Conflict of Interest: None declared.
Ethical Approval: The study was approved from Institutional Ethical Committee.

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