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Original Article

Paediatrics Section

Incidence, Morbidity Pattern and Outcomes among Preterm Babies Admitted in Special Newborn Care Unit: A Retrospective Observational Study from Nellore, Andhra Pradesh, India

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ABSTRACT

Introduction: Neonatal mortality and morbidity remain a significant challenge in India, accounting for 24% of global neonatal mortality. Special Newborn Care Units (SNCUs) have been established to address this issue. Therefore, it is important to evaluate the outcomes of SNCUs by measuring morbidity patterns and hospital stays among preterm neonates in these units.

Aim: To evaluate the incidence, morbidity patterns and outcomes of preterm neonates admitted to the SNCU.

Materials and Methods: This was a retrospective observational study conducted at ACSR Government Medical College, Nellore, Andhra Pradesh, India, from January 2020 to December 2022, during which 4,135 neonatal admissions were analysed. The study included all preterm newborns admitted to the SNCU. Additionally, only live births were included to ensure consistency in data analysis. The variables studied included gender, prematurity, birth weight, twin gestations, inborn/outborn status, outcomes in terms of mortality and morbidity, and complications. The Chi-square test was used for analysing differences in proportions.

Results: Out of 4,135 neonates, 1,559 (37.7%) were preterm, with annual variations of (494/1,461) 33.8% in 2020, increasing to (542/1,322) 41% in 2021, before slightly decreasing to (523/1,352) 38.7% in 2022. Among the preterm neonates, 809 (51.9%) were males and 750 (48.1%) were females. Early preterm births (≤32 weeks' gestation) constituted 69% (1,076) of the cases, while late preterm births accounted for 31% (483). Co-morbidities included Respiratory Distress Syndrome (RDS) 1,141 (73.2%), Low Birth Weight (LBW) 637 (40.9%), and birth asphyxia 139 (8.9%).

Conclusion: There was a relatively high incidence of preterm births in the SNCU. Mortality was observed to be notably higher among outborn neonates compared to inborn neonates, particularly due to RDS and sepsis. The study underscores the significant burden of preterm births in Nellore, highlighting the need for enhanced perinatal care, early referral systems and targeted interventions to mitigate neonatal morbidity and mortality in this region.

Keywords: Mortality, Perinatal care, Prematurity, Respiratory distress syndrome, Sepsis

INTRODUCTION

India faces a persistent challenge in addressing neonatal mortality and morbidity, accounting for up to 24% of global neonatal deaths [1-3]. To tackle this critical public health issue, the government has established SNCUs as part of its comprehensive strategy to reduce infant mortality. Common morbidities in SNCUs include neonatal jaundice, sepsis, respiratory distress and prematurity [2,4,5]. Low Birth Weight (LBW) and preterm births are major contributors to neonatal morbidity and mortality [1,2].

Preterm birth, defined as delivery before 37 completed weeks of gestation, remains a significant public health challenge globally and is a leading cause of neonatal mortality and morbidity [6]. According to the World Health Organisation (WHO), India contributes the highest number of preterm births worldwide, accounting for nearly 3.5 million cases annually [7]. These preterm babies are highly vulnerable to various health complications, including RDS, sepsis, feeding difficulties and long-term neurodevelopmental disabilities [8].

SNCUs play a pivotal role in the management of preterm neonates in India, providing critical care and improving survival rates [9]. However, the burden of preterm births and their associated morbidity and mortality patterns vary significantly across regions, influenced by socio-economic, healthcare and demographic factors. Understanding these variations is crucial for tailoring healthcare interventions and optimising neonatal outcomes [3]. Minimally invasive therapeutic procedures and the presence of parents during hospitalisation play a significant role in reducing the consequences in a premature child [10].

The Nellore district in Andhra Pradesh, India, represents a region with a high burden of preterm births. However, data on the incidence, morbidity patterns, duration of hospital stay and outcomes of preterm neonates admitted to SNCUs remain scarce. A systematic evaluation of these parameters is essential to identify gaps in care, prioritise resource allocation, and develop region-specific strategies to reduce neonatal morbidity and mortality. With this background, this study aimed to assess the incidence of preterm births, explore their morbidity patterns and evaluate the outcomes among preterm neonates admitted to the SNCU at a tertiary care hospital in Nellore, Andhra Pradesh, India. The findings from this study will provide critical insights into the challenges associated with preterm care in

this region and help inform evidence-based interventions to improve neonatal health outcomes.

MATERIALS AND METHODS

This was a retrospective observational study conducted at the SNCU of ACSR Government Medical College, Nellore, Andhra Pradesh, India. The study period spanned three years, from January 2020 to December 2022, with data analysed from January to March 2023. The study was approved by the Institutional Ethics Committee of ACSR Government Medical College (IEC approval number: ECR/961/Inst/AP/2017/RR-20/83-22/28-04-23).

Inclusion criteria: All live preterm births admitted to the SNCU during the study period were included in the study.

Exclusion criteria: All term babies and preterm babies with congenital anomalies were excluded from the study.

Sample size: The sample size consisted of all eligible preterm newborns admitted during the study timeframe.

Data collection: Data were collected retrospectively through a SNCU admission register and individual case files. Parameters assessed included demographic characteristics (gestational age, birth weight, gender), morbidity patterns (RDS, sepsis, hyperbilirubinaemia, necrotising enterocolitis, intraventricular haemorrhage and retinopathy of prematurity), and outcomes (survival, mortality and causes of death).

STATISTICAL ANALYSIS

Descriptive analysis was conducted using frequency and proportion for categorical variables. The Chi-squared test was employed to assess the statistical significance of cross-tabulation between unpaired categorical variables. A p-value of <0.05 was considered statistically significant. Data were analysed using coGuide software, version 2.0 [11].

RESULTS

This study analysed 4,135 births from 2020 to 2022, revealing an overall preterm birth rate of 37.7% (1,559 out of 4,135). The highest proportion of preterm births was observed in 2021 at 41%, while 2020 had the lowest at 33.8% [Table/Fig-1].

Year	Pre-term	Full-term
2020 (n=1461)	494 (33.8%)	967 (66.2%)
2021 (n=1322)	542 (41%)	780 (59%)
2022 (n=1352)	523 (38.7%)	829 (61.3%)
Total (n=4135)	1559 (37.7%)	2576 (62.3%)

[Table/Fig-1]: Proportion of preterms in the study subjects (N=4135).

Among the 1,559 preterm neonates, 809 (51.9%) were male and 750 (48.1%) were female. Early preterm births (≤32 weeks' gestation) constituted 1,076 (69%) of cases, while late preterm births (34-36 weeks' gestation) accounted for 483 (31%). Twin gestations were present in 167 (10.7%) of preterm neonates. Based on birth weight classification, 124 (8%) were classified as Extremely Low Birth Weight (ELBW), 1,023 (65.6%) as Very Low Birth Weight (VLBW), and 412 (26.4%) as Low Birth Weight (LBW). A higher proportion of preterm neonates were inborn, with 986 (63.2%) compared to outborn neonates at 573 (36.8%) [Table/Fig-2].

Trends in inborn and outborn preterm admissions: The proportion of inborn preterm neonates decreased over the years, from 344 (65.15%) in 2020 to 338 (62.81%) in 2021 and further down to 304 (57.53%) in 2022. Conversely, the proportion of outborn preterm neonates increased from 150 (34.84%) in 2020 to 219 (42.46%) in 2022 [Table/Fig-3].

Parameters	n (%)
Gender	
Male	809 (51.9)
Female	750 (48.1)
Prematurity	
Early Preterm (32 to 33 weeks 6 days)	1076 (69.0)
Late Preterm (34 weeks to 36 weeks 6 days)	483 (31.0)
Twin gestation	
Yes	167 (10.7)
No	1392 (89.3)
Weight group (g)	
ELBW (<1000)	124 (8.0)
VLBW (1000 to 2000)	1023 (65.6)
LBW (2000 to 2500)	412 (26.4)
Inborn/Outborn	
Inborn	986 (63.2)
Out born	573 (36.8)

[Table/Fig-2]: Distribution of baseline data of study population (N=1559). ELBW: Extreme low birth weight; VLBW: Very low birth weight; LBW: Low birth weight

Year	Inborn/ Outborn	LAMA	Discharge	Died	Referred
		n (%)	n (%)	n (%)	n (%)
2020 (n=494)	Inborn (n=344) (69.63%)	40 (11.6)	255 (74.0)	41 (12.1)	8 (2.3)
	Outborn (n=150) (30.36%)	20 (13.3)	104 (69.3)	26 (17.3)	0
2021 (n=542)	Inborn (n=338) (62.36%)	29 (8.6)	230 (68.1)	74 (21.9)	5 (1.4)
	Outborn (n=204) (37.63%)	14 (6.9)	105 (51.5)	81 (39.7)	4 (1.2)
2022 (n=523)	Inborn (n=304) (58.12%)	12 (4.0)	221 (72.7)	69 (22.7)	2 (0.7)
	Outborn (n=219) (41.87%)	14 (6.4)	141 (64.4)	58 (26.5)	6 (2.7)
Total (n=1559)	Inborn (n=986) (63.24%)	81 (8.2)	706 (71.6)	184 (18.7)	15 (1.5)
	Outborn (n=573) (36.75%)	48 (8.4)	350 (61.1)	165 (28.8)	10 (1.7)

[Table/Fig-3]: Year-wise outcome of inborn and outborn neonates admitted to SNCU (2020–2022) (N=1559).

Outcome distribution of the 1,559 preterm neonates: Of the preterm neonates, 706 (71.6%) inborn neonates and 350 (61.1%) outborn neonates were discharged after treatment, while 184 (18.7%) of inborn neonates and 165 (28.8%) outborn neonates died during hospitalisation [Table/Fig-3].

Morbidity profile: RDS was the most common diagnosis, observed in 1,141 (73.2%) of cases. LBW care was observed in 637 (40.9%) of neonates. Birth asphyxia (8.9%) and neonatal sepsis (3.7%) were other significant diagnoses. Neonatal jaundice (2.3%) and metabolic complications (1.1%) were also noted. Congenital anomalies, including congenital heart disease (1.0%), spina bifida

(0.1%), hydrocephalus (0.3%), and meningomyelocele (0.1%), were encountered less frequently [Table/Fig-4].

Diagnosis	n (%)
RDS/HMD	1141 (73.2)
Birth asphyxia	139 (8.9)
Sepsis	58 (3.7)
Neonatal jaundice	36 (2.3)
Metabolic complications	17 (1.1)
Low Birth Weight (LBW) care	637 (40.9)
Syndromic baby	3 (0.2)
HBsAg positive mother	3 (0.2)
Meningomyelocele	2 (0.1)
Spina Bifida	2 (0.1)
Hydrocephalus	4 (0.3)
Congenital heart disease	16 (1.0)
Others (LOS, EOS, TTNB, IUGR)	81 (5.2)

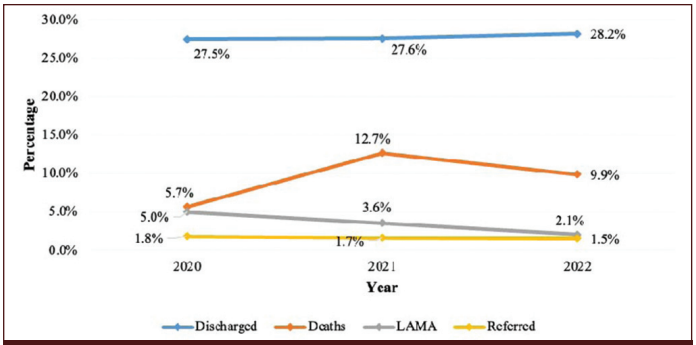
[Table/Fig-4]: Distribution of primary diagnoses of the study population (N=1559).
RDS: Respiratory distress syndrome; HMD: Hyaline membrane disease; LOS: Late onset sepsis; EOS: Early onset sepsis; TTNB: Transient tachypnoea of newborn; IUGR: Intrauterine growth retardation

Yearly trends in prematurity: The difference in prematurity across study years (early preterm births vs late preterm births) was not statistically significant (p-value=0.187) [Table/Fig-5].

Year	Prematurity		p-value
	Early preterm (<34 weeks)	Late preterm (>34 weeks)	
2020 (n=494)	333 (67.4%)	161 (32.6%)	0.187
2021 (n=542)	390 (72%)	152 (28%)	
2022 (n=523)	353 (67.5%)	170 (32.5%)	

[Table/Fig-5]: Distribution of prematurity across the study years (N=1559).

Comparative analysis of aetiology-specific mortality between inborn and outborn neonates: Death due to hyaline membrane disease/RDS was significantly higher among outborn neonates (132, 23%) compared to inborn neonates (139, 14.1%), with a statistically significant difference (p-value <0.001). Sepsis-related mortality was also significantly higher among outborn neonates (49, 8.6%) compared to inborn neonates (44, 4.5%) (p-value <0.001). Other causes of death did not show statistically significant differences [Table/Fig-6,7].



[Table/Fig-6]: Trends in discharge, mortality, LAMA, and referral outcomes (%) among preterm neonates admitted to SNCU (2020-2022).

Cause of death	Inborn (986)	Outborn (573)	p-value
HMD/RDS (n=271)	139 (14.1)	132 (23)	<0.001
Birth asphyxia (n=57)	39 (3.9)	18 (3.14)	0.409
Sepsis (n=93)	44 (4.5)	49 (8.6)	<0.001
CHD (n=16)	8 (0.81)	8 (1.39)	0.269
TTNB (n=2)	2 (0.2)	0 (0)	0.281
Hydrocephalus (n=3)	2 (0.2)	1 (0.18)	0.92
Aspiration Pneumonia (n=7)	3 (0.3)	4 (0.7)	0.262
MAS (n=2)	2 (0.2)	0	0.281
Hypoglycaemia (n=1)	1 (0.1)	0	0.446

[Table/Fig-7]: Comparison of aetiology specific mortality across inborn/out-born preterm.

DISCUSSION

Preterm birth remains a major global health concern, contributing significantly to neonatal morbidity and mortality. In this study, the proportion of preterm births among neonates admitted to the SNCU was 37.7%, with year-wise variations of 33.8% in 2020, 41% in 2021 and 38.7% in 2022. These findings are consistent with studies conducted in similar hospital-based settings in India, where preterm birth rates range between 22% and 40% [12-15]. The differences in incidence may be attributed to variations in access to antenatal care, maternal risk factors and referral patterns.

Among the preterm neonates in this study, early preterm births constituted 69%, while late preterm births accounted for 31%. This pattern contrasts with community trends, where late preterm births are generally the majority [13,16]. Additionally, some non medical college district hospitals have shown different trends with a lower prevalence of preterm births in the SNCU [17]. However, in hospital settings, it is typically the early preterms that become more severely ill and hence are admitted to the SNCU. Male preponderance (51.9%) was observed in this cohort, which was consistent with previous studies that suggest a higher vulnerability of male neonates to preterm-related complications due to sex-linked genetic and hormonal factors [18].

Twin gestations contributed to 10.7% of preterm births, which was comparable to earlier studies reporting a prevalence of 8-12%. The high proportion of VLBW neonates (65.6%) is concerning, as these neonates are at an increased risk of complications such as RDS, sepsis, and feeding difficulties, similar to findings by Malkar VR et al., and Kshirsagar VD and Rajderkar SS [12,13].

The proportion of inborn preterm neonates decreased from 69.64% in 2020 to 58.12% in 2022, while the proportion of outborn admissions increased. This trend could indicate improved referral mechanisms or an increasing burden on tertiary care centres. A similar high rate of outborn admissions was reported in other SNCUs in India, highlighting the need to strengthen peripheral neonatal care to reduce outborn admissions and the subsequent risks associated with transport and delayed interventions [15,18]. This study also reported higher mortality among outborn babies, further emphasising the importance of timely referrals, as indicated by other studies [1,19].

RDS was the most common aetiology (73.2%), which is significantly higher than in most studies, where the rates range from 10% to 20% [9,10,12,15]. A similar study conducted at the same location at a different time (2019) reported a rate of 40.2% [20].

The high burden of RDS can be attributed to the exclusive inclusion of preterm infants in this study, who often present with surfactant deficiency and underdeveloped lungs. LBW was observed in 40.9% of cases, and birth asphyxia was present in 8.9%, which was in agreement with previous studies highlighting these conditions as major contributors to neonatal morbidity and mortality [12,15]. Furthermore, this study reported higher RDS-related mortality in outborn babies compared to inborn babies, which was consistent with findings from studies in the Himalayan region [21].

Sepsis was noted in 3.7% of cases, which aligns with some previous studies [12,13]. However, other studies, such as that by Sinha R et al., reported a significantly higher proportion of sepsis, nearly 30%, which is almost ten times more than in the present study [14]. This variation may be due to differences in infection control practices and the early initiation of antibiotics. Congenital anomalies were rare, with congenital heart disease accounting for 1%, which aligns with global estimates of 0.8-1.5% [22]. Similar proportions were observed in other SNCUs across India [12-14].

The overall mortality rate among preterm neonates was 22.4%, which was comparable to previous studies [15]. Another study conducted in Karnataka reported a lower rate of 0.9% [23]. However, in a study by Malkar VR et al., the mortality rate was only 11% [12], while a study of an SNCU in Jammu reported a mortality rate of just 3%, although it had a high referral rate [15]. Sahu S and Subbarayalu Y reported that 71% of the study participants were discharged, while the remaining either expired, were left against medical advice (LAMA), or were referred, which was similar to the current study [15].

This study did not include data on the decadal trend of mortality in the SNCU over the years; however, a ten-year dataset from Gujarat indicated a reduction in mortality of over 90% within ten years, suggesting improvements in the functioning of SNCUs over time [24].

The leading causes of death were RDS, followed by sepsis. This aligns with a study conducted in Kashmir, which reported sepsis (27.4%) as the leading cause of death [18]. The significantly higher mortality among outborn neonates due to RDS and sepsis underscores the impact of delayed interventions and suboptimal resuscitation at referral centres; findings that are echoed in earlier studies. Additionally, another reason for the high incidence of RDS in this study is the exclusive inclusion of preterm babies, in comparison to other studies. Consequently, similar higher proportions of RDS-related deaths have been reported from medical college SNCUs in Karnataka and across the whole state of Gujarat [19,25,26].

Birth asphyxia-related mortality did not show statistical significance, indicating the emergency nature of the condition and the necessity for immediate management. Other studies reported that birth asphyxia, respiratory distress and sepsis were leading causes of death [1,5]. The presence of congenital heart disease and metabolic complications was less frequent, with no significant difference in mortality patterns, which was consistent with findings from other tertiary care units in India.

Limitation(s)

This study was limited by its retrospective nature and reliance on hospital records, which may have resulted in some missing data. Additionally, long-term neurodevelopmental outcomes were not assessed.

CONCLUSION(S)

This study highlights the significant burden of preterm births and the associated morbidity in a tertiary care setting. The increasing trend of outborn admissions and their higher mortality rates emphasise the need for strengthening perinatal care in peripheral areas and improving efficient referral mechanisms. RDS and sepsis remain the primary causes of mortality, necessitating enhanced neonatal resuscitation and infection control measures. Improving maternal care services and ensuring timely interventions can help enhance survival and outcomes in preterm neonates. Future research should prioritise prospective multicentre studies across diverse regions to identify setting-specific risk factors for preterm outcomes, as well as longitudinal follow-up studies to assess long-term neurodevelopmental and physical outcomes.

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