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Research Article

EVALUATION OF MORBIDITY AND MORTALITY OF THE NEWBORN ADMITTED TO SPECIAL NEWBORN CARE UNIT

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ABSTRACT

Objectives: Under the facility-based newborn care scheme (FBNC), special newborn care units (SNCUs) are being established in India with the primary motto of reducing the neonatal mortality rate (NMR).

Methods: The present study was a retrospective study conducted for 2 years to gain knowledge of the functioning of SNCU, and its morbidity and mortality pattern of sick newborn attending were evaluated in the present research. The study was conducted at SNCU, SVRRGGH, Tirupati. The total admissions were male, referrals from outside facilities, and low birth-weight newborns.

Results: The overall leading cause of admissions was birth asphyxia-related morbidity (BA) (24%), infections (22.2%), followed by respiratory distress syndrome (RDS) (15.3%). The causes of mortality were BA (33.2%), followed by RDS (27%) and infections (16.4%). The case fatality rates of RDS (45%) were the highest, followed by meconium aspiration syndrome (40%) and BA (35.6%). Although morbidity was high, case-fatality rate of infections (16.4%) was low.

Conclusion: This study has highlighted the deficiencies at SNCU influencing the outcome of admitted newborns, thus guiding steps for improvisation.

Keywords: Birth asphyxia, Birth weight, Case fatality rate, Morbidity, Mortality, Respiratory distress syndrome, Special newborn care units, Inborn, Out born.

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INTRODUCTION

Throughout the past several decades, there has been a significant decline in child mortality worldwide. Worldwide, the Under-5 Mortality Rate has decreased by 56%. Nonetheless, neonatal fatalities showed a rising trend, accounting for 46% of all deaths in children under five in 2016, up from 41% in 2000. South Asia experienced 39% of all infant fatalities worldwide [1]. India contributed 24% of all newborn fatalities worldwide. In India, the neonatal mortality rate (NMR) accounts for 58% of infant fatalities and 74% of infant deaths. 25/1000 live births are the NMR [2]. Pre-term delivery (35%), neonatal infections (33%), birth asphyxia (20%), and congenital disabilities (9%) account for the majority of newborn mortality in India [3]. Therefore, care for ill newborns is required to significantly lower NMR in India. The Reproductive and Child-Health program (RCH)-II, which incorporates treatments that enhance child health and tackle variables that contribute to a neonatal, infant, and under-five mortality, was launched by the National Rural Health Mission (NRHM) to address the needs of child health. Facility-based newborn care (FBNC) is one such initiative launched to address NMR reduction [4]. A focus is placed on establishing facilities for the care of sick newborns, such as Special Newborn Care Units (SNCUs) at district hospitals, Newborn Stabilization Units (NBSUs) at community health centers/First Referral Units, and Newborn Baby Corners (NBCCs) [5] at each facility where deliveries are taking place, attached to the labor room and operation theater (OT) for the provision of essential newborn care [4]. Hence, the SNCU is a neonatal unit that treats all unwell babies except those who need significant surgery or assisted ventilation. The SNCU is anticipated to offer services such as postnatal care, follow-up of high-risk babies, referral services, immunization services, care at birth, including resuscitation of asphyxiated newborns, managing unwell newborns, and care at birth [4]. As a result, the FBNC is establishing SNCU and strengthening NICU (Neonatal Intensive Care Unit) in the district and tertiary care hospitals. Despite the implementation of various health-related programs, accurate data on morbidity and mortality of unwell newborns is still not readily available. As a result, the present study intends to fill in information gaps regarding data on the morbidity and death patterns of sick newborns attending SNCU, Sri Venkateswara Ramnarayan Ruia Government General Hospital (SVRRGGH), Tirupati, and an evaluation of the influence of SNCU on newborn care. The study has been done every 2 years since the establishment of SNCU in 2013. The main scope of this study is to correlate the 2 years-2015 and 2016 SNCU data by considering the admissions and deaths categorically in related categories of sex, place of birth, birth-weight, and gestation, compare the pattern of morbidity and case-fatality rate in various morbidities and finally, the overall outcome of newborns admitted.

METHODS

A retrospective study was conducted at SNCU, SVRRGGH, Tirupati. This SNCU caters as a referral center to Chittoor and adjoining districts such as Kadapa, Nellore, and others, as it is attached to a Medical College and provides even advanced level-III care. The SNCU is equipped with basic facilities of radiant warmer, phototherapy units, oxygen therapy, infusion pumps, various medical drugs, and basic laboratory support. Trained doctors able to perform invasive procedures such as lumbar puncture, surfactant administration, exchange transfusion, and ventilation (non-invasive-bubble CPAP units and invasive- Mechanical Ventilators) are available around the clock. The SNCU has 18 beds, with eight inborn and 10 outborn beds in level II and 15 beds in level III, 28 beds for level-I care. A separate Kangaroo Mother Care (KMC) ward is provided for pre-term and low birth weight newborns with 11 beds and KMC chairs. Hospital stay, drugs, and investigations are accessible to all babies admitted to SNCU.

Study design

This was a hospital-based, retrospective, and cross-sectional study.

Sample size
Total number of newborns admitted in 2015–2016 SNCU was included in the study.

Study setting
The study was conducted bySNCU at SVRRGGH, Tirupati.

Study period
The duration of the study was 2 years from January 1, 2015, to Deember 31, 2016.

Institutional ethics approval
Ethical clearance was obtained on March 5, 2016, from the IEC (Institutional ethical committee) of SV Medical College. Approval number - Lr. No.22/2016

Scientific approval
On February 23, 2016, at the 1st Research Advisory Committee (RAC) meeting.

Inclusion criteria
Data of all the newborns admitted during the study period were included in the study.

Exclusion criteria
Data of newborns, Treated on an outpatient basis, Referred with minor complaints, who came for follow, Brought dead to the facility, and Admitted under pediatric surgery were all excluded from the study.

Data from SNCU from January 1, 2015, to December 31, 2016, were collected online from the SNCU website, and any gaps were filled from nominal registers maintained at SNCU. Data regarding admissions and deaths concerning sex, place of birth, birth weight, gestational age, duration of stay, specific morbidities, and the overall outcome were collected and analyzed. The study's diagnosis of neonatal illness and cause of death was made using clinical information based on working definitions of the South-east Asia regional Neonatal-Perinatal Database WHO [5,6]. To prevent overlapping of cases in different categories of morbidities, the primary disease was considered the final diagnosis even when the baby developed complications of primary infection or had more than one disease. No autopsy was done to confirm the cause of death. The definitions of the following terminologies are used in the study from the source mentioned above [6].

- Intramural/inborn-birth of a baby in the same facility,
- Extramural/outborn- the birth of a baby outside the facility and referred here.
- Low birth-weight (LBW) < 2.5 kgs, very LBW < 1.5 kg), extreme LBW < 1 kg)
- Respiratory distress syndrome (RDS), meconium aspiration syndrome (MAS), birth asphyxia (BA), septicemia, pneumonia, meningitis (Sepsis), major congenital malformations (MCM) [6].

Data analysis
The data were collected, and data analysis was done using percentages, proportions, Chi-square test, and p values. Variables on nominal types of data were compared using Chi-square. "p" < 0.05 was considered significant.

RESULTS

A total of 4019 newborns were admitted to SNCU during the study period. The total admissions increased from 2015 to 2016 (p>0.05). Out of the total admissions, a larger proportion was male neonates (58.3%) (p<0.001), outborn (referrals from the outside facility was more than 62.5%) (p<0.001) and terms (52%) (p<0.001). Admissions of LBW neonates (55.4%) predominated the normal birth-weight newborns (p<0.001). The morbidity pattern of admitted newborns was analyzed. The overall leading cause of admissions in the year 2015 was BA (23.5%) related morbidity, followed by RDS (17.5%) and sepsis (17.5%).In 2016, sepsis (26.8%) became the most common reason for admissions, followed by BA (24%) and RDS - 13%. Apart from these, the other causes of admissions were Jaundice requiring phototherapy, MCM, MAS, and others. The average duration of stay in 2015 was 8.6 days and in 2016 was 10 days. The average duration of stay of the inborn was less than the outborn (p=0.359). The outcome of newborns admitted was represented in Table 1 as discharge (60.4%), deaths (25.6%), referral to higher center (%), and cases that left against medical advice (LAMA). Among the deaths that occurred, an analysis was made based on different variables. There was no difference in outcome based on the place of birth (χ^2=0.16, p=0.69) and gestational age (χ^2=0.96, p=0.327) of neonates. The ratio of inborn deaths/inborn admissions was 33%, ratio of outborn deaths/outborn admissions was 22%. However, birth-weight of neonates had a significant impact (p<0.001) on the outcome. Higher percentage of discharges occurred in normal birth weight (>2.5 kg – discharge rate in inborn – 77%, outborn – 86%) (1.5–2.5 kg inborn – 71%, outborn – 81%) (1–1.5 kg inborn – 44%, outborn – 55%) (<1 kg inborn – 7%, outborn – 39%) and <1 kg neonates had highest death rates (<1 kg – inborn – 93%, outborn – 61%) (>2.5 kg – Inborn – 23%, outborn – 14%). The mortality pattern in specific morbidities was analyzed. The overall leading cause of death in the years 2015–16 was BA-related morbidity (33.2%), followed by RDS (27%) and infections (16.4%). Other causes of deaths were – prematurity – 5%, MCM – 5%, MAS – 5%, others – 9%. The case-fatality rate (CFR) and proportional mortality rate (PMR) for each disease have been discussed (Fig. 1). The CFR of RDS has increased (p=0.007) from 2015 to 2016 – Inborn (p<0.001), outborn (p=0.11). There is no significant difference in the CFR of inborn and outborn. The PMR is also in an increasing trend χ^2=1.185, p=0.28. In intramural cases, admissions have decreased, but CFR has increased drastically (p=0.03), indicating most of the cases admitted were of severe morbidity, which subsequently had high mortality. In extramural cases, both number of admissions and mortality have increased (p=0.5). There is a significant difference (p=0.003) in CFR of inborn and outborn babies with high mortality rates contrary to expectation. The PMR is also on a rising

Table 1: Outcome of admitted newborns to SNCU

Study name	Admissions	Discharge	Referral	LAMA	Deaths
2015	1980	1142 (58%)	32	305	501 (25.3%)
2016	2039	1231 (60.4%)	52	233	523 (25.6%)
Total	4019	2373	84	538	1024
Chi-square	0.837	0.34	1.97	0.615	0.018
p-value	0.36	0.85	0.16	0.43	0.8942

SNCU: Special newborn care unit, LAMA: Left against medical advice

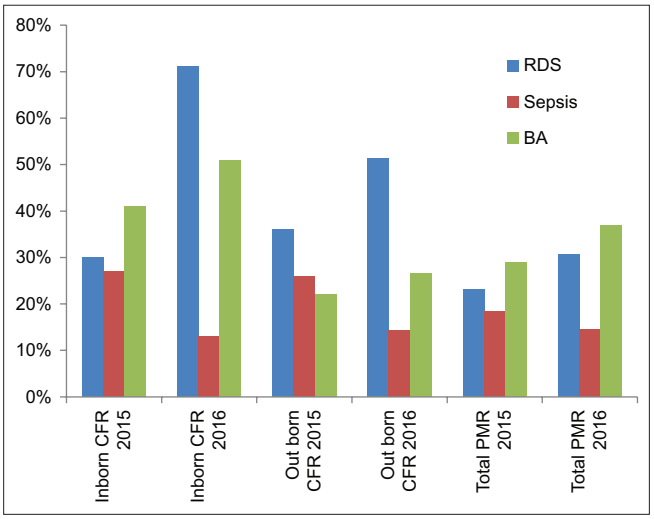

Fig. 1: Comparison of case-fatality rates and proportional mortality rates of various morbidities

trend. Although the percentage of admissions has increased from 2015 to 2016, the CFR (inborn – 15–16: p=0.03, outborn – 15–16: p=0.06) and PMR (p=0.5) of sepsis cases have decreased. There is no significant difference in CFR among inborn and outborn on a whole (p=0.88). The CFR has decreased in inborn (p=0.127) and outborn (p=0.113). The PMR has decreased too (p=0.325).

DISCUSSION

In the present study, the proportion of male admissions was higher. It was similar to previous study reports of SNCU India, Andhra report 13–15 [7], Neogi *et al.* [8], Garg *et al.* [9], and this is due to the male fetus being biologically more fragile [10]. The extra attention from caregivers as male children is more valued, most likely due to sociocultural factors in a traditionally patriarchal society. Regarding the admission source, this facility received a higher share from outside (63%) in contrast to studies – SNCU India, Andhra report 13–15 [7] and Neogi *et al.* [8] which had higher inborn admissions. The current research findings were compared with so many previous studies and depicted in Tables 2-4. This SNCU is best equipped with facilities even for Level-III care, so it gets referrals from districts around Tirupati, Chittoor, Kadapa, and Nellore. Therefore have more outborn cases. This can be a positive sign of the presence of a strong referral system. When the number of deaths based on place of birth was considered, there was no difference in the outcome, in contrast to studies like SNCU India, Andhra report 2013-15 [7], Neogi *et al.* [8], and Shah *et al.* [11]. The usual finding of being born in the same facility was having better survival chances as they had access to 24 × 7 timely newborn resuscitation. This might be due to the admission of relatively stable inborn cases at SNCU attached to Government Maternity hospital (GMH) and referral of only morbid and sick cases directly from the labor room to SNCU, SVRRGGH. Thus, inborn with high morbidity alone is admitted into the SNCU, SVRRGGH reflecting the same on the outcome. There was no difference in outcome based on gestational age in the present study, while many studies by Neogi *et al.* [8] and Garg *et al.* [9] showed better survival outcomes based on gestational age. LBW admissions (<2.5 kg) predominated our study in contrast to SNCU Andhra data (13–15) [7], where normal birth-weight (>2.5 kg) admissions were more. Birth weight had a significant impact (p<0.001) on outcomes similar to other studies like Shah *et al.* [11], making it a key independent prognostic factor. The morbidity pattern of admitted newborns was comparable with other studies, with the leading cause as BA, followed by sepsis and RDS. The percentage of BA admissions was similar to data of India, Andhra SNCU 13–15 [7] but was higher when compared to Shah *et al.* [11] and other studies. The CFR due to BA was high with inborn than outborn. This highlights the importance of antenatal and natal care during labor and timely newborn resuscitation support by trained staff in preventing BA. The sepsis admissions were higher (outborn exceeded inborn) than in other studies. This may be due to unhygienic delivery practices, no stringent aseptic precautions in newborn care, overcrowding, and insufficient health-care staff in peripheral health centers. Furthermore, prevailing widespread practices such as pre-lacteal feeds, indigenous drug administration, and early introduction of non-human milk, diluted and unclean, added to it. Although the CFR and the PMR of sepsis cases have decreased from 2015 to 2016 significantly, still the rates are higher when compared to studies like Sharma *et al.* [12]. An improvement is needed in the implementation of aseptic strategies, strict antibiotic policy, and audit of the work environment at SNCU. Furthermore, educating health-care providers and the masses on the importance of exclusive breastfeeding, simple infection prevention measures, and hazards of indigenous drugs and pre-lacteal feeds are important. The RDS admissions were almost similar to other areas in India. The most common cause of mortality in prematurity is RDS. CPAP and surfactant replacement therapy form the mainstay in managing moderate-to-severe RDS cases. Antenatal corticosteroid therapy for pregnant women in pre-term labor can prevent the complication of RDS in pre-term [13-15]. The CFR and PMR of RDS are high in the present study. This was due to a lack of CPAP (continuous positive airway pressure) machines (which were installed later in the mid-year of 2016) and Surfactant. This makes prevention of RDS a better approach than management, as the feasibility of the above in terms of cost and equipment maintenance is a challenge. In the present study, the discharge percentage was low, and deaths were more when compared to studies of SNCU but were similar to NICU studies like Garg *et al.* [9]. This can be explained as this SNCU provides extra level-III care (NICU care) along with level-II and Level-I care (which are basic functions of SNCU); its statistics reflect a NICU. All cases are managed here, even those requiring mechanical ventilation. SNCUs get referral of morbid cases not manageable at CHCs, district hospitals, and other SNCUs like GMH from the surrounding four districts. Only morbid cases delivered are referred after initial stabilization from GMH to SNCU, SVRRGGH (the distance between them is 450 m, and travel takes 2–3 min). Therefore, SNCU has a high mortality.

Table 2: Comparison of research findings of the present study with the previous studies

Study name	Discharge %	Referrals %	LAMA %	Deaths %
Present study 2015–2016				
2015 average	57.7	1.6	15.4	25.3
2016 average	60.4	2.5	11.4	25.6
Inborn	54.6	3.1	11.4	31
Outborn	60	0.7	18	21.6
Inborn	50.4	5.7	9	35
Outborn	66	0.8	12.8	20.5
SNCU India Report 13–15 [7]				
Inborn	79	7	4	10
Outborn	70	8	7	15
SNCU Andhra Report 13-15 [7]				
Inborn	78	7	7	8
Outborn	62	7	11	20
Average	72	-	-	12
Garg *et al*. [9]	65.5	5.4	4.2	25

SNCU: Special newborn care unit, LAMA: Left against medical advice

Study limitations

The present study being retrospective in nature could not analyze the epidemiological factors related to neonatal health especially socioeconomic background, antenatal, natal, and postnatal factors that

Table 3: Discussion on proportional mortality rate

Comparison of proportional mortality rate (PMR) of various studies						
Study name	**Prematurity related+RDS (%)**	**BA (%)**	**Sepsis (%)**	**MAS (%)**	**Major Conj (%)**	**Others (%)**
Present study	32	33.3	16.4	5.5	4.5	8.6
SNCU India 13–15 [7]	36	32	18	-	4	10
Andhra SNCU Report 13–15 [7]	43	32	14	-	-	-
Negogi *et al*. [8]		47	22	-	-	17 (LBW)
Garg *et al*. [9]	24	29	43	-	-	-

SNCU: Special newborn care unit, MAS: Meconium aspiration syndrome, BA: Birth asphyxia, RDS: Respiratory distress syndrome, LBW: Low birth-weight, Sepsis: Septicemia, pneumonia, meningitis

Table 4: Comparison of case fatality rates (%) in different studies

Comparison of case fatality rates (%) in other studies				
Study name	**RDS**	**BA**	**Sepsis**	**MAS**
Present study 2015–2016 average	33.5	31.4	26.5	47
	60	40	14	33.3
	45	35.6	18.8	40
Malik *et al.* [14]	52.6	15.9	29.4	
Sharma *et al.* [12]	0.8	6	1.8	0.6
Garg *et al.* [9]	77	30	38.3	

MAS: Meconium aspiration syndrome, BA: Birth asphyxia, RDS: Respiratory distress syndrome, Sepsis: Septicemia, pneumonia, meningitis

could have influenced the outcome like administration of antenatal steroids to mother. The morbidity and mortality data were dependent on the extent of data available retrospectively from case records and monthly reports updated in website. The data of neonates admitted in level-III care (NICU) and level-II care were combined and had no separate representation. This led to false projection of high mortality rates when compared to other studies based on SNCU. Detailed information of each neonate has not been collected. The aggregated data of indicators were taken into the study. The study has not explored the reasons behind the LAMA and referral to higher centers. Autopsy was not carried out to determine the pathologic cause of death in subjects and the cause was clinically determined by pediatricians.

RECOMMENDATIONS

Separate collection of data for newborns admitted at SNCU and NICU will help in correct projection and assessment of CFR and PMR. Separate protocols have to be formed for the care of newborn in NICU and SNCU. Data regarding the epidemiological factors related to neonatal health and maternal health have to be recorded. To counteract high CFR of RDS, guidelines for moderate-severe RDS management with CPAP and Surfactant have to be followed. Based on these recommendations, three new CPAP units have been brought in mid 2016. In continuation of this study with the next 2 years (2017–2018) of SNCU, the effectiveness of CPAP on RDS will be assessed.

CONCLUSION

Timely obstetric and newborn care is the key strategy to reduce morbidity and mortality in newborns. Since the mother and new born exist as a dyad, the care provided to the mother during the antenatal period has a significant bearing on newborn survival. Premature babies in India could be saved with simple, feasible, and cost-effective interventions such as the use of antenatal steroids, KMC, proper temperature regulation at birth, and simple infection prevention measures.

AUTHORS' CONTRIBUTIONS

First author of the study, ASK, contributed conceptual design and guided the work. The study's second author, BSK, contributed to drafting and correcting the manuscript. The third and corresponding author of the work MY performed the research and managed the data analysis. The fourth author of the study MP performed the statistical analysis. The fifth author MM collected the literature part of the study.

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CONFLICTS OF INTERESTS

Declared none.

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