Original Research Article

An Assessment of 7 Years' mortality pattern of Neonates Admitted in Special Newborn Care Unit (SNCU) of Jalgaon, Maharashtra

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Abstract

Background: An estimated 130 million babies are born each year and about 4 million of them die in the neonatal period. Facility Based Newborn Care has a significant potential for improving newborn survival. **Aims and objectives:** To study the neonates' mortality observed in Special Newborn Care Units (SNCUs) of a tertiary level hospital. **Materials and method:** The present descriptive observational study with longitudinal design was conducted in the Government- supported SNCU of District Hospital of Jalgaon District of Maharashtra. In the present study aggregated yearly data from January 2013 to December 2019 was collected. The collected data was entered in Microsoft excel and was analyzed by using Statistical Package for the Social Sciences (SPSS) version 20 (SPSS-Inc., IBM, USA). **Results:** Out of 16455 neonates admitted, 12939 (78.63%) were discharged after successful management and 1720 (10.45%) died during treatment. 654 (3.97%) were referred to higher center for further specialized management and 1142 (6.94%) were left the hospital against medical advice. Mortality among the outborns (790 out of 6594 i.e. 11.98%) was higher than that among the inborns (930 out of 9895 i.e. 9.40%). The difference was statistically significant ($\chi 2$= 28.23, $p<0.001$).Low birth weight babies (1362 out of 1720 i.e. 79.19%) had significantly higher proportional mortality that of normal birth weight babies 358 out of 1720 i.e 20.81%). Mortality among the preterm neonates (1047 out of 5452 i.e.20.38%) was significantly more than that among the fullterm (672 out of 11323 i.e 5.94%) neonates. Prematurity and respiratory distress syndrome were the common causes of death among both inborns (24.95% and 26.58%) as well as outborns (23.55% and 25.57).
Key words: SNCU, mortality, low birth weight.

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INTRODUCTION

An estimated 130 million babies are born each year and about 4 million of them die in the neonatal period.[1] Nearly 99% of all neonatal deaths occur in low- and middle-income countries. A quarter of the global neonatal deaths occur in India and little progress has been made in reducing it in the last decade. A combination of universal outreach and family-community care intervention at 90% coverage has been estimated to avoid 18 to 37% of neonatal deaths.[2]These interventions include family care of the new-born, essential new-born care, resuscitation of the new-born, care for low-birth-weight babies, and emergency new-born care. However, concurrent expansion and scaling-up of clinical care for sick neonates is essential to achieve the reduction in neonatal deaths to meet the millennium development goal for child survival.[2] Facility Based Newborn Care has a significant potential for improving newborn survival. Provision of newborn care facilities at various levels at health facilities will not only increase the confident in the health care delivery system

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but also increase the coverage of services at the time of greatest risk – birth and the first few days of life – and thus addresses the challenge of bringing down neonatal mortality in the country. Newborn Care Corner (NBCC), Newborn Stabilization Unit (NBSU) and Special Newborn Care Unit (SNCU) are newborn care facilities at MCH level I (PHC/SC), MCH level II (CHC/FRU) and MCH level III (District hospital/Medical College/tertiary care hospital) respectively.[3] The new-born health challenge faced by India is more formidable than that experienced by any other country in the world. It is estimated that out of 3.9 million neonatal deaths that occur worldwide, almost 30% occur in India. The traditional practices like applying cow dung on the umbilical stump, oil instillation into nose etc also contribute to new-born's risk of morbidity and mortality.[2] Facility Based Newborn Care (FBNC) at various levels performs critical role to strengthen care of sick, premature, and low birth weight newborn. Minimal or absence of data provides in-depth knowledge and views on newborn morbidity and mortality in larger proportions. Hence, the current study was aimed to assess the pattern of neonates' mortality observed in Special Newborn Care Units (SNCUs) of a tertiary level hospitals and medical college attached hospitals. [3]

Aims and objectives:

To study the neonates' mortality observed in Special Newborn Care Units (SNCUs) of a tertiary level hospital.

MATERIALS AND METHOD

The present descriptive observational study with longitudinal design was conducted in the Government-supported SNCU of District Hospital of Jalgaon District of Maharashtra. The SNCU is a 20 bedded unit and equipped with radiant warmer, phototherapy machines, ventilation facilities. Trained manpower including pediatricians, medical officers, nurses, counsellors, data entry operators, supportive staffs, etc. are posted. All services including stay, investigations, treatments are provided free of cost to the admitted neonates. Standard national level guidelines and protocols are practiced for the diagnosis and management of neonates as well as recording and reporting of the information. Permission from the head of institute was obtained before starting the study. Ethical approval was sought from the institutional ethical committee of Government Medical College, Jalgaon. Confidentiality of data was strictly maintained at all levels. All the neonates admitted in SNCUs were considered as the study participants. In the present study aggregated yearly data from January 2013 to December 2019 was collected. The source of information was SNCU reports generated from admitted (Indoor cases only) neonates. The SNCU monthly report is in a predefined format from Ministry of Health and Family Welfare, Government of India, which includes data on admission information, reasons of admission, course of admission, and mortality reasons (if any) with treatment outcomes. It also includes information on gender, birth weights, gestation age, and duration of stay. These participants were categorized into two sections as in-born, who have delivered in same facility and outborn, who have referred from peripheral health facilities or community. The outcomes were classified into four groups viz. Expired (died during the management), Discharged (discharged after successful treatment), LAMA (left against medical advice) and Referred (referred to higher centre for further management). The collected data was entered in Microsoft excel and was analysed by using Statistical Package for the Social Sciences (SPSS) version 20 (SPSS-Inc., IBM, USA).

RESULTS

Table 1: Distribution of neonates according to outcome

Outcome	Number	%
Referred	654	3.97
LAMA	1142	6.94
Expired	1720	10.45
Discharged	12939	78.63
Total	**16455**	**100.00**

There were total 16489 neonates were admitted in SNCU from 1st January 2013 to 31st December 2019. Out of these neonates out-comes of 16455 were available. Out of these 16455 neonates admitted, 12939 (78.63%) were discharged after successful management and 1720 (10.45%) died during treatment. 654 (3.97%) were referred to higher center for further specialized management and 1142 (6.94%) were left the hospital against medical advice. Mortality among male neonates was slightly higher than that among female neonates as out of 9187admitted male neonates 981 (10.68%) died as compared to 739 (10.12%) out of 7302female neonates. But this difference in mortality among males and females was found statistically insignificant ($\chi2= 1.35$, $p>0.05$).

Mortality among the outborns (790 out of 6594 i.e. 11.98%) was higher than that among the inborns (930 out of 9895 i.e. 9.40%). The difference was statistically significant ($\chi2= 28.23$, $p<0.001$). Low birth weight babies (1362 out of 1720 i.e. 79.19%) had significantly higher proportional mortality that of normal birth weight babies 358 out of 1720 i.e 20.81%). This difference observed was found statistically significant by Chi square test ($\chi2= 278.5$,$p<0.001$). It was observed that mortality rate was inversely proportional to the birth weight of neonates as mortality was 53.96%, 28.51%, 8.38% and 5.51% among the babies having birth weight <1000 gm, 1000 -1500 gm, 1500-2500 gm and >= 2500gm respectively. The association between neonatal mortality and birth weight was found statistically significant ($\chi2= 1587$, $p<0.001$).

Similar to the birth weight, maturity had significant impact on the mortality among the neonates.

Table 2: Association of various factors with neonatal outcome.

	Admission		Mortality		
	Number (n=16489)	%	Number (n=1720)	%	
Gender					
Male	9187	55.83	981(10.68%)	57.03	χ2= 1.35,
Female	7302	44.38	739 (10.12%)	42.97	p>0.05
Inborn/Outborn					
Inborn	9895	54.07	930 (9.40%)	60.01	χ2= 28.23,
Outborn	6594	45.93	790 (11.98%)	39.99	p<0.001
Birth Weight					
< 2500 Gms	9988	60.70	1362 (13.64%)	79.19	χ2= 278.5,
≥ 2500 Gms	6501	39.51	358 (5.51%)	20.81	p<0.001
Birth Weight					
<1000 Gms	391	12.57	211(53.96%)	2.38	χ2= 1587
1000-1499 Gms	1755	28.72	494 (28.15%)	10.67	p<0.001
1500-2499 Gms	7842	38.20	657 (8.38%)	47.66	df = 3
>=2500 Gms	6501	20.81	358 (5.51%)	39.51	
Maturity					
PRETERM	5162	60.47	1047 (20.38%)	31.37	χ2= 1587
FULLTERM	11323	39.07	672 (5.94%)	68.81	p<0.001
POSTTERM	4	0.06	1(25.00%)	0.02	df = 3
Gestational Age					
<28 Wks	97	3.60	62 (63.92%)	0.59	χ2= 1618
28 to<32 Wks	1417	30.29	521 (36.77%)	8.61	p<0.001
32 to<34 Wks	3160	24.13	415 (13.13%)	19.20	df = 4
34 to<37 Wks	488	2.85	49 (10.04%)	2.97	
37 to<42 Wks	11323	39.07	672 (5.93%)	68.81	
>=42 Wks	4	0.06	1 (25.00%)	0.02	
Category					
GEN	9622	55.06	947 (9.84%)	58.47	χ2= 16.68
OBC	3744	25.99	447(11.94%)	22.75	p<0.05
SC	1380	9.36	161 (11.67%)	8.39	df = 3
ST	1741	9.59	165 (9.48%)	10.58	
Not Available	2	0.00	0 (0.00%)	0.01	
Place of Delivery					
Hospital Delivery	15448	93.69	1559(10.10%)	90.64	χ2=30.15
Home Delivery	1041	6.31	161 (15.47%)	9.36	p<0.001
Transport					
Govt. Provided	2072	13.84	238(11.49%)	12.59	χ2= 2.82
Self-Arranged	14417	86.16	1482(10.28%)	87.61	p>0.05
Age on Admission					
< 1 day	9609	63.37	1090 (11.34%)	58.40	χ2= 73.49
1-3 Days	4795	29.65	510 (10.64%)	29.14	p<0.001
4-7 Days	1057	1.92	33 (3.12%)	6.42	df = 4
8-14 Days	467	2.27	39 (8.35%)	2.84	
>= 15 Days	561	2.79	48 (8.56%)	3.41	
Duration of Stay					
< 1 day	1693	10.29	380(22.45%)	22.09	χ2= 332.3
1-3 Days	9109	55.36	944(10.36%)	54.88	p<0.001
4-7 Days	3310	20.12	226(6.83%)	13.14	df = 3
> 7 Days	2343	14.24	170(7.26%)	9.88	

Mortality among the preterm neonates (1047 out of 5452 i.e.20.38%) was significantly more than that among the fullterm (672 out of 11323 i.e 5.94%) neonates. Also it was also revealed that mortality rate was inversely proportional to the gestational age of neonates as mortality was 63.92%, 36.77%, 13.13% , 10.04% and 5.93% among the babies having gestational age <28 weeks, 28-32 weeks, 32-34 weeks,34-37 weeks37-42 weeks respectively. As far as

distribution of neonatal mortality according to the category considered, it was more i.e.11.94% and 11.67% among the neonates belonging to the other backward class (OBC) and scheduled caste (SC) respectively than among the neonates belonging to the general and scheduled tribe (ST) category, i.e. 9.84% and 9.48% respectively. Proportion of neonates who died was higher (161 out of 1041 i.e. 15.47%) among the neonates delivered at home than that among the neonates delivered at hospital (1559 out of 15448 i.e10.28%). The difffernce observed was statistically significant ($\chi 2$= 30.15, p<0.05). As far as distribution of neonatal mortality according to the age of newborn at the time of admission is considered, highest mortality was observed among the neonates having age < 1day (1090 out of 9609 i.e. 11.34%) followed by 1-3 days (510 out of 4795 i.e. 10.64%) and it was lowest among the neonates having age 4-7 days (33 out of 1057 i.e. 3.12%). This association was statistically significant ($\chi 2$= 73.49, p<0.001). Duration of stay was significantly ($\chi 2$= 332.3, p<0.001). associated with the mortality rate of neonates as 22.54 %, 10.36%, 6.83% and 7.26% neonates who stayed in SNCU for <1 day, 1-3 days, 4-7 days and > 7 days died respectively.

Table 3: Distribution of neonates according to cause of death (LBW vs NBW)

	All Neonates		NBW Neonates		LBW Neonates	
Cause of Death	No	%	No	%	No	%
HIE / Moderate-Severe Birth Asphyxia	260	15.12	136	37.99	124	9.10
Meconium Aspiration Syndrome	132	7.67	84	23.46	48	3.52
Pneumonia	10	0.58	3	0.84	7	0.51
Respiratory Distress Syndrome	421	24.48	43	12.01	378	27.75
Neonatal Tetanus	2	0.12	2	0.56	0	0.00
Cause not established	3	0.17	2	0.56	1	0.07
Meningitis	4	0.23	2	0.56	2	0.15
Major Congenital Malformation	9	0.52	1	0.28	8	0.59
Prematurity (<28 weeks of Gestation)	442	25.70	4	1.12	438	32.16
E.L.B.W. (Wt. less than 1000g)	131	7.62	0	0.00	131	9.62
Sepsis	133	7.73	26	7.26	107	7.86
Any Other	173	10.06	55	15.36	118	8.66
Total	1720	100.00	358	100.00	1362	100.00

Prematurity (25.70%) was the most common cause of death followed by respiratory distress syndrome (24.48%) and birth asphyxia (15.12%). Prematurity (32.16 %), respiratory distress syndrome (27.75%) extremely low birth weight (9.62%) and birth asphyxia (9.10%) were the common causes of mortality among low birth weight (LBW) babies while birth asphyxia (37.99%), meconium aspiration syndrome (23.46%) and respiratory distress syndrome (12.01%) were the common causes of mortality among normal birth weight (NBW) babies. Sepsis was cause death for 7.73%, 7.86% and 7.26% among all, low birth weights and normal birth weights neonates respectively.

Table 4: Distribution of neonates according to cause of death (Inborn Vs Outborn)

	All Neonates		Inborn Neonates		Outborn Neonates	
Cause of Death	No	%	No	%	No	%
HIE / Moderate-Severe Birth Asphyxia	260	15.12	173	18.60	87	11.01
Meconium Aspiration Syndrome	132	7.67	100	10.75	32	4.05
Pneumonia	10	0.58	1	0.11	9	1.14
Respiratory Distress Syndrome	421	24.48	219	23.55	202	25.57
Neonatal Tetanus	2	0.12	1	0.11	1	0.13
Cause not established	3	0.17	2	0.22	1	0.13
Meningitis	4	0.23	2	0.22	2	0.25
Major Congenital Malformation	9	0.52	6	0.65	3	0.38
Prematurity (<28 weeks of Gestation)	442	25.70	232	24.95	210	26.58
E.L.B.W. (Wt. less than 1000g)	131	7.62	55	5.91	76	9.62
Sepsis	133	7.73	28	3.01	105	13.29
Any Other	173	10.06	111	11.94	62	7.85
Total	1720	100.00	930	100.00	790	100.00

Prematurity and respiratory distress syndrome were the common causes of death among both inborns (24.95% and 26.58%) as well as outborns (23.55% and 25.57). Among the outborns mortality was higher (9.62% vs 5.91% and 13.21% vs 3.01%) due to extreme low birth weight and sepsis respectively than inborns while it was lower (11.01% vs 18.60% and 4.05% vs 10.75%) due to birth asphyxia and meconium aspiration syndrome respectively.

DISCUSSION

There were total 16489 neonates were admitted in SNCU from 1st January 2013 to 31st December 2019. Out of these neonates out-comes of 16455 were available. Out of these 16455 neonates admitted, 12939 (78.63%) were discharged after successful management and 1720 (10.45%) died during treatment. 654 (3.97%) were referred to higher center for further specialized management and 1142 (6.94%) were left the hospital against medical advice. Mortality rate in the present study was found to be 10.45% which is similar to that found by Verma J *et al.* [4](11.00%), S A *et al.*[5] (10.4%). A study conducted in Gujarat by Shaha *et al.*[6] and in Uttarakhand by Rakholia *et al.* [7] reported higher rate of mortality (16.00% and 20.53% respectively) while in Bihar by Sinha *et al.* [8]and in Mumbai by Randad *et al.* [9]recorded lower rate of mortality (0.9% and 1.55% respectively) among the admitted neonates. Apart from clinical condition of newborns, recovery and mortality also depends upon the availability of trained health persons, specialized equipment and medicines as well as timely admission and intervention. These factors must be evaluated and taken care of while planning and implementation of SNCU services. Mortality among male neonates (10.68%) was slightly higher than that among female neonates (10.28. But this difference was found statistically insignificant ($\chi 2$= 1.35, p>0.05). Kumar *et al.*[12] and Adikane *et al.*[13] also observed higher mortality proportions among female neonates (69.00% vs 31.00% and 65.21% vs 34.79%respectively), but difference was statistically insignificant, as observed in the present study. Outborn neonates (neonates referred from other health facility and home) had significantly higher (11.98% vs 9.40%) mortality than that of inborns (neonates delivered at the same institute). Consistent with this study finding Manab Narayan Baruha *et al.*[14], SA *et al.*[5] and Sridhar s *et al.*[15] also revealed significantly higher mortality among the inborns than outborns. The higher outborn mortality highlights the issues like delayed referral, lack of pre transport stabilization and inadequate functioning of peripheral neonatal facilities as rightly pointed out by Manab Narayan Baruha *et al.*[14] in their study. Low birth weight babies (79.19%) had significantly higher proportional mortality than that of normal birth weight babies (20.81%). It was also observed that mortality rate was inversely proportional to the birth weight of neonates because mortality rates decreased as weight of neonates increased. Similarly Shah *et al.*[6] in their study at Gujrat also revealed that neonates admitted in SNCU having lower birth had less chances of survival. Sinha *et al.*[8] had also recorded that birth weight <2 .5 kg was significantly associated with the death of neonate at the end of neonatal period. Strengthening nutritional, medical and socioeconomic interventions during the antenatal period at the community level is utmost important to decrease the prevalence of low birth weight babies which will eventually increase the chances of survival and better health outcome. Similar to the birth weight, maturity had significant impact on the mortality among the neonates as mortality among the preterm neonates (20.38%) was significantly more than that among the fullterm (5.94%) neonates. It was also revealed that chances of survival of neonates increased as gestational age increased. In consistent with the present study findings Adikane *et al.*[13] (72.22%) and Malik *et al.*[16] found higher (42.63%) mortality proportion among preterm neonates. Identification of risk factors in women with improved care before, between and during pregnancies; better access to contraceptives and increased empowerment/ education can further decrease the preterm birth rate.[9] Significantly higher proportion of neonates delivered at home (15.47%) died than the neonates delivered at hospital (93.69%). Altman *et al.*[17] observed that institutional delivery was protective against neonatal mortality. Early diagnosis and treatment of intrapatrum maternal complication as well as timely access to specialized neonatal care might be the factors for increased survival of neonates. Trained birth attendant and environmental hygiene also made the difference.

Duration of stay was significantly ($\chi 2$= 332.3, p<0.001) associated with the mortality rate of neonates as 22.54 %, 10.36%, 6.83% and 7.26% neonates who stayed in SNCU for <1 day, 1-3 days, 4-7 days and > 7 days died respectively. Duration of time between admission and death was the highest (54.76%) between 1 to 3 days, similar to that found by Adikane *et al.* [13](54.76%) and Sridhar *et al.* (40.21%)[15]. As critically ill neonates are admitted in SNCU, probability of their dying is the highest within first few days. Major causes of the neonatal mortality were prematurity (25.70%) and respiratory distress syndrome (25.48%). Birth asphyxia (15.12%), sepsis (7.73%), meconium aspiration syndrome (7.67%) and extremely low birth weight (7.62%) were other important conditions leading to the death of newborns. More than half of the neonates among those who died were due to the prematurity (25.70%) and respiratory distress syndrome (25.48%). Similarly Rakholia *et al.*[7](25.70%) and National perinatal database[18] (26.5%) in India and Lawn *et al.*[19] (28.00%) and Elhassan *et al.* [20](25.7%) from outside India recorded death of almost one fourth mortality due to prematurity. A significant number of preterm neonates can be saved practicing inexpensive care such as antenatal steroid injections, essential care during child

birth, postnatal care like kangaroo mother care as well as basic care for infections and breathing difficulties[9]. Respiratory distress syndrome was also the most common cause of death of neonates as observed by Adikane H *et al.*[13] (57.14%) , Sridhar *et al.*[15] (43.3%), Shreshtha *et al.*[21] (42%), Verma *et al.*[4] (39%), Shah *et al.*[6](23.00%). Antenatal administration of corticosteroid and broad spectrum antibiotics (Ampicillin + Gentamycin) during the preterm labour is very effective to increase the survival rate of newborns and should be widely encouraged. At the same time good antenatal care and adequate maternal nutrition is the utmost important for prevention of respiratory distress among the newborns. Birth asphyxia was recorded as a cause of death among 15.12 % neonates which was (16.00%) and Rakholia *et al.* [7](19.6%). Strict intrapartum monitoring is mandatory for early detection and subsequent early intervention to reduce the mortality and morbidity among the neonates. 24*7 availability of functional resuscitation facility including mechanical ventilation and continuous positive airway pressure (CPAP) and trained manpower is required at all SNCUs. Neonatal sepsis was recorded as the cause of death for 7.73% neonates in the present study which was in line with the observations by Kumar S *et al.*[12] (9.00%), Sridhar *et al.*[15] (8.25%) and Adikane H *et al.*[13] (6.35%) from India. However there was wide variation among the results of different epidemiological studies as far as sepsis and neonatal mortality is considered. Randad *et al.*[9] recorded that there was not a single death of neonate due to sepsis while almost one fourth neonatal mortality was recorded due to sepsis by Lawn *et al.*[19] (26.00%), Elhssan *et al.*[20] (24.8%), Rakholia *et al.*[7] (21.6%) and Shah *et al.*[6] (21.00%). Klebsiellapnemoniae, Streptococcus faecalis (enterococcus), Citrobacter, Methicillin resistant staphylococcus aurius (MRSA) and Pseudomonas are the major organisms responsible for neonatal sepsis, especially fatal sepsis. Moreover changing pattern and emergence of resistance of bacteria make the management more difficult. Hence practicing hygienic measures before and during delivery as well as handling and transport of newborns is required for prevention of neonatal sepsis. Present study revealed meconium aspiration syndrome caused mortality among 7.67% neonates which was higher than that observed by Adikane H *et al.*[13] (.97%), Sridhar *et al.*[15] (3.09%) and Sharma and Gaur *et al.*[22] (2.87%) while it was less than that found by Shah *et al.*[6] (14.00%) and Rakholia *et al.*[7] (9.45%). Tracheal suctioning immediately after birth will clear the airway the airway and prevent mortality as well as morbidity among the affected newborns. Ongoing training of health workers and constant motivation is essential.

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