The outcome of creating a Sick Newborn Care Unit at a Tertiary Care Hospital

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Abstract:

Background: Neonatal mortality is a very serious global public health issue that requires special attention, especially in Pakistan because of lower knowledge and limited resources provided for newborn units. Currently, researches on neonatal mortality are a requirement so that policymakers can focus on this area and work to rebuild comprehensive neonatal healthcare programs.

Objective: To assess the outcome of creating a Sick Newborn Care Unit (SNCU) in a tertiary care hospital

Methodology: This is an observational study conducted from July 2016 to June 2017 during the establishment of the SNCU at the Pediatric department of a tertiary care hospital. Study subjects were 121 and 726 newborn babies before and after the establishment of SNCU respectively. Baseline data for six months were compared with 6 months' data of SNCU operation.

Results: A total of 847 neonates were admitted over a year including 488 (57.61%) males and 359 (42.38%) females, with a mean gestational age of 38.6 weeks (retrospective data) and 37.2 weeks (prospective data). There were 726 neonates admitted after the establishment of SNCU of which 681 (93.8%) were discharged and 45 (6.19%) expired. The reduction in Neonatal Mortality Rate after the implementation of SCNU was not statistically significant (p=0.06).

Conclusion: Although our results were not statistically significant. We observed an increase in admission rate which shows how much neonatal morbidity is there for which more similar setups are required. There is indeed an immediate need to rebuild a comprehensive care unit for neonates especially in our region.

Index Terms- Neonate, Birth Asphyxia, Neonatal Care, Sepsis; Mortality

I. INTRODUCTION:

Babies who are less than 28 days old are referred to as neonates [1]. Due to the delivery procedure, newborns are vulnerable to opportunistic infections and other health issues, making this a particularly important stage of life [2, 3]. The term "neonatal mortality" refers to a neonate's passing within the first 28 days of life [1]. With rates of 28 deaths per 1000 live births and 25 deaths per 1000 live births, respectively, Sub-Saharan Africa (SSA), Southern, and Central Asia have been identified as the locations with the highest neonatal mortality rates worldwide [4]. Nigeria (36 deaths per 1000 live births) and the Central African Republic (41.2 deaths per 1000 live births) are the African nations with the highest neonatal mortality rates, followed by South Sudan (40 deaths per 1000 births), Somalia (37.5 deaths per 1000 live births), Guinea-Bissau (36.6 deaths per 1000 live births), and Somalia (37.4) [5]. Infants born in these areas have a 10 times lower chance of surviving past the first 28 days than their peers in first-world countries [4].

Over the past 50 years, the globe has made significant strides in the fight against infant mortality [6]. According to the World Health Organization (WHO) [2], the majority of the 2.4 million newborn deaths that occurred in 2019 were thought to have occurred in low- and middle-income countries (LMICs) [4]. Tanzania has made significant efforts to enhance newborn care and lower mortality through the adoption of different WHO-recommended recommendations and regulations [7]. Important newborn care, kangaroo mother care, integrated management of childhood illness (IMCI), growth monitoring, and care for infant development are included in this [7]. Compared to the WHO's resumption of these interventions, the national coverage in Tanzania is still low (40 to 80 percent) [7]. The Tanzanian government has compiled national recommendations, which are accessible in all levels of health facilities, to close the gap [7]. Better nutrition formulas, surfactants to treat respiratory distress syndrome, and antibiotics to combat infections have all significantly decreased the number of newborn deaths in HICs like the UK [6]. However, these advancements are frequently unavailable to or unaffordable for families living in low-resource environments [7]. In Kenya, it was investigated that the viability of employing early warning scores for neonates and concluded that these ratings would help identify neonates who are in danger [8]. They did, however, also draw attention to the problems with the score's reliance on scant data recording in low-resource environments [7]. Neonatal early warning systems are in demand, but there is also a need for tools that are simple to use in environments with limited resources [8]. Every year in

China, there are about 0.2 million births of very preterm infants (VPIs) with gestational age (GA) of less than 32 weeks [9,10]. VPIs in China continue to bear a disproportionate share of the burden of neonatal death and long-term developmental disability, despite reports of consistent improvements in outcomes [11]. Data on VPI outcomes and treatment methods at the national level are currently insufficient in China [11]. To benchmark outcomes for institutions to evaluate their performance, identification of care deficiencies, facilitation in quality improvement, improvement in the deliverance of health services, and support parental counseling and clinical decision-making, collecting information on care practices, morbidity, and mortality of VPIs is crucial [11].

From 74.5 deaths per 1,000 live births in 1971 to 40.4 deaths per 1,000 live births in 2020, Pakistan's neonatal mortality rate decreased progressively [12]. Pakistan had a newborn mortality rate of 40.4 per 1,000 live births in 2020 [13]. If effective therapies with high coverage are used, it is thought that roughly 70% of newborn fatalities might be avoided [13]. In Pakistan, studies are needed to assess the impact of Sick Newborn Care Units (SNCUs) as this may be applied to all districts and Taluka levels, just like in our neighboring country. It is hypothesized that the outcome of SCNU is good in neonatal care and the creation of SCNU will reduce the neonatal mortality rate. Keeping in mind the significance of SNCUs, we established an SNCU in our department and conducted this study to assess the outcome of the creation of SCNU on neonatal mortality. We investigated if there is an association of mortality rate with the duration of stay and assessed mortality rate with respect to birth weight, and gestational age accompanied by the diagnosis.

II. METHODOLOGY:

This observational study was done at the Pediatric Department of Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan with data collected from 1st July 2016 to 30th June 2017 (12 months' duration). Permission was taken from the ethical review committee of the institute. Sick Newborns of 0 to 28 days either from outside, with or without a referral (outborn), or those delivered in this institute (inborn) were admitted.

A 15-bed SNCU was established in January 2017, equipped with a controlled environment, individual warming, oxygen concentrators along with a central oxygen system, resuscitation trolley, equipment for exchange transfusion, supporting X-Ray, and laboratory services round the clock. Recruitment of health care providers was done through a formal interview, were trained and an 8-hourly shift was assigned to each doctor, nurse, technician, aya, sweeper, and security guard. A register was maintained to keep the record of all admitted babies.

Baseline data of six months were compared with six months' data after the establishment of SNCU. For the baseline data, the medical files of the neonates were retrospectively reviewed (from 1st July to 31st December 2016) (Group A). All neonates whether inborn or outborn of both genders above 1 kg except with major congenital malformations were included. Neonates who expired within 30 minutes of receiving in triage and had less than 28 weeks of gestation been excluded from the study. The data on all inborn and outborn neonates from January to June 2017 were prospectively collected and compared (Group B). All data were collected and divided into two groups based on pre and post-SNCU admission. IBM Statistical Package for the Social Sciences (SPSS) Statistics for Windows, Version 21.0 (IBM Corp., Armonk, NY) was used for statistical analysis. A Chi-square test was used to compare the two groups. P-value of ≤ 0.05 was taken as significant.

III. RESULTS:

Both pre and post-SNCU admissions (categorized into groups A and B respectively) and the results with their outcome were compared. Demographic information is given in Table 1. A total number of 847 neonates were admitted over a year, with group B having 726 admitted from January to June 2017 and group A having 121 patients admitted from 1st July to 31st December 2016.

In our study before the establishment of SNCU, 9 (20%) neonates expired within 24 hours, 4 (8.8%) within 2 days, 16 (35.5%) within 3 days, 9 (20%) within 7 days, and 7 (15.5%) after 7 days. After the establishment of SNCU, 2 (15.3%) neonates died within 24 hours, 4 (30.7%) within 2 days, 2 (15.3%) within 3 days, 3 (23%) within 7 days and 2 (15.3%) after 7 days.

In group B, 681 (93.8%) were discharged and 45 (6.19%) expired (Table 2). Nine patients expired within 24 hrs. of life, 4 within 48 hrs., 60 within 72 hrs., 9 within 7 days, and 7 after 7 days (Table 3). The birth weight of two was above 2.5 kg, 22 between 2.5-1.5 kg, and 16 were 1.5-1 kg There were 14 term (babies born after 37 weeks of gestation) and 31 preterm (babies born before 37 weeks of gestation) neonates in this group (Table 5)

In group A, 108 (89.25%) were discharged while 13 (10.74%) expired (Table 1). Two patients expired within 24 hrs. of birth, 4 within 48 hrs., 2 within 3 days, 3 within 7 days, and 2 after 7 days (Table 4). The birth weight of two patients was above 2.5 kg, 7 between 2.5-1.5 kg, and 4 were 1.5-1 kg. There were 4 term and 9 preterm neonates in this group (Table 6). There were 53.3% patients prematurely born, 20% with sepsis, 22.2% with birth asphyxia, and 4.4% with neonatal jaundice in group B whereas group A had 46.1% premature, 30.7% septic, 7.6% birth asphyxia and 15.3% neonates suffering from jaundice. Prematurity, birth asphyxia, and sepsis were the major factors of expiration.

IV. DISCUSSION:

The care given to the newborns in their transitional period is crucial to their long-term survival. In the recent past, various studies have been done to assess the impact of establishing SCNU in reducing the neonatal mortality rate. Around 10-15% of all neonates require care from a specialized unit. In

developed countries, most neonates die due to congenital abnormalities, which are mostly unpreventable [14,15]. On the contrary, neonatal death in developing countries is mostly due to prematurity and birth asphyxia, which are preventable [16]. Here in this study, results after the establishment of an SNCU we compared with those in the past. Although the results were statistically nonsignificant (p=0.06), mortality reduced from 10.74% to 6.19% (40% decline).

Our study was similar to a study done in India in which before SNCU, 19.1% died and after its formation, 7% of neonates died [17]. However, because of the large sample size, they found statistical significance and a reduction in neonatal mortality after the formation of SNCU. In another similar study from Bangladesh, mortality reduced from 30.4% to 5.9% after the SNCU was established [18]. The mentioned study found a significant positive impact of SNCU, the reason that was mentioned by the mothers was the better awareness of temperature maintenance, cord care, the importance given to breastfeeding within the first hour; knowledge given to them about vaccination, exclusive breastfeeding for 6 months and burping technique. In our study, the majority of deaths occurred during the 1st week of life, which is similar to a Pakistani study in which 74% of neonates died within the 1st week of [19]. A study in 2021 found a 10% mortality rate of neonates while our study found an average of 15% neonatal mortality rate [1]. The same study disclosed that the neonates suffered from jaundice (5.7% outborn), sepsis (22.5% inborn), prematurity (37.50% inborn), and birth asphyxia (33.80% inborn) [1]. Group B neonates in our study suffered from sepsis and jaundice with a similar percentage (sepsis: 20% vs 22.5%, jaundice: 4.4% vs 5.7%). Similarly, research conducted in Ethiopia saw 30.3% of neonates suffering from sepsis and 4.8% from jaundice which is in resemblance with Group A neonates' sepsis rate (30.7%) and Group B's jaundice rate (4.4%) [20]. Both the previously mentioned studies stressed educating the mothers as they found the neonatal mortality rate increasing as their studies progress. In a large sample size (9552) study in China, they found that 9.4% of neonates suffer from sepsis [11]. They concluded that the survival of neonates without major morbidity is still lower than in other high-income countries which shows how difficult it is to maintain a proper setup for sick neonates.

There was a seven-time increase in admission rate after the establishment of SNCU, which is compatible with various international studies showing 100% bed occupancy after SNCU formation [21, 22]. This may be due to the increased number of beds and the possible advertisement or spread of the knowledge about SNCU formation.

Prematurity is the leading cause of death among neonates [23]. Annually, 15 million babies are born before term, and 32.4 million are born small for gestational age. Prematurity causes 80% of all newborn deaths in Southern Asia and Sub-Saharan Africa [23]. In our data, 46.1% of the neonates who died in group A were premature, while those in group B were 53.3%. Contrasting results were seen in an African study showing that perinatal asphyxia (52.9%) was the leading cause of death, while neonatal sepsis (29.4%), and very low birth weight (0.06%) were less common causes [24]. In a similar study from India, 37.5% died due to prematurity, and that was the leading cause of death among them [25].

Annually, 10 million neonates suffer birth asphyxia, among them, most of the neonates just need the bag and mask ventilation to revive. In our study, before the establishment of SNCU birth asphyxia was the cause of death in 7.6% of neonates, while, after the establishment of SNCU birth asphyxia caused 22.2% of neonatal death. In a similar study, Birth Asphyxia caused death in 19.5% of neonates (Group A) and 7.8% (group B) [26].

There were several limitations in the current study. For instance, in our study, with the inauguration of this SNCU, the patient load increased. Although, SNCUs and other special care setups are required, with it comes the need for specialized types of equipment and highly trained staff. If we would have managed this with appropriate staff and medical equipment, it might have led to a reduction in mortality. As previously mentioned in several studies their staff was trained with proper instructions given to the mothers about certain techniques, regarding vaccination and breastfeeding. There was a lack of new training techniques in our staff. Also, ventilators were not available for managing the babies with severe respiratory distress. Higher sample size could have been conclusive for which this study would have been supportive.

V. CONCLUSION:

By establishing a specialized neonatal care unit, neonatal survival can be improved. Although our results were not statistically significant. We observed an increase in admission rate which shows how much neonatal morbidity is there for which more similar setups are required. There is indeed an immediate need to rebuild a comprehensive care unit for neonates especially in our region due to poor education in neonatal care and the low education level of mothers. This research was just a start in understanding the needs of sick neonates and how fatal consequences are present if care is not taken and given. Hopefully, future researchers will further work towards the improvement of neonatal care to acquire better outcomes.

REFERENCES:

1. Ojima WZ, Olawade DB, Awe OO, Amusa AO. Factors Associated with Neonatal Mortality among Newborns Admitted in the Special Care Baby Unit of a Nigerian Hospital. Journal of Tropical Pediatrics. 2021 Jun;67(3): fmab060.
2. Goyal NK. The newborn infant. In: Kliegman RM, St. Geme JW, Blum NJ, et al. (eds.). Nelson Textbook of Pediatrics. 21st edn. Philadelphia, PA: Elsevier, 2020, Chap 113.
3. Rozance PJ, Wright CJ. The neonate. In: Landon MB, Galan HL, Jauniaux ERM, et al. (eds.). Gabbe's Obstetrics: Normal and Problem Pregnancies. 8th edn. Philadelphia, PA: Elsevier, 2020, Chap 23.
4. World Health Organisation. Newborns: improving survival and well-being [internet]. WHO fact sheets; 2019. Available from: https://www.who.int/en/news-room/fact-sheets/detail/newborns-reducing-mortality
5. UNICEF. Neonatal mortality. 2019. https://data.unicef.org/topic/child-survival/neonatal-mortality/
6. Lissauer T, Fanaroff AA, Miall L, Fanaroff JM. Neonatology at a glance. 4th ed. Hoboken: Wiley-Blackwell; 2020. At a glance series
7. Kovacs, D., Msanga, D.R., Mshana, S.E. et al. Developing practical clinical tools for predicting neonatal mortality at a neonatal intensive care unit in Tanzania. BMC Pediatr 21, 537 (2021). https://doi.org/10.1186/s12887-021-03012-4
8. Mitchell EJ, Qureshi ZP, Were F, Daniels J, Gwako G, Osoti A, et al. Feasibility of using an early warning score for preterm or low birthweight infants in a low-resource setting: results of a mixed-methods study at a national referral hospital in Kenya. BMJ Open. 2020;10(10):e039061.
9. National Bureau of Statistics Population. Population. China statistic yearbook. 2019. Accessed November 30, 2020. http://www.stats.gov.cn/tjsj/ndsj/2019/indexch.html
10. Chen C, Zhang JW, Xia HW, et al. Preterm birth in China between 2015 and 2016. Am J Public Health. 2019;109(11):1597-1604. doi:10.2105/AJPH.2019.305287
11. Cao Y, Jiang S, Sun J, et al. Assessment of neonatal intensive care unit practices, morbidity, and mortality among very preterm infants in China. JAMA Network Open. 2021 Aug 2;4(8): e2118904-. doi:10.1001/jamanetworkopen.2021.18904.
12. Pakistan Neonatal mortality rate, 1960-2021 - knoema.com [Internet]. Knoema. 2022 [cited 23 July 2022]. Available from: https://knoema.com/atlas/Pakistan/Neonatal-mortality-rate
13. Prashantha Y N, Shashidhar A, Balasunder B C, Kumar B P, Rao P N. Onsite mentoring of special newborn care unit to improve the quality of newborn care. Indian J Public Health [serial online] 2019; 63:357-61. Available from: https://www.ijph.in/text.asp?2019/63/4/357/273364
14. Neogi SB, Malhotra S, Zodpey S, Mohan P. Assessment of special care newborn units in India. J Health Popul Nutr. 2011;29:500–9. 10.3329/jhpn.v29i5.8904
15. Andegiorgish AK, Andemariam M, Temesghen S, Ogbai L, Ogbe Z, Zeng L. Neonatal mortality and associated factors in the specialized neonatal care unit Asmara, Eritrea. BMC Public Health. 2020;20:10. 10.1186/s12889-019-8118-x
16. Desalew A, Sintayehu Y, Teferi N, Amare F, Geda B, Worku T, et al. Cause and predictors of neonatal mortality among neonates admitted to neonatal intensive care units of public hospitals in eastern Ethiopia: a facility-based prospective follow-up study. BMC Pediatr. 2020;20:160. 10.1186/s12887-020-02051-7
17. Gautam S, Agrawal A, Bangre A. Original article Impact of a tertiary sick newborn care unit on neonatal mortality and morbidity. Int J Healthc Biomed Res. 2016;4:55–9.
18. Mia M, Hasan S, Islam M, Sharmin L, Haque M. The impact of special care newborn unit on routine neonatal care practices and survival of neonates in 250-bed general hospital, Sirajganj. J Teach Assoc. 2018;30:65–8.
19. Khan A, Kinney M V, Hazir T, Hafeez A, Wall SN, Ali N, et al. Newborn survival in Pakistan: a decade of change and future implications. Health Policy Plan. 2012;27 Suppl 3:iii72—87. 10.1093/heapol/czs047
20. Alebel, A., Wagnew, F., Petrucka, P. et al. Neonatal mortality in the neonatal intensive care unit of Debre Markos referral hospital, Northwest Ethiopia: a prospective cohort study. BMC Pediatr 20, 72 (2020). https://doi.org/10.1186/s12887-020-1963-z
21. Neogi SB, Khanna R, Chauhan M, Sharma J, Gupta G, Srivastava R, et al. Inpatient care of small and sick newborns in healthcare facilities. J Perinatol. 2016;36:S18—S23. 10.1038/jp.2016.186
22. Sharma RK, Khan R, Anjum S. A study to evaluate the functioning of Special Care Newborn Unit (SNCU) established at a District Hospital. Int J Biomed Res. 2017;8:514–20.
23. Yismaw AE, Tarekegn AA. Proportion and factors of death among preterm neonates admitted in University of Gondar comprehensive specialized hospital neonatal intensive care unit, Northwest Ethiopia. BMC research notes. 2018 Dec;11(1):1-7.Ashish KC,
24. Wrammert J, Nelin V, Ewald U, Clark R, Målqvist M. Level of mortality risk for babies born preterm or with a small weight for gestation in a tertiary hospital of Nepal. BMC public health. 2015 Dec;15(1):1-9.
25. Mishra AK, Panda SC. Status of neonatal death in sick newborn care unit of a tertiary care hospital. Int J Contemp Pediatr. 2017;4:1638–43.
26. Tripathi G, Mishra N. The impact of special care newborn units on routine neonatal care practices in central India: observational study. Int J Contemp Pediatr. 2016;3:1252–5.

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Table 1: Demographic Information

	Group A (n=121)	Group B (726)
Mean gestational age	38.6±1.92 weeks	37.2±1.86 weeks
Males	57	302
Females	64	427
Mean Weight	2.3 kg	2.45 kg

Table 2: Discharge and Expiries Information of Both Groups

	Expired	Discharge	X^2	P value
Group A (n=121)	13 (10.74%)	108 (89.25%)	3.36	**0.06**
Group B (n=726)	45 (6.19%)	681 (93.80%)		

Table 3: Group B Mortality with Duration Stay in The Sick Neonatal Care Unit

Month	Within 24 hrs.	Within 2 days	Within 3 days	Within 7 days	After 7 days	X^2	p-Value
January	1	1	1	4	1	15.34	0.75
February	0	0	2	1	1		
March	1	0	3	1	1		
April	0	0	2	0	1		
May	1	2	3	1	1		
June	6	1	5	2	2		
Total no	9	4	16	9	7		
Total %	20	8.8	35.5	20	15.5		

Table 4: Group A Mortality With Duration Stay In Sick Neonatal Care Unit

Month	Within 24 hrs.	Within 2 days	Within 3 days	Within 7 days	After 7 days	X^2	p-Value
July	1	1	0	1	1	13.48	0.85
August	0	0	0	0	0		
September	1	0	0	0	0		
October	0	1	0	0	0		
November	0	1	1	0	0		
December	0	1	1	2	1		
Total no	2	4	2	3	2		
Total %	15.3	30.7	15.3	23	15.3		

Table 5: Group B Mortality with Birth Weight, Gestational Age, and Diagnosis

Month	Weight above 2.5kg	Weight b/w 2.5 to 1.5kg	Weight b/w1.5 to 1kg	Weight less than 1kg	Post-term	Term	Preterm	Prematurity	Sepsis	Birth asphyxia	Neonatal jaundice
January	0	6	2	0	0	2	6	3	3	2	0
February	1	2	1	0	0	2	2	0	1	3	0
March	0	3	2	1	0	1	5	5	0	0	1
April	1	1	1	0	0	1	2	2	0	1	0
May	0	2	5	1	0	1	7	6	1	0	1
June	0	8	5	3	0	7	8	8	4	4	0
Total no	2	22	16	5	0	14	30	24	9	10	2
Total %	4.4	48.8	35.5	11.1	0	31.1	66.6	53.3	20	22.2	4.4

Table 6: Group A Mortality with Birth Weight and Gestational and Diagnosis

Month	Weight above 2.5kg	Weight b/w 2.5 to 1.5kg	Weight b/w1.5 to 1kg	Weight less than 1kg	Post term	Term	Preterm	Prematurity	Sepsis	Birth asphyxia	Neonatal jaundice
July	0	2	2	0	0	0	0	2	2	0	0
August	0	0	0	0	0	0	0	0	0	0	0
September	0	1	0	0	0	1	0	0	1	0	0
October	0	0	1	0	0	0	1	1	0	0	0
November	0	1	1	0	0	0	2	2	0	0	0
December	2	3	0	0	0	3	2	1	1	1	2
Total no	2	7	4	0	0	4	5	6	4	1	2
Total %	15.3	53.8	30.7	0	0	30.7	38.4	46.1	30.7	7.6	15.3