

OUTCOMES OF NEONATAL SURGERIES WITHOUT NICU IN LMIC

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Abstract: Dealing with neonatal surgery, which nearly invariably entails emergency neonatal surgical scenarios, is the most challenging and complex problem in pediatrics and pediatric surgery. Congenital abnormalities are the most common reason for emergency neonatal surgery. Pakistan and other low and middle-income countries (LMICs) account for over ninety percent of these abnormalities. **Objective:** Our goal is to examine the factors contributing to the high mortality rate in neonatal surgery among those individuals who didn't have access to the NICU. This will inform our recommendations for the worldwide community and the need for NICU care post-operatively. **Method:** This prospective research was carried out in PIMS hospital from December 2022 to December 2023. Our center has a 15-bed NICU facility, which is almost negligible compared to the patient load of our center. Two hundred patients who underwent surgery during the study were enrolled in our study. Demographic and clinical data were gathered using a questionnaire, and SPSS 25 was used for analysis. **Results:** Throughout the study period, 33 of 200 neonates died, resulting in a 16.5% mortality rate. Over 53% of these cases were preterm. The research had a minimum gestation age of 29 weeks and a mean gestational age of 35.54 ± 3.56 weeks. The mean newborn's weight had been 2.41 ± 0.52 kg (range: 1.22–3.5 kg). There were more male babies (67.5%) than females. Anorectal malformation was found in four infants who died following surgery. Gastroschisis was discovered in five infants who died after surgery. Sepsis was the most common cause of death following neonatal surgery, amounting to 84.84% of total deaths. Cardiogenic shock was the reason for expiry in 9.09% of the cases, and 6.06% of the cases had respiratory failure as the cause of death. Gastroschisis and esophageal atresia were associated with the most significant mortality. **Conclusions:** In underdeveloped nations like Pakistan, surgical infants account for a sizable fraction of the total neonatal death rate, most of which may be avoided with proper perioperative and NICU care. Nevertheless, the national health strategy does not give neonatal surgery the priority it deserves. NICUs should be established countrywide to enhance patient care and decrease the overall mortality rate of pediatric surgery.

Keywords: Pediatric surgery, neonatal surgery, challenges, LMIC, NICU.

Introduction

Neonatal surgery has dramatically improved in industrialized nations, leading to lower morbidity and fatality rates (1). Improved perioperative care, which is costly and inaccessible in low-income countries, is driving that shift (2).

Low and middle-income countries (LMICs) account for almost 90% of all newborn surgical cases (3). Poverty is a significant contributor to this massive load, and the care of these children exacerbates the issue. The disparity in newborn surgical outcomes among high-income and low-middle-income nations arises from poverty and inadequate medical services (4). Pakistan has one of the highest newborn mortality rates worldwide (5). Every year, over 62,000 babies die here (6). The impact of neonatal surgery on mortality is debatable, although it is sure that the burden is increasing. Neonatal surgery is frequently disregarded in healthcare plans despite its growing occurrence. The high death rate is due to under-recognition. Avoidable circumstances contribute to the tragic situation, with surgical newborns eventually experiencing adverse effects. The provided data solely includes inpatient-admitted newborns with access to the neonatal intensive care unit. However, many neonates in low- and middle-income

countries lack access to surgical NICUs, exacerbating disparities in outcomes. Although data on neonatal surgical patient load in Pakistan is limited, it is believed to be a substantial contributor to neonatal death (7). Optimal post-surgical care might prevent at least two-thirds of these deaths. SDG-3 aims to eliminate avoidable newborn mortality by 2030 (8). Improving surgical treatment and post-surgical care for newborns in under-served areas is necessary to achieve this goal.

Our goal is to examine the factors that contribute to the high mortality rate in neonatal surgery among those individuals who didn't have access to the NICU. This will inform our recommendations for the worldwide community and the need for NICU care post-operatively.

Methodology

This study was conducted in the Department of Pediatric Surgery at PIMS Hospital from December 2022 to December 2023 after obtaining authorization from the hospital's ethics council.

Those neonates involved in our study received surgical intervention and management during the hospital stay but didn't get access to the hospital's NICU. Those cases were

enrolled in our study who gave their consent. Those who didn't consent and got access to the hospital NICU were excluded from the research project. All infants with surgical conditions are admitted to wards or private rooms based on availability and affordability.

The wards lack a temperature-controlling system and have beds separated by less than two feet. No digital patient monitoring devices are in the wards or private rooms; thus, neonates are manually monitored before and after surgery. Routine operations are often conducted during standard office hours (8 a.m. to 2.30 p.m.) by consultants or senior residents under supervision. Residents in their final year of postgraduate training typically do emergency surgeries late in the evening, often under supervision. Healthcare facilities are pretty inadequate. Demographic and clinical data were gathered using a questionnaire. The form was created to detect limitations in delivering optimal surgical care for

newborns, including demographic and clinical characteristics and available treatment options.

The data collected from the questionnaire were analyzed using SPSS version 25. Categorical data were presented as frequencies, whereas numerical data were shown as mean ± standard deviation.

Results

Throughout the study period, 33 of 200 neonates died, resulting in a 16.5% mortality rate. Over 53% of these cases were preterm. The research had a minimum gestation age of 29 weeks and a mean gestational age of 35.54 ± 3.56 weeks. The mean newborn's weight had been 2.41 ± 0.52 kg (range: 1.22–3.5 kg) (Table 1). There were more male babies (67.5%) than females (figure 1).

Table 1: Demographics of study population

Variable	Result	Percentage
Mean gestational age ± SD	35.54 ± 3.56 weeks	-
Number of preterm cases (N,%)	112	56
Mean newborn's weight in kg	2.41 ± 0.52	-
Gender		
Male	135	67.5
Female	65	32.5
Mortality (N,%)	33	16.5

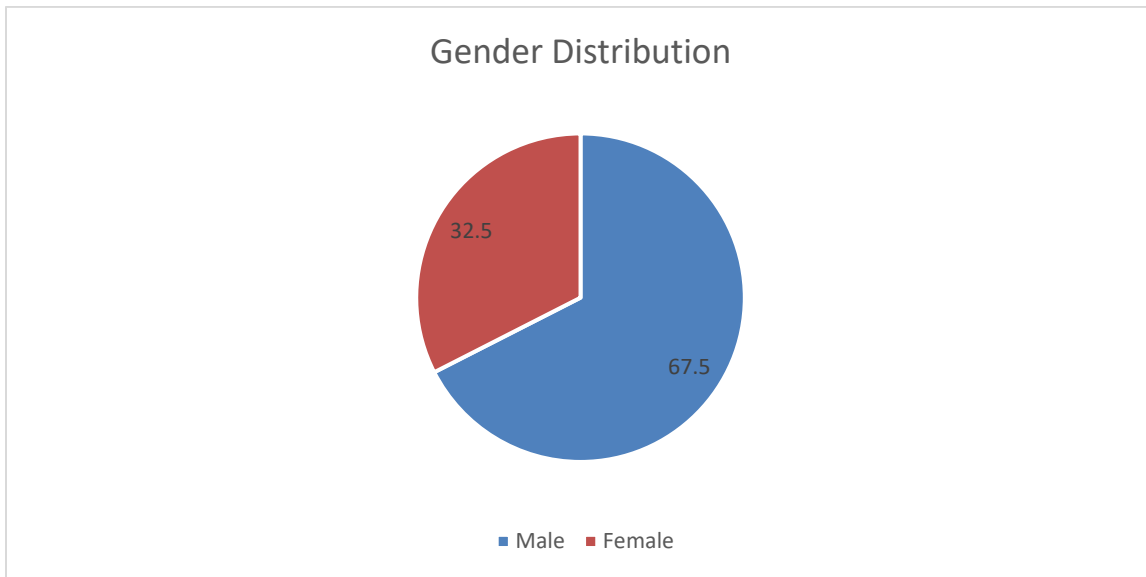


Figure 1 shows the gender distribution in the study population.

Anorectal malformation was found in four infants who died following surgery. Gastroschisis was discovered in five infants who died after surgery. Two infants that died were diagnosed with meconium ileus. Three neonates who died

after surgery had an omphalocele. Table 2 provides further information on prevalent diagnoses and their proportional percentages among people who died after surgery.

Table 2: Common diagnosis of neonates who expired after surgery

Variable	Result N-33	Percentage
Ano rectal malformation	4	12.12
Gastroschisis	5	15.15
Simple	4	-
Complicated	1	-
Hirschsprungs Disease	3	9.09

Jejunao ileal atresia	4	12.12
Meconium ileus	2	6.06
Spontaneous Intestinal perforation	2	6.06
Omphalocele	3	9.09
Esophageal atresia	1	3.03
Duodenal atresia	1	3.03
Congenital diaphragmatic hernia (left-sided)	1	3.03
Necrotising enterocolitis	2	6.06

Sepsis was the most common cause of death following neonatal surgery, amounting to 84.84% of total deaths. Cardiogenic shock was the reason for expiry in 9.09% of the

cases, and 6.06% of the cases had respiratory failure as the cause of death (table 3)(fig 2).

Table 3: Common causes of death following surgery

Variable	Number	Percentage
Sepsis	28	84.84
Cardiogenic shock	3	9.09
Respiratory failure	2	6.06

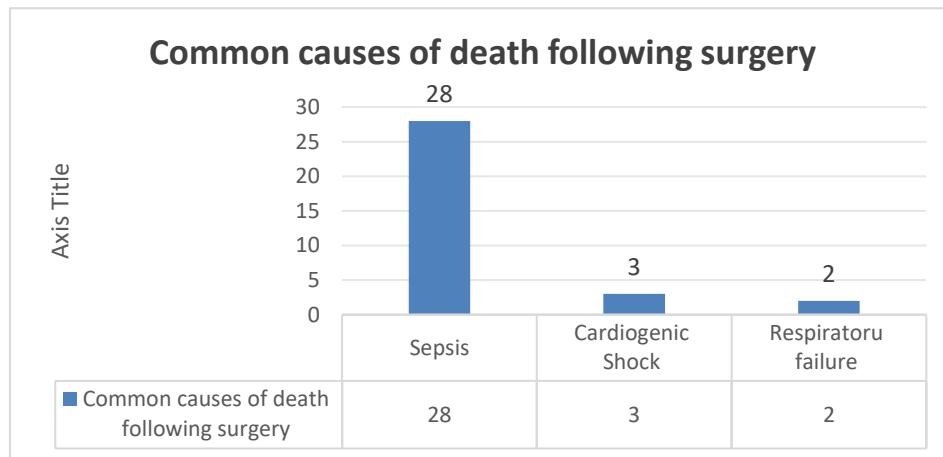


Figure 2 shows the common causes of death among neonates.

Esophageal atresia had a mortality rate of 100%, while Gastroschisis had a mortality rate of 83.3%. The mortality

rate of jejunal atresia was 22.22%, while that of intestinal perforation was 22.5% (Table 4).

Table 4: Diagnosis with the most significant mortality.

Variable	Number	Percentage
Gastroschisis	5/6	83.33
Esophageal atresia	1/1	100
Jejunal atresia	4/18	22.22
Anorectal malformation	4/29	13.79
Intestinal perforation	2/16	22.5

Discussion

Pakistan has one of the most excellent neonatal death rates internationally (9). Each year, almost 62,000 newborns die here (6). The impact of newborn surgery on mortality is uncertain; however, it is obvious that the burden is growing. Neonatal surgery is often overlooked in healthcare strategies despite its increasing prevalence. Under-recognition is the cause of this high mortality. Avoidable factors contribute to this unfortunate situation, with surgical neonates ultimately suffering the consequences. This study's death rate of 16.5% is comparable to those reported from two different high-volume centers in a

different country (10) (11), indicating similar neonatal surgical settings. Although data is not readily available, we might expect a worse scenario in smaller centers. The neonatal surgical death rate in low and middle-income countries (LMICs) is unacceptably higher than in high-income nations (3). The disparity is attributed to surgery's unavailability of costly perioperative care and inadequate NICU resources (4). Neonatal surgery is often overlooked in policymaking in low- and middle-income countries owing to high perioperative costs and a lack of supporting evidence.

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Over half of the neonates that died were premature, and the average birth weight was lower than usual in our study. Prematurity and low birth weight (12) are independent predictors of neonatal surgical death (13). Puri et al. found that preterm and low birth weight significantly increases the risk of neonatal surgical death (3.38 and 3.41 times, correspondingly) (10). These results are in line with the findings of our study, as more than 53% of the neonates who died after surgery were premature. However, with better perioperative care systems, these factors no longer correlate with HICs' mortality (14).

Early detection of complicated congenital disabilities during pregnancy improves delivery preparation and post-natal care, leading to better outcomes (15). Developing nations lag in this sector due to insufficient tools and experts. Our analysis confirmed that while over 83% of mothers got at least one ultrasound examination throughout their pregnancy, just three newborns received a prenatal diagnosis. It caused delays in diagnosing, referring, and treating neonates with complicated congenital abnormalities.

Neonatal surgery is intricate and complex in many aspects. Extended surgery, per-operative bleeding, post-operative hypothermia, and lack of NICU care can all hurt outcomes (16).

Our study found that 63.6% of neonates died following emergency surgery conducted by residents late in the evening. Emergency surgeries cannot be rescheduled during office hours due to substantial demand and limited theatre and workforce availability.

The most prevalent diagnoses among the deceased neonates were Anorectal Malformation (ARM) and Gastroschisis, possibly due to the increased prevalence of both defects in that area. Studies from other facilities in Bangladesh (17) and India (18) confirm this. Gastroschisis and esophageal atresia were associated with the most significant mortality. These results are in line with the findings of previous research done in Pakistan (19, 20). The leading causes are delays in treatment and a lack of critical care facilities. Furthermore, the absence of a prenatal diagnosis leads to treatment delays. Research from a corporate hospital in Bangladesh found that prompt access to advanced perioperative care can enhance the outcomes of these neonates to satisfactory levels (21).

Sepsis was the leading cause of mortality in this research. These findings are based on the findings of previous research (22). According to Mitul AR, surgical newborns in low- and middle-income countries have limitations in diagnosis and management. Surgeons operating in these places typically experience frustration and exhaustion when their efforts are unsuccessful (11). There was no outcome disparity between newborns admitted to paid and non-paying beds.

This analysis highlighted two problems: inadequate infrastructure and human resource crises. We propose a solution that requires coordination among hospital authorities, government, and NGOs. Having all advanced current technology here is unnecessary since that would be absurd. Instead, locally customized and economical technology should be used. Providing a separate NICU for surgical neonates with temperature and infection control capabilities might help lower sepsis and related fatality rates. Implementing vigilant patient monitoring systems would aid in the early detection and treatment of critical

neonates. The ratio of healthcare providers (surgeons, anesthesiologists, nurses, and auxiliary staff) to patients is much lower than the required standard. The hospital administration and government must prioritize this issue immediately.

International organizations such as WHO, UNICEF, and other assistance agencies play a crucial role in helping LMICs overcome their issues. Collaboration at both regional and global levels is essential. Recognizing all of these issues is vital when approaching this field of medicine. Our study had many limitations that should be considered while interpreting these results. First, the small sample size limits the generalization of the findings. Second, the limited sample size reduces the research's statistical significance. The research also has other limitations, including a lack of consideration for different complications in the study population.

Conclusion

In developing countries such as Pakistan, surgical newborns represent a significant proportion of total neonatal mortality, much of which can be prevented with proper perioperative and NICU care. Despite this, the national health policy does not adequately prioritize neonatal surgery. Establishing NICUs nationwide is essential to enhance patient care, improve monitoring, and ultimately reduce the overall mortality rate associated with pediatric surgery.

Declarations

Data Availability statement

All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate.

It is approved by the department concerned. (IRB-PIMS_0342 dated 12-10-21)

Consent for publication

Approved

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Conflict of interest

The authors declared an absence of conflict of interest.

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Concept & Design of Study

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