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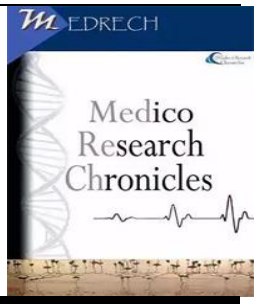

Surgical Management of Congenital Diaphragmatic Hernia in Newborn

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ABSTRACT

ORIGINAL RESEARCH ARTICLE

Background: Congenital diaphragmatic hernia (CDH) is a life-threatening condition in newborns that requires prompt surgical intervention. This study aims to evaluate the outcomes of surgical management of CDH in newborns, focusing on survival rates, complications, and long-term prognosis.
Objectives: To assess the survival rate of newborns with congenital diaphragmatic hernia (CDH) who undergo surgical management.
Methods: This retrospective study was conducted at Dhaka Shishu Hospital from 2021 to 2023, involving 57 newborns diagnosed with CDH who underwent surgical repair. Preoperative stabilization, surgical techniques, postoperative care, and complications were documented. The primary outcome was survival rate, while secondary outcomes included the incidence of postoperative complications, duration of mechanical ventilation, and overall hospital stay
Result: Among the 57 newborns, among them 56.1% male and 43.8% are female. Mild genetic variant 1.3% and severe 1.2%. Cardiac malformation mild (61.4%) and severe (38.5%). Diaphragmatic defect size A and B (66.6%), C and D (22.8%). Caesarean section delivery is higher (61.4%) The most common long-term complications were thoracic deformity, intestinal obstruction and GERD. Surgical approach through abdomen (78.9%) is higher than other surgical approach. Outcome of the congenital diaphragmatic hernia of type A (38.59%)is higher among other types. Newborns with isolated CDH had a better prognosis compared to those with associated anomalies. Early surgical intervention within the first 48 hours of life was associated with improved survival rates.
Conclusion: The surgical management of CDH in newborns can lead to favorable outcomes, particularly when performed early and supported by comprehensive preoperative and postoperative care. Despite the challenges associated with CDH, prompt surgical intervention and

Corresponding author Dr. MD. Shahjahan*	meticulous postoperative management significantly contribute to improving survival rates and reducing complications. Further studies are needed to optimize treatment protocols and improve long-term outcomes for these patients

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INTRODUCTION

A diaphragmatic abnormality that causes the protrusion of abdominal contents into the thoracic cavity and impairs normal lung development is known as a congenital diaphragmatic hernia (also known as CDH).

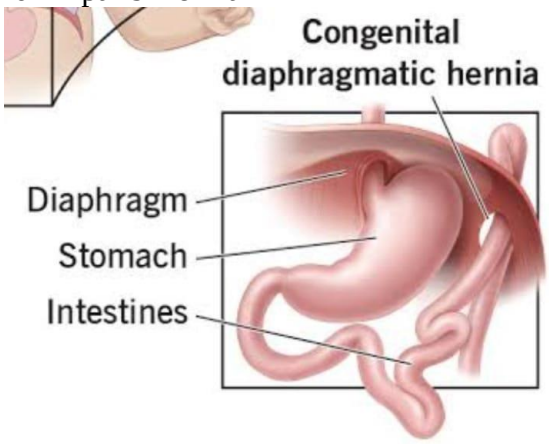

Fig 1: Congenital diaphragmatic hernia [Origin from behance.net]

The illness could show up as a single lesion or as a component of a syndrome. According to the research that is currently accessible, the incidence of CDH varies throughout the population and ranges from roughly 0.8 to 5/10,000 newborns [1-4]. African-Americans have been found to have a lower incidence of isolated CDH and a slightly higher male predominance [3, 5].

The mortality and morbidity rates for CDH remain high despite advancements in medicinal and surgical therapy [6–8]. Furthermore, newborns with CDH require longer hospital stays, which makes interdisciplinary treatment and post-discharge monitoring necessary. A few of the variables influencing these patients' results include proper perinatal care and management in an institution equipped with the knowledge and resources required to deliver high-quality treatment [9–11].

Large defects are associated with an increased mortality compared to small defects. The morbidity and complications observed in patients that survive surgery are heterogeneous. Their association with defect size continues to be an area of interest in this complex condition [12-13]. The aim of our study was to describe the survival rate of newborns with congenital diaphragmatic hernia (CDH) who undergo surgical management.

METHODOLOGY

We carried out an inferential, descriptive, and retrospective investigation. All patients operated for correction of CDH admitted to the Dhaka Shishu Hospital's newborn intensive care unit between January 1, 2022, and December 31, 2023, were included in the sample. For neonates with CDH, the Dhaka Medical College Hospital's Department of Neonatal Intensive Care serves as a level reference unit. It has been supplying data to the CDHSG since 2022. Every year, it admits 25 to 30 patients, some of whom are referred by other institutions [14]. Patients

who were not operated on, operated patients who passed away before to release, and operated patients who were not categorized using the CDHSG staging criteria were not included in our analysis. A cooperative, multi-center registry of CHD patients is called the CDHSG [15].

This group suggested a staging approach that classified flaws as type A, B, C, or D, which indicate increasing magnitude, based on direct inspection of the defect as seen by the surgeon during the treatment. Less than 10% of the chest wall and more than 90% of the diaphragm tissue are present in type A abnormalities, which are the smallest. At least 50% of the chest wall is affected by type B abnormalities, and 50% to 75% of the diaphragm tissue is absent. More than 50% of the chest wall and more than 50% of the diaphragm tissue are absent in type C abnormalities. Less than 10% of the normal diaphragm tissue is present in Type D abnormalities, which are the biggest and affect over 90% of the chest wall [16].

Birth weight (BW), gestational age, sex, right/left side of the abnormality, prenatal/postnatal diagnosis, referral from another facility, and the existence of a genetic syndrome or related abnormalities were the descriptive variables. The presence of chronic pulmonary disease (CPD), which is defined as the need for respiratory assistance for more than 30 days, the length of stay (in days), the duration of parenteral nutrition (PN), and the requirement for extracorporeal membrane oxygenation (ECMO) were the outcome factors.

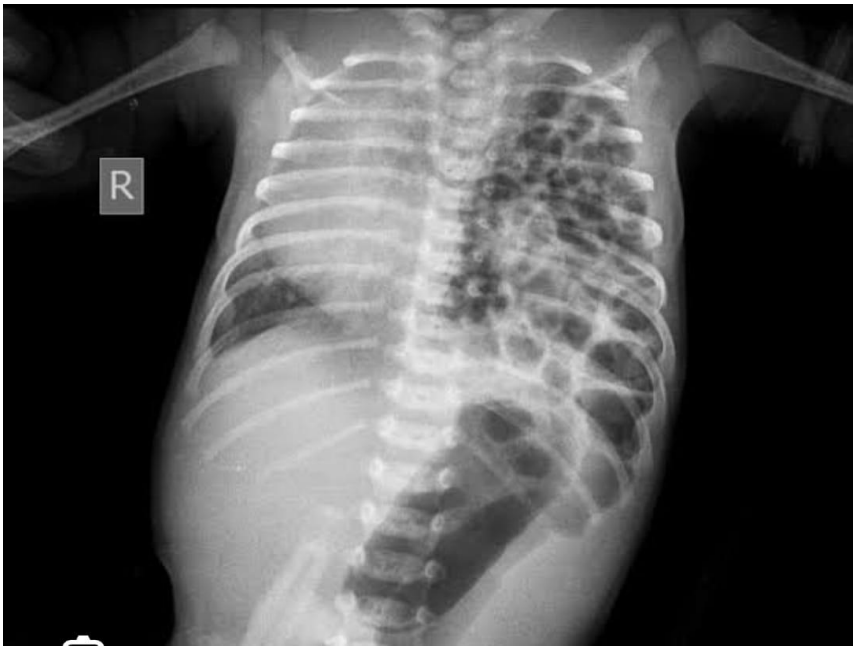

Fig 2: Erect X-ray abdomen showing complex, multicyclic mass lesion

We examined the existence of complications, including deep vein thrombosis (DVT), which was identified through Doppler ultrasonography; gastro-esophageal reflux (GOR), which was determined by clinical or radiological features; imaging-detected pneumothorax; chylothorax, which was identified by the presence of chyle in the pleural space necessitating dietary modification and drainage; and the presence of pathological lesions on brain ultrasonography. Following their hospital discharge, patients were monitored.

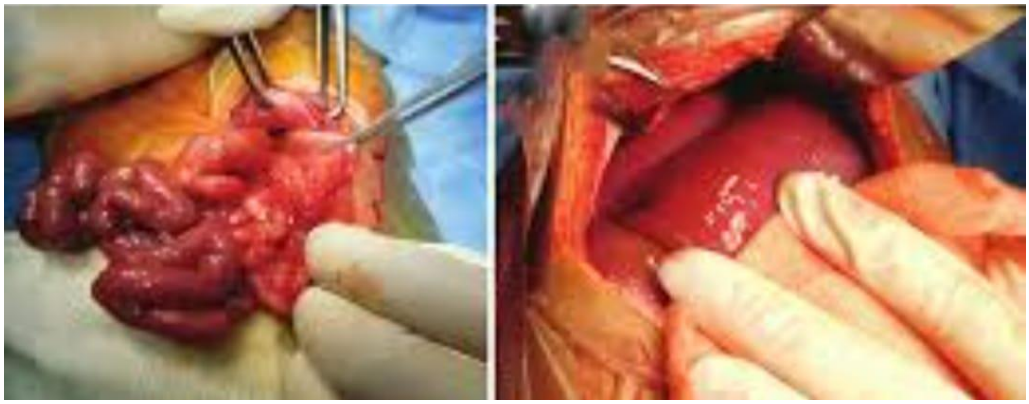

Fig 3 and 4: Photography showing per-operative herniated bowel loop with defect.

We computed percentages for categorical variables and measures of central tendency and dispersion for quantitative variables in the descriptive statistical analysis. To compare numerical variables, we used the Wilcoxon test; to compare multiple variables, we used the Kruskal-Wallis test; and to compare categorical variables, we used the 2 test. Based on defect size, we classified the sample into two categories: small (types A—B) and large (types C—D). Bivariate and multivariate analyses using multiple logistic regression fitted with the Hosmer-Lemeshow test were carried out. P values less than 0.05 were regarded as statistically significant. STATA SE 12 (Stata Corp LP, USA) was the software used for the statistical analysis. The Dhaka Shishu Hospital's Ethics Committee and Board of Education and Research both gave their approval to the study.

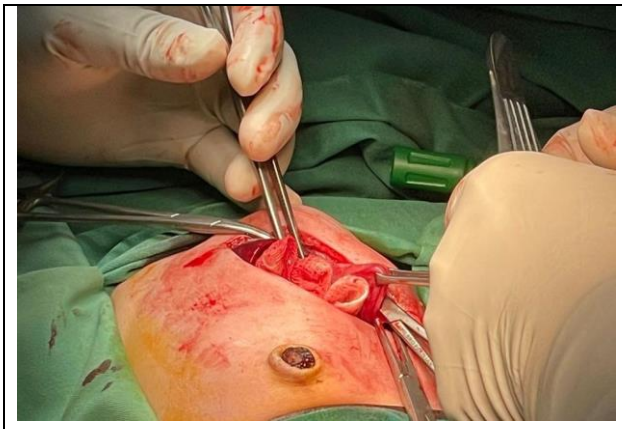

Fig 5:

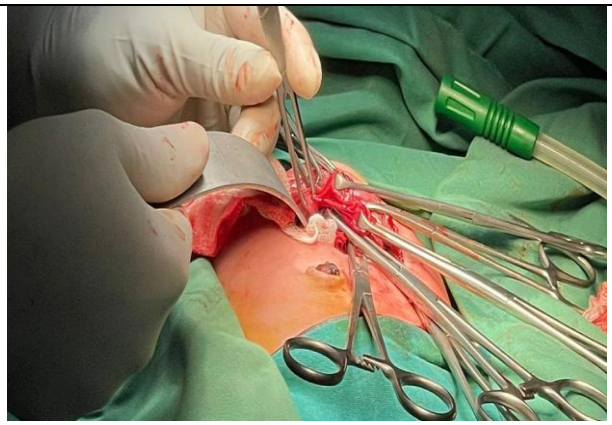

Fig 6:

Fig. 5 and Fig 6: Photography showing per operative repair of diaphragmatic hernia.

RESULTS

Table-1: Demographic data and characteristics of patients with chronic diaphragmatic hernia. (n=57)

Variables	(n or Median)	(% or IQR)
Gender		
Male	32	(53.2)
Female	25	(42.5)
Gestational age (week)	37	(37-38)
Birth weight (g)	2524	(2324-2990)
Genetic variant		
Mild	8	(1.3)
Severe	7	(1.2)
Cardiac malformation		
Mild	35	(61.4)
Severe	22	(38.5)
CDH laterality		
Left	34	(59.64)
Right	22	(38.5)
Bilateral	1	(5.26)
Diaphragmatic defect size		
Defect size A and B	38	(66.6)
Defect size Cand D	13	(22.8)
Unknown	3	(10.5)
Position of the liver		
Intra-abdominal	34	(54.2)
Intrathoracic	23	(46.8)
Delivery		
Vaginal birth	22	(38.5)
Caesarean section	35	(61.4)
Age at repair (days)		
Surgical approach		
Abdominal	45	(78.9)
Thoracic	3	(5.2)
Laparoscopy	1	(1.7)
Thoracoscopy	8	(14.0)

1. Reported as the median (IQR; interquartile range) or n (%). 2. Severe was defined as affecting life prognosis, systemic status, and respiratory and circulatory dynamics, while mild was defined as strongly non-affecting life prognosis. 3. Based on the CDH Study Group Staging System, diaphragm defects were classified as defect size A, B, C, or D: Defect A, diaphragm defect involves 50% of the chest wall; defect D, diaphragm defect involves >90% of the chest wall.

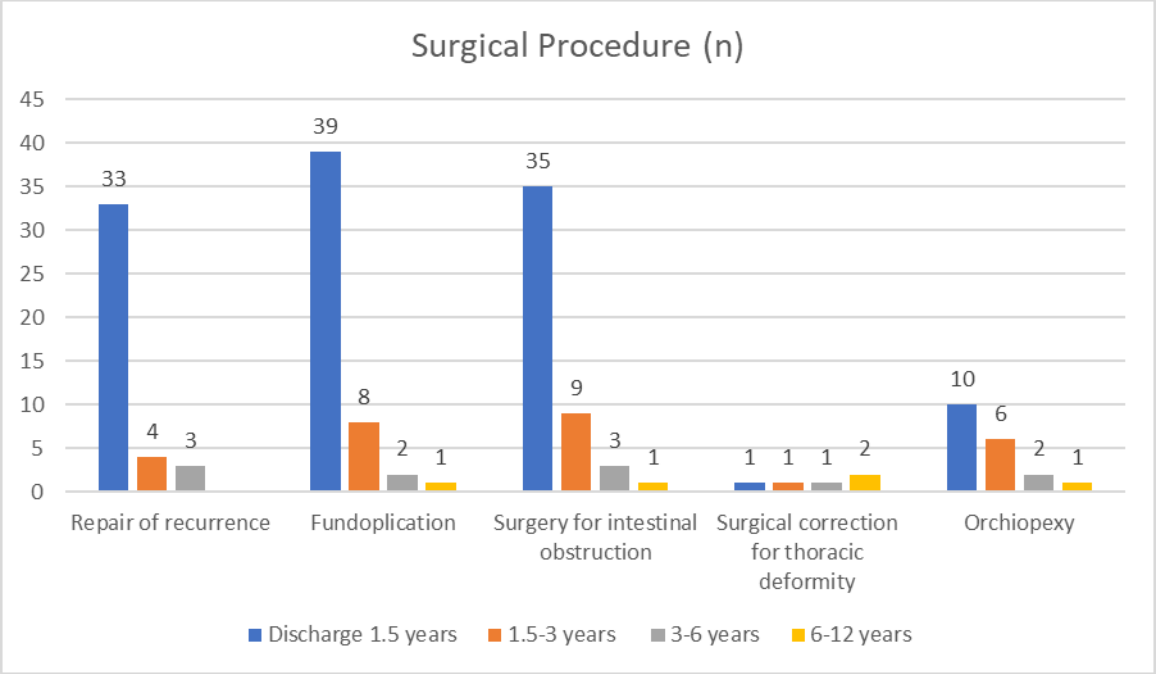

Figure 7: The proportion of different surgical procedures.

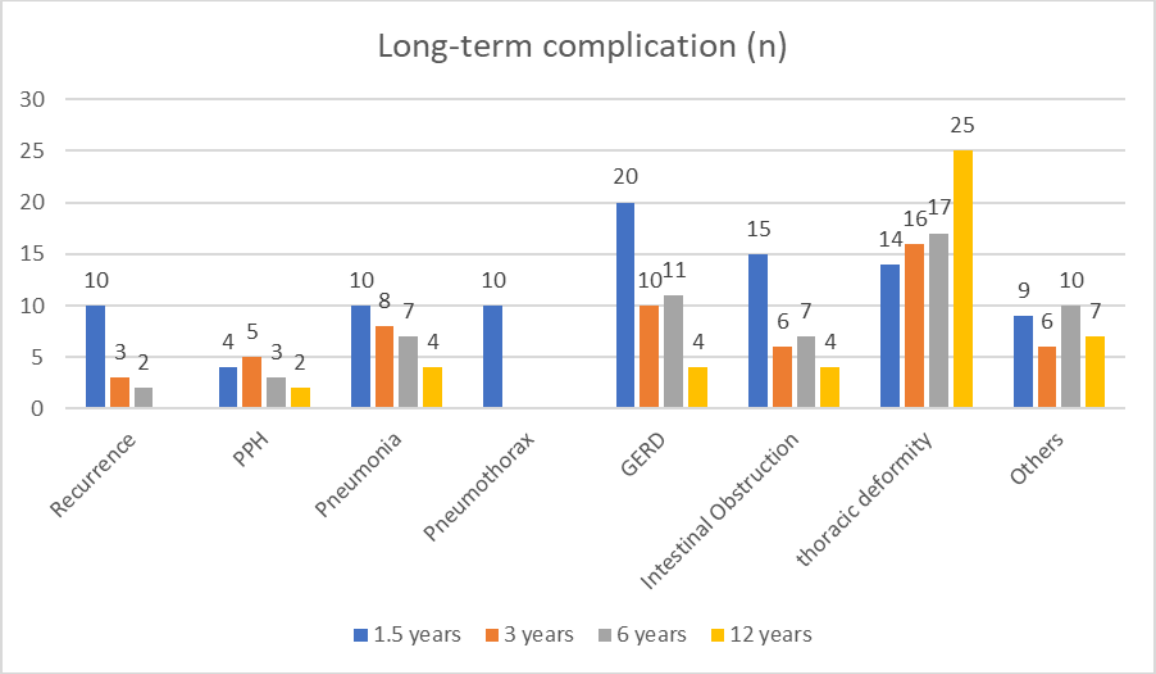

Figure 8. The proportion of long-term complications of surgery.

Table 2. Outcome of congenital diaphragmatic hernia. (n=57)

Variables	n=57	%
Type A	22	(38.59)
Type B	16	(28.07)
Type C	8	(14.03)
Type D	5	(8.77)
Unknown	6	(10.52)

DISCUSSION

The treatment of congenital diaphragmatic hernia remains difficult. More long-term morbidity, such as undernutrition, chronic lung disease, and neurodevelopmental disorders—disorders that impair quality of life—has been linked in recent years to the rise in patients' survival from this illness [17]. We discovered a relationship between short- and medium-term morbidity and defect size. Greater defects increase the risk of chylothorax, which necessitates CPD and ECMO. It was discovered that this correlation existed regardless of the side of the defect—left or right. This was in line with other authors' findings that laterality had little bearing on the morbidity linked to significant abnormalities [18].

The anatomical classification method known as the CDHSG staging system is closely linked to mortality and enables the standardization of surgical severity criteria [12].

According to Lally et al., using this staging system with four categories (A, B, C, and D), each of which is further subdivided according to the presence or absence of a congenital heart defect, results in varying survival rates for each category, ranging from 99% to 39% in decreasing order, and 0% for patients who do not receive surgical repair. The authors came to the conclusion that this classification shouldn't be used as a prognosis factor and that the only reason for staging the problem is to enable standardized reporting [16].

In our study, the association with congenital heart defects was infrequent, as only 2 of the patients had a congenital heart defect requiring surgical repair, both of who died before discharge and therefore were excluded from the analysis [19].

According to a comprehensive analysis, individuals who had an ECMO admission or had hernia patch repairs had a higher incidence of pulmonary problems. Patch repairs may act as a stand-in indicator of severity because the patients who get them are frequently the ones with the biggest problems [20]. Certain types of morbidity have been found to be substantially correlated with defect size. In the multivariate study, Guglielmetti et al. discovered that defect size was the best indicator of needing an esophageal fundoplication (Nissen fundoplication) because of severe GOR (OR, 5.65; 95% CI, 2.18-16.07; P <.0001). This connection was not seen in our research.

During the study period, none of the patients had fundoplication; instead, they were treated with medication, despite the identical frequency of GOR in our sample [21]. Putnam et al. discovered a correlation between a higher likelihood of respiratory, gastrointestinal, and neurological morbidity and the magnitude of the defect and duration of stay (type A defect A, 22 days vs. type D defect, 89 days) in a cohort of 3665 patients who were recorded in the CDHSG database. According to the multivariate analysis, the best indicator of morbidity at discharge was defect size.

Additionally, the scientists carried out a long-term study between 2007 and 2014 and found that while morbidity had stabilized in patients with greater lesions, it had improved in those with smaller faults. A few of our results aligned with those of Putnam et al. For example, in the multivariate analysis, the variable most strongly linked to defect size was respiratory morbidity at discharge. Probably as a result of the small sample size, we were unable to discover a statistically significant connection with any of the other factors in our investigation [13].

Comparing our hospital's patient distribution by defect size to the CDHSG report, we discovered discrepancies. For example, type D abnormalities accounted for 5% of the total in our hospital, but 13% in the CDHSG study. Type C problems showed similar trends, accounting for 37% of cases in our sample and 30% in the CDHSG analysis. Since only full diaphragm agenesis is classified as a type D abnormality in our institution, this could be linked to the rater's subjectivity [16, 22].

One of the study's advantages is that, because it was carried out in a single facility, the therapeutic strategy stayed consistent throughout the follow-up, according to the same protocol in every instance, and the defect size was established by a single surgical team.

Limitations of the study

Among the limitations, we should highlight that we only analyzed morbidity at the time of discharge, without considering the development of additional morbidity in the long term. We ought to mention that all of these patients are assessed during childhood by the follow-up care team of our hospital

CONCLUSION

In our study, defect size was significantly associated with the presence of CPD, the need of ECMO, chylothorax, the length of stay in days and the days of PN. Grading the defect size using the CDHSG staging system helps homogenize care delivery and predict patient outcomes during the hospital stay. The long-term follow-up and outcomes in these patients will provide evidence on the predictive value of defect size.

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This research did not receive any external funding.

Conflicts of interest

The authors have no conflicts of interest to declare

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