

To Study Factors Affecting Surgical Outcomes Of Congenital Diaphragmatic Hernia Repair In Pediatric Patients

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ABSTRACT

Introduction- Congenital diaphragmatic hernia (CDH) is a challenging and potentially life-threatening congenital anomaly that occurs in neonates. The management of CDH requires a multidisciplinary approach, including prenatal diagnosis, neonatal intensive care, and surgical intervention. Major differences in physiology between neonates and adults makes the former group more liable to morbidity and mortality. Risk estimation in these neonates helps to counsel parents about the post operative outcomes.

Aim: - To analyse the potential risk factors affecting the surgical outcome in neonates undergoing CDH repair in our tertiary health care setup.

Material and Methods: This is a retrospective and prospective study done from January 2023 to January 2025, total 124 neonates who underwent CDH repair over a period of 2 years. Demographic data and clinical and laboratory parameters at admission were recorded in a proforma. Pre-operative, intra-operative and post-operative adverse events were observed and recorded. Various factors were subjected to tests of significance and a further multivariate analysis was done to assess the significance of the independent variables in predicting the final surgical outcome.

Results: out of 124 patients 91 neonates were discharged successfully, with mortality noted in 34 patients (27.2%). Gestational age, weight at admission and associated congenital anomalies affected the post-operative outcome significantly. Pre-operative persistent pulmonary hypertension (PPHN), need for transfusion of blood products, inotropic and respiratory support correlated with adverse post-operative outcomes. Similarly, post-operative mortality was noted to be higher in the neonates who required re-intubation, post-operative transfusion of blood products, surgical site infection or ventilator associated pneumonia (VAP).

Conclusion: from this study we concluded that Low birth weight, associated congenital anomalies, PPHN, need for transfusion of blood products, need for inotropes and mechanical ventilation, wound infection and duration of hospital stay are various factors that significantly influence the surgical outcome in CDH repair. Identification of such potential prognostic factors not only helps in improving the surgical outcome in these neonates, but also helps in prognostication and appropriate counselling of the parents.

Keywords: neonates, congenital diaphragmatic hernia, risk factors, surgical repair, persistent pulmonary hypertension

1. INTRODUCTION

Congenital diaphragmatic hernia (CDH) is a severe diaphragmatic malformation that permits herniation of abdominal contents into the chest cavity. It is rare, with population studies giving an estimated prevalence of 2.3 per 10,000 live births [1]. Varying outcomes may depend on a wide range of physiological severities. Treatment of CDH is challenging, requiring the expertise of integrated multidisciplinary teams in a well-resourced intensive care unit. The aim is to gradually recruit the lungs while simultaneously minimizing lung injury. This may be achieved by using 'gentle hyperventilation' and permissive hypercapnia. High-frequency oscillatory ventilation (HFOV) helps to mitigate this morbidity, which can further compromise the already hypoplastic lung [2–4]. Cardio-respiratory stabilization before surgical repair, is a well-established practice, associated with improved outcomes and remains the cornerstone to maintaining hemodynamic stability in the post operative period as well [4, 5].

Extracorporeal membrane oxygenation (ECMO) is used in some countries to support these neonates but is not typically available in lower- and middle-income countries. Indeed, the survival benefit of ECMO may be confined to more severe cases of CDH [6]. Antenatal interventions such as fetal endoscopic tracheal occlusion and termination of pregnancy are other approaches. [3, 7, 8, 9]

Population-based studies from the 1970s to 1990s, which included elective termination and still-born neonates, consistently reported CDH mortality rates ranging from 61–66% [3, 9, 10]. The presence of co-existing major anomalies can reduce survival to 22% [3].

The CDH Study Group (CDHSG) initiated a registry, collecting multi-institutional data from many countries, to evaluate the variation in treatment and outcome, with the ability to adjust for severity [11]. This registry data showed a decrease in the use of ECMO and an increase in the use of iNO over the period of time. From 2007 to 2019, the overall survival of CDH liveborn neonates was 72% [12]. However, patients continue to spend a substantial amount of time in the hospital and suffer from significant morbidities and mortality, particularly those with associated severe defects [13]. Over the past two decades, studies from South and Southeast (SE) Asian countries, mostly involving relatively small numbers of neonates with varying selection criteria, reported survival rates ranging from 56–78% in India [14–18], 52% in Malaysia [19], and 56–79% in Taiwan [20, 21] and Singapore [8, 22], moving from low-middle, upper-middle, and high-income countries, respectively.

Aims and objectives

This is a retrospective and prospective study done to determine the factors affecting outcomes in neonates undergoing CDH repair.

2. METHODS AND MATERIALS

This is a retrospective and prospective study done from January 2023 to January 2025, total 124 neonates who underwent CDH repair over a period of 2 years.

Inclusion criteria-

-Neonates undergoing CDH repair.

Exclusion criteria-

-infants ≥ 30 days.

-neonates undergoing thoracic, cardiac, neuro, ortho, ENT and eye surgery.

-failure to obtain consent.

Demographic data and clinical and laboratory parameters at admissions were recorded in a predesigned proforma. Pre-operative, intra-operative and post-operative adverse events were observed and recorded. The variables were subjected to test of significance and further multivariate analysis was done to assess the independent variables predicting the outcome.

Postoperative events like Persistent pulmonary hypertension, Hypotension, Re-intubation, Ventilator associated pneumonia, Sepsis, Wound dehiscence, Duration of IV fluids, Total duration of stay till discharge or death was also noted.

Observations and Results-

124 neonates underwent CDH repair during the study period. Male: Female ratio was 3.4:1. Majority of the babies (51.2%) were term born. Majority of the babies (51.2%) were term. Mean gestational age at birth in female babies was 36.05 ± 2.81 weeks. Mean gestational age at birth in male babies was 35.89 ± 3.48 weeks.

Table- 1 Association of Outcome with Birth Weight

Birth Weight	Outcome		Total	P Value
	Died	Survived		
	N	N	N	
<2500	19	12	32	0.016
2500-3000	8	57	65	
>3000	6	22	28	
Total	33	91	124	

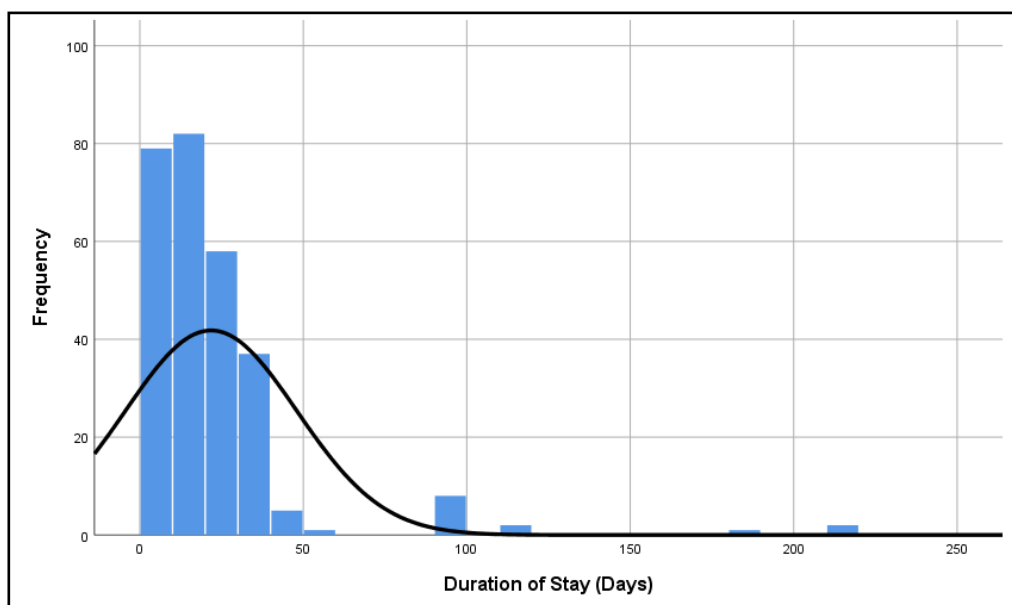
Mean birth weight in non – survivors was 2023 ± 649.88 gms while in survivors it was 2522 ± 708.84 gms . Babies below 2500gms had highest mortality (20/34). Lowest mortality was observed in babies weighing more than 3000 gms (06/34).

Mean weight at admission of neonates who died post operatively was - 2035 ± 610.86 gms. The neonates who survived had mean weight of 2455.75 ± 690.14 gms. Of all the parameters studied, weight at admission was the only parameter found to be significantly associated with postoperative mortality.

Almost half of the neonates required preoperative ventilation support (n:64; 51.2%). Some neonates required more than one type of blood products in the form of Packed RBC, FFP and Platelet transfusion. Need for inotropic support and blood transfusions (PRBC/ FFP/ Platelets)in the preoperative period was seen to be significantly associated with postoperative mortality.

Post operative ventilator associated pneumonia (VAP), hypotension, need for transfusion, Re-Intubation, and postoperative sepsis are factors found to significantly affect post operative survival or mortality. Wound dehiscence and urinary tract infection were not found to be significant.

Table -2 Duration of Hospital Stay



The mean total duration of hospital stay was 21.79 ± 26.24 days. The median (IQR) duration of stay was 12 days.

3. DISCUSSION

This is a retrospective and prospective study done from January 2023 to January 2025, total 124 neonates who underwent CDH repair over a period of 2 years. Majority of the babies (51.2%) were term. Mean gestational age at birth in female babies was 36.05 ± 2.81 weeks, while in male neonates, it was 35.89 ± 3.48 weeks. Mean birth weight in non-survivors was 2023 ± 649.88 gms while in survivors it was 2522 ± 708.84 gms. Babies below 2500gms had highest of mortality (20/34). Lowest mortality was observed in babies weighing more than 3000 gms 06/34. Mean weight at admission of neonates who died post operatively was 2035 ± 610.86 gms. The neonates who survived had mean weight of 2455.75 ± 690.14 gms.

Of the 124 patients operated, 91(72%) neonates were discharged. Studies from other Indian centers have reported survival rates ranging from 58% to 78%.[32,33,34] On the other hand, studies from developed countries have reported a survival rate of 85%–90% with protocolized care.[36,37]

Babies with antenatal diagnosis have better prognosis, especially if the occurrence of diaphragmatic hernia is later in gestation.[38] In this study, no such significant relation could be established between antenatal diagnosis of CDH and postoperative survival. This may be explained by the reason that majority of them were diagnosed early in gestation with higher rates of pulmonary hypoplasia and pulmonary hypertension. Similar results were observed by Chandrasekaran *et al.*[32] Contents of hernia including liver and stomach have been reported to have a poor prognosis.[38,39,40] In the present study also, babies with liver or stomach as the content of hernia were associated with a poorer outcome. Of all the parameters studied, weight at admission was the only parameter found to be significantly associated with postoperative mortality. Pre operative need for transfusion of blood products, inotropic support or ventilatory support also was an indicator of poor outcome. Post operative ventilator associated pneumonia (VAP), reintubation of the patient, hypotension, postoperative sepsis and need for blood transfusion are significant factors affecting postoperative survival or mortality.

Timely institution of respiratory support, thermo stabilization, transfusion of blood/blood products and inotropic support play a major role in determining the final outcome. Postoperative adverse events like need for re-intubation and transfusion of blood/blood products are associated with significant post operative mortality.

Wound dehiscence and urinary tract infection were not found to be significant. The mean total duration of hospital stay was 21.79 ± 26.24 days. The median (IQR) duration of stay was 12days.

A low APGAR score at birth, shock, need for extracorporeal membrane oxygenation (ECMO) and presence of PPHN are also associated with poor prognosis.[32,35,37]. Need for high ventilatory settings in the preoperative period, low PaO_2 , high $\text{AaDO}_2(>500)$, and high $\text{OI} >20$ within first 24 hours were also found to be significantly associated with mortality. Incidence of pneumothorax was 23.33% in this study, which was comparable to 22% incidence observed in a study by Chandrasekaran *et al.* [32]

4. CONCLUSION

CDH is a surgical anomaly associated with major physiological disturbances. The severity is determined by both antenatal and postnatal factors. From this study we concluded that Low birth weight, associated congenital anomalies, PPHN, need for transfusion of blood products, need for inotropes and mechanical ventilation, wound infection and duration of hospital stay are various factors that significantly influence the surgical outcome in CDH repair. Identification of such potential prognostic factors not only helps in improving the surgical outcome in these neonates, but also helps in prognostication and appropriate counselling of the parents. The insights gained from this study will not only contribute to the existing body of knowledge on CDH but also aid in refining our clinical practices, ultimately improving the surgical outcomes in these newborns.

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