

# Post-Operative Neurological Complication after Congenital Heart Surgery (ASD, VSD, TOF) Operation in Pediatric Patients at Bangladesh Shishu Hospital

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## ABSTRACT

**Background:** Congenital Heart Disease (CHD) is becoming more frequently identified, which could be attributed to improvements in diagnostic technologies and the availability of skilled labour. There is a lack of information on the aetiology and outcome of the numerous research that have been carried out in Bangladesh to determine the prevalence and pattern of CHD. To examine the post-operative neurological consequence following Congenital Heart Surgery.

**Materials and methods:** It was a cross-sectional study conducted in cardiac intensive care unit, Bangladesh Shishu Hospital between June 2021 and June 2024. The data of all children less than 15 years old of either gender who underwent open-heart surgery for congenital heart defects, admitted in cardiac intensive care unit and had CT brain secondary to CNS insult were extracted from hospital record. Children who had bleeding disorder and normal Glasgow coma scale 15/15 were excluded. EEG is done for the patients who had clinical seizures, and its not routinely done for all patients.

**Results:** Most common neurological complication was seizure (11.63%) followed by late consciousness 9.30% and absent brain stem reflexes 2.33%, abnormal movement 4.65%, epilepsy 2.33% and Behavioral changes 3.26% respectively. Figure II shows mortality was found 14(4%). The children with neurological complication after surgery had significantly longer ICU stay ( $p=0.006$ ) hospital stay ( $p=0.04$ ), mortality after surgery ( $p=0.002$ ).

**Conclusion:** The most prevalent neurological complications were seizure, late consciousness, absent brainstem reflexes, aberrant movement, epilepsy and behavioural abnormalities. Children who experienced neurological complications following surgery had considerably higher ICU stays, hospital stays and mortality rates.

## KEY WORDS

Congenital heart surgery; ICU stays; Mortality rates; Neurological complications.

## INTRODUCTION

Congenital Heart Disease (CHD) is among the most common congenital anomalies, occurring in approximately nine out of 1000 live births.<sup>1</sup> Survival rates for individuals with Congenital Heart Disease

(CHD) have significantly increased in recent decades, largely due to progress in medical therapies and surgical interventions.<sup>1</sup>

In Saudi Arabia, the incidence of Congenital Heart Defects (CHDs) varies between 2.1 and 10.7 per 1,000 live births, with severe cases occurring at a rate of approximately 5.4 per 1,000. Depending on the nature and severity of the defect, nearly half of these infants require corrective or palliative surgery early in life, placing them at increased risk for various postoperative complications.<sup>2</sup>

Congenital heart surgery admissions comprise approximately 20% of all Adult Congenital Heart (ACH) disease hospitalizations. It is not uncommon for these admissions to occur in pediatric hospitals, where there is surgical expertise in congenital heart disease. Despite the central role pediatric hospitals play in the surgical treatment of congenital heart disease, little is known about the outcomes of ACH surgical care in these hospitals.<sup>3</sup>

Because of improvements in prenatal identification, perioperative care and the improvement of bypass procedures, the mortality rates among children

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underwent cardiac surgery have decreased over the last ten years. Despite this, it has led to an increase in the morbidities like neurological complications.<sup>4,5</sup> Complications occurred in 43 % of pediatric cardiac surgeries performed both with and without cardiopulmonary bypass.<sup>6</sup>

Seizures are the most frequent neurological complication, representing approximately 70% of all neurological sequelae cases.<sup>7</sup> Other neurological complications include hemiparesis and gaze palsies, peripheral nerve injury as phrenic nerve or brachial plexus, dyskinesia and changes in personality.<sup>7</sup> It has been ascertained that neurological impairment can lead to neurodevelopmental delays and cognition impairments affecting the quality of lifemarkedly.<sup>8</sup>

The aims of this study are to examine the independent association of a complication, as defined by a complication screening method, on risk of death during congenital heart surgery admissions.

#### MATERIALS AND METHODS

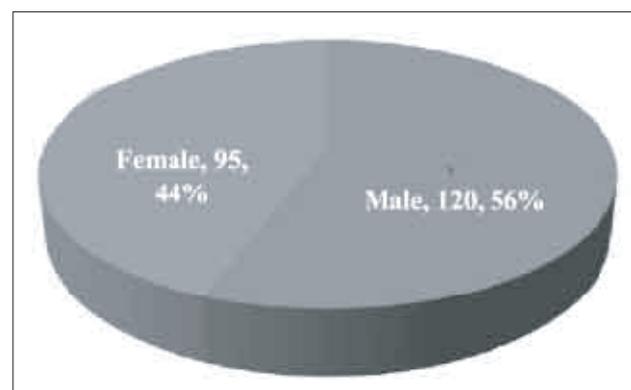
It was a cross-sectional study conducted in cardiac intensive care unit, Bangladesh Shishu Hospital, Dhaka between June 2021 and June 2024. The data of all children less than 15 years old of either gender who underwent open-heart surgery for congenital heart defects, admitted in cardiac intensive care unit and had CT brain secondary to CNS insult were extracted from hospital record. Children who had bleeding disorder and normal Glasgow coma scale 15/15 were excluded. EEG is done for the patients who had clinical seizures and its nor routinely done for all patients. The samples were included in the study using non-random purposive sampling. The data regarding demographics, the appropriate perioperative and operative data including use of heparin dose, pre and post coagulation profile, the clamp time, pump time, preand post-operated labs, extubation failure and dayson ventilator were extracted. Primary outcome was incidence of CNS insult in form of clinical or subclinical symptoms evident radiologically. Secondary outcomes were death after surgery or before hospital discharge for the index hospitalization, length of stay in ICU and hospital. Data was collected using a pre-designed form that indicated the patients' identification number only. The database and all computer files relevant to this research were password protected and known only to the investigators and research coordinator. Statistical Package for Social Sciences (SPSS) version 25 was used to analyze data. Missing and incomplete data were pretermitted from analyses. Qualitative variables were presented as count and percentage.

#### RESULTS

Table shows maximum age group was found 1yr-5 yrs and 5-10 years with were 46.51% and 23.26% respectively. Majority of the children were males (56.0%), Out of 215 cases 12.09% had syndrome, 5.58% were premature and 10.70 % had previous CNS insult (Table I). Figure I shows majority of the children were males (55.06 %). Table II found that the most common neurological complication was seizure (11.63%) followed by late consciousness 9.30%, and absent brainstem reflexes 2.33%, abnormal movement 4.65%, epilepsy 2.33% and Behavioral changes 3.26% respectively. Figure II shows mortality was found 14(4%). Table III shows the children with neurological complication after surgery had significantly longer ICU stay ( $p=0.006$ ), hospital stay ( $p=0.04$ ), mortality after surgery ( $p=0.002$ ).

**Table I** Characteristics of Admissions (n=215)

Demographic characteristics	Number	Percentage (%)
Age group		
6m-1yr	45	20.93
1-5yrs	100	46.51
5-10yrs	50	23.26
>10yrs	20	9.30
Syndrome		
Yes	26	12.09
No	189	87.91
Prematurity		
Yes	12	5.58
No	203	94.42
Previous CNS insult		
Yes	23	10.70
No	192	89.30

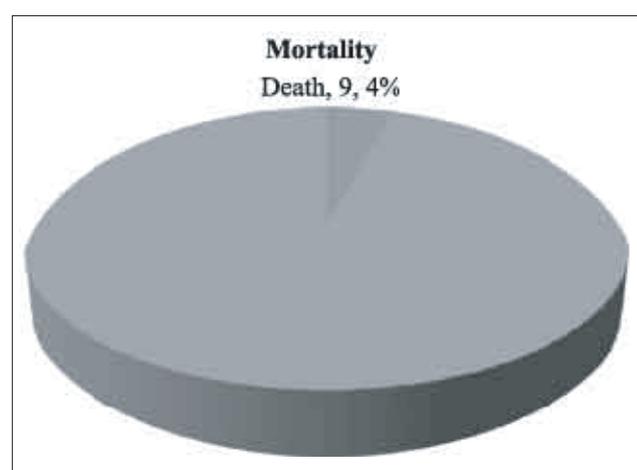


**Figure 1** Gender distribution of the study subject (n=215)

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**Table II** Post operative neurological complication of the study subjects (n=215)

Post operative neurological complication	Number	Percentage
Neurological complication found	67	31.16
Seizure	25	11.63
Late consciousness	20	9.30
Absent brain stem reflexes	05	2.33
Abnormal movement	10	4.65
Epilepsy	05	2.33
Behavioral changes	07	3.26
ICU length of stay (3-11 days)	08	3.72
Hospital length of stay (6-35 days)	10	4.65

**Figure 2** Mortality after surgery**Table III** Comparison of neurological complication with ICU and hospital length of stay and mortality

	Neurological complication		Total	p value
	Yes	No		
	n=67	n=148		
ICU length of stay (3-11 days)	6 (8.96)	2 (1.35)	08	0.006
Hospital length of stay (6-35 days)	6 (8.96)	4 (2.70)	10	0.04
Mortality after surgery	7 (10.45)	2 (1.35)	09	0.002

**DISCUSSION**

In this study observed that that maximum age group was found 1yr-5yrs and 5-10 years with were 46.51% and 23.26% respectively. Majority of the children were males (56.0 %), Out of 215 cases 12.09% had syndrome, 5.58 % were premature and 10.70 % had previous CNS insult. Similar observation was found Shahzad et al. they showed median age of the children was 5 months ranging from 0 to 46 months. Majority of the children were males (55.06%).<sup>9</sup> 10.09% had

syndrome of 208, 2.9% were premature and 9.1% had previous CNS insult. Another An l et al. study also agreement with our observation they showed that the median patient age at operation was 14 months (range, 5-51.75 months). Among the patients, 348 (50.3%) were male.<sup>10</sup>

In the current study, we found that the most common neurological complication was seizure (11.63%), followed by late consciousness 9.30% and absent brainstem reflexes 2.33%, abnormal movement 4.65%, epilepsy 2.33% and Behavioral changes 3.26% respectively. Several studies have also reported the high frequency of neurological complications after pediatric cardiac surgery. Elnaggar et al. found that 15.2 % of children who underwent cardiac surgery had neurological complications, including seizures (n=11) disturbed conscious level and stroke (n=3).<sup>11</sup> Chrysostomou et al. reported that 12 % of the ECMO runs had neurological complications, but it does not provide specific information about seizures or strokes.<sup>12</sup> In a review by Walsh et al. suggested that cardiopulmonary bypass, deep hypothermia and circulatory arrest during congenital heart disease surgery can lead to neurological complications, including stroke, seizures, and cognitive deficits.<sup>13</sup> In another study by Avila-Alvarez et al. found that acute neurological complications was developed in 38 children out of 900, of which 44.7 % were in central nervous system and 55.3 % were in the peripheral nervous system. The most complications were seizures (n=8) hypoxic-ischemic encephalopathy events (n=4) cerebrovascular accidents (n=4) and reversible neurological deficit (n=1) respectively.<sup>14</sup> Hence, the high frequency of neurological complications emphasizes the need for careful monitoring and early intervention in this high-risk population.

Present study observed that the children with neurological complication after surgery had significantly longer ICU stay (p=0.006) hospital stay (p=0.04) mortality after surgery (p=0.002). In the Shahzad study, they found higher ICU stay, hospital stay, mortality after surgery and mortality within 2 weeks of surgery in children with CNS insult. Mortality was related with multi-organ failure, not solely related to CNS complications. Arslanoglu et al. found that 33.3% of the children who developed neurological complications expired and 66.7% were discharged.<sup>4</sup> They found that presence of CNS insult soon after surgery was significantly associated with mortality among children after cardiac surgery (p = 0.001). In another study by Elnaggar et al. 86% of the children with congenital heart defects who underwent cardiac

surgery discharged from ICU and 14% of the children died during the ICU stay having mean duration of hospital stay as 15 days.<sup>11</sup> Thus, prevention of CNS insults is an important goal in the management of pediatric cardiac surgery patients. Strategies that have been shown to reduce the incidence of CNS insults include optimizing perioperative oxygenation, maintaining blood pressure within a narrow range and minimizing the cardiopulmonary bypass time.

### CONCLUSION

The significance of appropriate evaluation and management in this population is highlighted by the large percentage of patients who have experienced a prior CNS trauma. The need for focused measures to lower the risk of neurological complications following congenital heart surgery is highlighted by the observation that these complications are linked to noticeably worse outcomes, such as longer hospital and intensive care unit admissions and higher mortality. All things considered, these findings imply that improving outcomes for patients underwent heart surgery and those with a history of CNS damage requires close observation and care.

### RECOMMENDATION

Further research is needed to better understand the mechanisms underlying this association and to develop effective prevention and management strategies.

### DISCLOSURE

All of the authors declared no competing interests.

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