



## The outcomes of cardiac surgery in patients with congenital heart disease in the Eastern Region of Libya between 2021 and 2023

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### ARTICLE INFO

### ABSTRACT

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**Background:** Congenital heart disease (CHD) is a frequent birth abnormality. As surgical and medical care improves, more kids born with congenital heart disease survive to grow up in developed countries. Hospitals in eastern Libya have continuous to depend on operation of foreign cardiac missions for emergency & surgical management of kids with congenital heart disorders. The aims of this project are to assess both the type & diagnosis of CHD that is surgically managed and the challenges with pediatric cardiac operation facilities in the eastern portion of Libya. **Methods:** The data were obtained from medical reports & monitoring of 163 congenital heart disease cases that underwent operating correction at the National Heart Center and Benghazi Medical Center between May 2022 and March 2023, including those with an age less than 30. **Results:** Males (47.8%), females (52.1%), and patients came mainly from Benghazi (46%) and Jebel Kadar (35.5%), and the most frequent diagnoses were VSD (26.3%), CCHD, and ASD (19.8%), TOF (17.4%), and ASD (12%). With an overall morbidity rate of 7.4%, PS and AS reported the greatest mortality rate (33.3%), followed by COA (12.2%), TOF (10.3%). **Conclusion:** The collaboration among the mission team and the local team improves the local team's care for CHD children. One of the fundamental criteria for assisting children with CHD in Libya is training local healthcare providers to participate in cardiac humanitarian trips and to continue their training through different workshops and programs. We need an extensive treatment plan for these patients, along with ability of the local team to treat congenital heart disease cases on their own.

**Keywords:** CHD, Total Surgical Repair, Cardiac Surgery, Eastern Part of Libya, Benghazi, National Heart Center, Benghazi Medical Center.

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## INTRODUCTION:

Congenital heart disease (CHD), which affects 8 to 12 babies out of every 1000 live births, is a term used to describe anomalies of the intra-thoracic great vessels or structural heart. There is a lack of research on the incidence and prevalence of CHD in Libya, and there aren't any based on the community statistics on the condition countrywide. According to a study conducted by (Abraham M. Mansour in 2018)<sup>1</sup> on the incidence & patterns of CHD in South Libya, ventricular septal defect was the most frequent type of congenital heart disease (14.8%), and tetralogy of Fallot was the most prevalent type of complex congenital heart disease (13.2%). Atrial septal defect (40.4%), ventricular septal defect, (30.8%), and congenital heart disease occurrence were all slightly greater in men compared to women in a single center in the middle of Libya, according to the investigators (M: F ratio of 1:0.9) in a separate study (RugeaMahmmed et al., 2020)<sup>18</sup>. The most of patients of congenital heart disorder, especially complex congenital heart disorder, are successfully treated due to the high standard of cardiac and medical surgical care providing to kids with congenital heart disease in higher-income & developed countries, and such children have a chance to reach maturity. The most of kids in low-income and undeveloped countries lack admission to such advanced congenital heart disease care. There are a variety of defects, ranging from minor defects that include ventricular septal defect, atrial septal defect, or patent ductus arterioles, that don't require immediate attention, to several major defects, including a significant aortic stenosis, single ventricle, pulmonary atresia, severe coarctation, truncus arteriosus, and a hypoplastic left heart that need early intervention. Neonates with critical congenital heart disease who aren't given treatment in the eastern region of Libya become to death. A few of these newborns were transported to Tripoli, which is 1,150 kilometers from Benghazi and requires approximately 2 hours to reach by air; the parents personally transported the children there. There are no local studies that measure the number of these kids that die from deficiency of services; therefore, the exact number is unknown. If a kid is diagnosed with congenital heart disease in one of our hospitals in the eastern region of Libya, the father and mother frequently face challenges, especially in cases where the lesion is critical and needs urgent intervention as a result of a lack of available surgeons. The number of patients necessitating operation has elevated significantly, and critical patients needing urgent treatment have resulted in mortality, as an outcome of our reliance on foreign cardiac operating missions and the resulting delay in cardiac operation for all kinds of congenital heart disease. The duration of heart operation in kids with congenital heart disorder is important. Due to the potential for delayed surgical intervention to lead to a range of complications and fatalities, including atrioventricular canal defect, and ventricular septal defect, development of early pulmonary hypertension is a possibility, that rises the probability of a prolonged stay in the ICU & an elevated death rate. A variety of causes, involving an inadequate continuous cardiac operation program & the delayed discovery of congenital heart disorder in periphery cities because of a deficiency of a comprehensive pediatric cardiac survey, were associated with the delay of cardiac operation in Libya. The local team should be able to independently manage congenital heart disease cases, as they necessitate critical care. To independently manage kids with congenital heart disorder, a comprehensive program is required, and the government must establish a conducive environment for local teams to receive training.

## Patients and Methods:

This is prospective descriptive research of 163 congenital heart disease cases that had cardiac operation (from May 2022 to March 2023) to study demographic data, gender & distribution of age, and the kind of CHD. The surgeries have been carried out in the Eastern region of Libya at the Benghazi National Heart Center and the Benghazi Medical Center, which serve as referral sites for every child with CHD from Libya's various cities. Patients were mentioned by local pediatric cardiologists, or children traveled to Benghazi from another city for medical or diagnosis monitoring. Because of a deficiency of pediatric cardiac care in this part of the country, patients from Libya's south were delayed in diagnosis and referred. The ages varied from seven days to twenty-eight years for such old cases, that were considered adults with ACHD. To confirm the diagnosis, a physical investigation, an ECG, a pulse oximeter, echocardiography and a chest X-ray have been employed. Cardiovascular CT or diagnostic catheterization was also recommended in some situations. Surgeries involving pacemaker implantation, thoracic duct ligation, removal, and stabilizing an unstable sternum have been excluded in this study. Death was included in this research 30 days within open heart operation. Cases from the Jebel Akadar and Benghazi regions, that also include Derna, Jabal al-Akhader, Marj, & Albeda, Ajdadia, the southern region, includes, Alkofra, Sabha, Awjilah and Jalu; the western region includes Tripoli & neighboring cities, in addition to the Western Mountain. Children from the Western Area who had a single local cardiac surgeon at Tripoli Medical Center came to this visiting team as they had a lot of children with congenital heart disorder on the waiting list for operation. These CHD operations relied on

mission trips. This operation will also act as a training opportunity for the local team. We hope that these missions are effective and that the local team will ultimately can deal with these cases on their own.

The descriptive information was examined in Microsoft Excel & described as percentages in charts& tables.

### Results:

A hundred sixty-three congenital heart disease cases had heart operation. There were man (47.8%)and women (52.1%).

**Table (1) Total Gender Distribution:**

Gender	Frequency (N)	%
Female	85	52.1%
Male	78	47.8 %

85.8 % of the cases were normal kids, & 11.6% had Down syndrome. *Table 2.*

**Table (2). A genetic condition in operated patients with CHD**

Genetic condition	(N)	%
Normal Child	140	85.8%
Down Syndrome	19	11.6%
Turner Syndrome	1	0.6%
Noonan syndrome	2	1.2 %
William Syndrome	1	0.6%

The age of operation varied from seven days to twenty-eight years. Most patients operated on were between the ages .*Table 3.*

**Table (3) Total Age Distribution at time of operation**

Age (Years)	Frequency (Number)	(%)
<1	40	24.5%
1_3	64	39.2%
3-5	24	14.7%
5-10	29	17.7%

Most cases come from Benghazi (46%) compared to Jebel Akadar (35.5%). Jebel Akadar involving: marj,Derna, Albeda. Western Region involving: Tripoli & neighboring cities, &Western mountain. Southern region involving: Alkofra,Sabha, Awji,Jalu. *Table 4.*

**Table (4).Total Region Distribution**

Region	(N)	(%)
Benghazi	75	46%
Eastern region	58	35.5%
Western region	19	11.5%
Southern region	12	7.3%

VSD (n = 43, 26.3%) was the most frequent type of congenital heart disease, after which TOF (number = 29,17.7%), ASD, and CCHD (n=27.14.7%). *Table 5.*

<b>Table(5) Types of Congenital Heart Defects:</b>		
<b>CHD</b>	<b>Frequency (N)</b>	<b>Percentages (%)</b>
VSD	43	26.3%
TOF	29	17.7%
ASD	27	14.7%
CCHD	27	14.7%
AVC	13	8%
COA	8	4.9%
PDA	3	1.8%
SAM	3	1.8%
PS	3	1.8%
AS	2	1.2%
MR	2	1.2%
AS+MR	1	0.6%
TAPVD	1	0.6%
ALCAPA	1	0.6%
<b>Total</b>	<b>163</b>	<b>100%</b>

And the highest mortality rate was in PS (33.3%) and (12.2%) in COA and (10.3%) in TOF, with a (7.4%) overall mortality rate. **Table(6)**

#### **Discussion:**

Limited community-based analysis of data on the occurrence & frequency of CHD throughout Libya necessitates further investigation. This needs the help of the government and the Ministry of Health. In this study, all patient data from two medical centers are analyzed. Transcatheter closure, associated with reduced problems and a shorter recovery duration, has predominantly supplanted operative closure of ASD and PDA ligation.

(Transcatheter intervention for patent ductus arterioles& atrial septal defect was initiated in the western region of Libya,

**Table (6) Types of CHD and Mortality Rate**

<b>CHD</b>	<b>No of Death(%)</b>
TOF(BT shunt/Total Repair)	3(10.3%)
VSD	1(2.3%)
CCHD(Palliative/Total Repair)	2(7.4%)
AVC(Total Repair)	2(7.4%)
COA( Repair )	1 (12.2%)
ASD(Patch closure)	0(0%)
PDA Ligation	0(0%)
PS	1(33.3%)
AS	1(33.3%)
TAPVD	0(0%)
ALCAPA	1(100%)
MR	0(0%)
<b>Total</b>	<b>12(4.7%)</b>

The most frequent complications that occur after operation were wound infection (number=8, 4.9%) and acute kidney injury (2.4%) Table 7.

Table (7) post-operative Complications:		
Complications	Frequency (Number)	Percentage %
Acute Kidney Injury	4	2.4%
Unstable sternum	3	1.8%
Wound infection	8	4.9 %
Limb ischemia	2	1.2%
Permanent CHB	1	0.6%
Transient CHB	4	2.1%

Maryam Mirani et al.,2016)<sup>15</sup> that the most frequent congenital heart disease are PDA (11%), VSD (25%), and ASD (13%) according to an evaluation of 203 cases that underwent open-heart operations in Iran,VSD was the most prevalent lesion in an investigation of seventy-two cases having congenital heart disease operation in Nigeria, (Ikechukwu A. Nwafor et al., 2019), subsequent to patent ductus arterioles (24.6%) & atrial septal defect (17.28%)<sup>13</sup>, This is consistent with prior investigation in Guatemala (Kowalsky RH et al., 2006; Egypt, Ahmed H. Gamala, 2020; &Twiam, Courtney McCracken, 2018).<sup>11,2,5</sup> The prior studies identified similarities with our research & suggested which cases of congenital heart disease are prevalent in these countries. The most prevalent operative process, regarding another investigation, was aortic valve replacement, that might have helped to an increased occurrence of certain types of congenital heart disease (Jacobs JP et al., 2019)<sup>9</sup>. The timing of cardiac operations in kids with congenital heart disease is crucial, as delayed intervention of operation may lead to a variety of mortality & morbidities, including ventricular septal defect andatrioventricular canal defect, that rise the probability of early pulmonary hypertension, an elevated death rate and an extended stay in the ICU (Beghetti M et al., 2009; Reza Riasi et al., 2015).<sup>16</sup> In a research performed in 2020 by (Iyad Al-Sammouri et al. 2020)<sup>10</sup>, While awaiting operation, the rate of death for Syrian refugee infants with cardiac illness was seventeen percent. It is challenging to manage Syrian refugee kids with heart illnesses, regardless regional and international efforts, which leads to delays and mortality in these kids. Regarding (Forud Salehi Abarghuie et al. 2015)<sup>7</sup>, research of 789 cases discovered which foreign cardiac missions are additionally conducted, seventy-five percent of cases who underwent cardiac operation were kids under the age of 10.in which 75.8% of the individuals were under the age of 3 while twenty-two percent were over the age of 3. In Nigeria, (Ikechukwu A. Nwafor et al., 2004)<sup>13</sup>. In a prior investigation conducted in the eastern region of Libya, 52.2% of cases with tetralogy of Fallot underwent operation at the age of two years or older (Mariam M. Almadany et al., 2020)<sup>14</sup> In this study, nine (31%) Tetralogy of Fallot patients have undergone operation before reaching one and a half years old. The mortality rate in the research we conducted was 7.4%. PS (33.3%) and COA (12.2%) were the most prevalent causes of mortality, subsequently, tetralogy of Fallot (10.3%). regarding prior investigations, the overall death rate was 4.8% in Egypt (Ahmed H. Gamble et al., 2020)<sup>2</sup>, 13.4% in Brazil (Jacobs JP et al., 2019)<sup>9</sup>, 2.6% in Lebanon (Arabia M. Majdalani M. et al., 2018)<sup>3</sup>, and 6.3% in Sudan (Osama Yousif Algibali et al., 2018)<sup>16</sup>. (Country et al. 2018; Khorosrow Hashemzadeh 2020)<sup>11,5</sup> revealed that the TOF mortality rates were, respectively, 6.9% and 7.4%, which corresponds to our findings. Comparing our results to other studies that include more cases, the relatively small number of pulmonary stenosis CoA, and AC patients contributes to a greater death rate. A 7.4% death rate was observed in our cases that delayed operation till they were older than one year, as compared to an investigation by Hirata Y., Hirahara et al.,2021, where the death rate in cases was two percent, and North American research (Logan G. Spector et al., 2018)<sup>8</sup>, where the death rate was 1.9 percent.the only opportunity for surviving in neonates with other critical congenital heart defects (CCHD)or transposition of the great artery (TGA) is the presence of a surgical team in the 1<sup>st</sup> few weeks of life. No transposition of the great artery or other critical neonatal congenital heart defects have been included into the present research due to the absence of babies with transposition of the great artery during the mission under investigation. The challenges of treating congenital heart defects with foreign cardiac operation include: Arriving late for cases, a large number of patients needing to be treated immediately, insufficient care after operation, mostly In certain instances, continued time required for recovery after operation, the deficiency of a trained local team to deal with certain situations following the mission teams left, & a deficiency of supplies that are needed, including NO , that isn't obtainable all over the country, the training of critical care teams & the use of the ECMO machine can all contribute to these issues.

### Conclusion: -

for providing treatment for children who were born with congenital heart disorder, pediatric cardiac surgery and cardiac surgical critical care facilities in eastern Libya stay dependent on cardiac operation missions from other countries. With the assistance of like a surgical team on its mission, the local team may get trained, in order to establish an effective pediatric cardiac program, public-spirited people, immediate attention from the government, international organization, & nongovernmental organizations is needed. We can arrange comprehensive therapy for these cases and confirm that the local team has the capability of managing CHD patients on their own. Even though foreign cardiac surgical missions are very helpful, their efforts are definitely insufficient. Therefore, they should concentrate more on the local team's training program so that they can improve and take care of more patients.

### Abbreviations:

AVC: Atrioventricular canal defect, PDA: patent ductus arterioles, TOF: tetralogy of Fallot, CCHD: Complex congenital heart disease, ASD: Atrial septal defect, PS: pulmonary stenosis, AS: Aortic stenosis, VSD: ventricular septal defect, SAM: Sub Aortic membrane, PAB: Pulmonary Artery banding, MVR: mitral valve repaired, CHB: Complete Heart BLOCK, ALCAPA: Anomalous left coronary artery from the pulmonary artery.

### References:

1. Abraheem M. Mansour, Prevalence and Pattern of Congenital Heart Disease in South Libya (2018). *Journal of Medical Sciences* (13)
2. Ahmed H. Gamala , El-Minshawy K. Ahmedb , Ismail E. Ahmedb& Sadek A. Oma(2020). *J Curr Med Res Pract* 5: 121-125
3. Arabi M, Majdalani M, El Hajj MA, Nemer G, Sawaya F&Obeid M Bitar FF. The status of pediatric in Lebanon. *J Med Liban.* 2011 Jul- tertiary center cardiology at Sep;59(3):136-42.
4. BeghettiM, TissotC. Pulmonary arterial hypertension in congenital heart diseases. (2009). *Semin Respir Crit Care Med*;30(4),421
5. Courtney McCracken, Logan G. Spector, Jeremiah S. Menk, Jessica H. Knight, Jeffrey M. Vinocur, Amanda S. Thomas&MatthewE. Oster, (2018). Mortality Following Pediatric Congenital Heart Surgery: An Analysis of the Causes of Death Derived From the National Death Index *J Am Heart Assoc.*207.(22),010624
6. Emile A. Bacha, Albertus M. Scheule, David Zurakowski, Lars C. Erickson&Judy Hung..(2001) Long-term results after repaired of tetralogy of fallot . *J Thorac Cardiovascular Surgery.* 122(1),154-61.
7. Forud Salehi Mohamad Reza, Mirza Aghayan& Hamid Reza Riasi. (2015) *Surgical.* (3),1-Hirata Y, Hirahara N, Murakami A, MotomuraN, MiyatH&Takamoto S. (2021) Status of cardiovascular surgery in Japan: A report based on the Japan Cardiovascular Surgery Database 2017–2018. *Asian Cardiovascular and Thoracic Annals.* 29(4):289-293.
8. Hirata Y, Hirahara N, Murakami A, MotomuraN, MiyatH&TakamotoS.(2021) Status of cardiovascular surgery in Japan: A report based on the Japan Cardiovascular Surgery Database 2017–2018. *Asian Cardiovascular and Thoracic Annals.* 29(4):289-293.
9. Jacobs JP, Mayer JE Jr, Pasquali SK, Hill KD, Overman DM, St Louis JD, Kumar SR, Backer CL, Tweddell JS Dearani JA & Jacobs ML(2019). The Society of Thoracic Surgeons Congenital Heart Surgery Database: 2019 Update on Outcomes and Quality. *107(3),691-704*
10. Lyad Al-Ammouri I, Daher A, Tutunji, Qutishat H, Hijazi A, Al- Shaikh H, Al Qusous L, Al-Othman N, Salah S&Alibrahim (2020). The outcome of Heart Disease in Syria Refugee Children Insights into Crisis. *Pediatr Cardiol.*41(5):877-884.
11. Khosrow Hashemzadeh& Shahryar Hashemzadeh (2010). Early and Late Results of Total Correction of Tetralogy of Fallot. *Acta Medica Irenics.* 48(2): 117-122.
12. Kowalsky RH, Newburger JW& Rand WM & Castaneda AR (2006). Factors Determining access to surgery for children with congenital cardiac disease in Guatemala, Central America. *Cardiol Young.* (16), 385-
13. Ikechukwu A. Nwafor, John C& Eze. (2019). Status of Congenital Heart Defects in Nigeria, The Role of Cardiac Surgery. *World Journal of Cardiovascular Surgery.* (9), 63-72
14. Marium Mohamed Mustafa, Rasmyia. Elfatory, Aziza I, Gadwar, Khadija them Elstree and Hagir M. Aldhabi .(2020) *Outcomes of Total Surgical Correction for Tetralogy of Fallot in Benghazi.* 35 (3): 212-217

15. Maryam Mirani, Samaneh Mirzaei, Elham Sepahvand, Afifeh Rahmanian Koshkaki Marzieh& Karma Jahromi. (2016) Evaluation of Complications of Heart Surgery in Children with Congenital Heart Disease at Dena Hospital of Shiraz Global Journal of Health Science .8(5) ,33–38
16. OsamaYousifAlgibali, Baha Eldin Juma, Reem OsamAlgibaly&Mohamed Hassan Ahmed(2018). The role of diaspora and non-governmental organization in helping Sudanese children with congenital heart diseases: 6 years pediatric cardiac surgery camps experience. Journal of Public Health and Emergency. 2:26
17. RezaRiasi (2015) Surgical outcomes of congenital heart diseases in a pediatric hospital: a two-year survey Journal of Surgery and Trauma.3(1-2).1-4.
18. RugeaMahmmed, Moftah Alhagamhmad, Naema Goobae, Abdelhamid Shaki, & Mohamed Masood (2020). A pattern of Congenital Heart Disease among Libyan Children: A Single Centre Study. Cardiology and Angiology: An International Journal 9(4),78-84