



Review Article

One-Year Experience of Congenital Heart Surgery at the National Heart Center in Benghazi

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Abstract

Background: Congenital Heart Disease (CHD) is a common birth defect; more children born with CHD in developed countries are surviving to adulthood due to improvements in medical and surgical care. In eastern Libya, hospitals continued to rely on foreign cardiac surgery missions for the surgical and critical treatment of children with CHD. The objectives of this study are to evaluate the nature and prognosis of surgically treated congenital heart disease as well as issues with pediatric cardiac surgery services in the eastern part of Libya. **Methods:** The information was collected from the medical records and follow-up of 91 patients with CHD who underwent surgical correction between May 2022 and March 2023 at the National Heart Center in Benghazi. Individuals under the age of 30. **Result:** males (52%), females (48%), The majority of patients (52%) were from Benghazi, followed by those from Jebel Kadar (22%), and the most prevalent diagnoses were VSD (29%), TOF (24%), and ASD (12%). The highest mortality rates were 25% in AVC and 12% in TOF, with a 9.8% overall mortality rate. **Conclusion:** The partnership between the mission team and the local team has a positive impact on the local team in the treatment of children with CHD. Training and participation of the local medical staff during cardiac charity missions and their continuation in various workshops and courses are among the basic requirements to help children with CHD in Libya. For these patients, we need a comprehensive treatment plan as well as the ability of the local team to manage CHD patients independently.

Keywords: Congenital Heart Disease; Cardiac Surgery; Congenital Heart Defect; Total Surgical Repair; Eastern Part Of Libya; Benghazi; National Heart Center

Abbreviations: ASD: Atrial Septal Defect, VSD: Ventricular Septal Defect, PDA: Patent Ductus Arteriosus, AVC: Atrioventricular Canal Defec, TOF: Tetralogy Of Fallot,

PS: Pulmonary Stenosis, AS: Aorticstenosis, CCHD: Complex Congenital Heart Disease, MVR: Mitral Valve Repaired, SAM: Sub Aortic Membrane. SAM: Sub Aortic Membrane

Introduction

Congenital Heart Disease (CHD) refers to structural heart or intra-thoracic great vessel abnormalities, and it is one of the most

common birth defects, impacting 8 to 12 newborns out of every 1000 live births. There have been few studies of the prevalence of CHD in Libya and no community-based data for the incidence and prevalence of CHD in the entire country. In a study on the frequency and patterns of Congenital Heart Disease (CHD) in South Libya by Mansour's AM, et al. [1], VSD was the most common CHD (14.8%), and TOF was the most common type of CCHD (13.2%). According to the results of another study Mahmmed R, et al. [2] in a single center in the middle of Libya, the incidence of ASD (40.4%) and VSD (30.8%) and the prevalence of CHD also were observed to be slightly higher in males than females (M: F ratio of 1:0.9). The advanced level of pediatric cardiology and cardiac surgery care provided to children with CHD in developed and high-income countries has allowed for the treatment of the majority of cases of CHD, including complex CHD, and these patients have a good chance of surviving to adulthood. The majority of children in low- income and developing countries do not have access to such advanced CHD care. The variety of defects ranges from a single, minor defect, such as an ASD, PDA, or VSD, which doesn't need immediate attention, to numerous, major defects, such as a single ventricle, significant aortic stenosis, severe coarctation, pulmonary Artesia, a hypoplastic left heart, and Truncus arteriosus, which need early intervention ,untreated neonates with critical CHD in eastern part of Libya die ,and a few of these newborns are transferred to Tripoli, which is about 1,150 km from Benghazi and takes about two hours by plane, and the parents transported their children there themselves. The exact number of these children who pass away from lack of treatment is unknown because there are no local studies to quantify them. When a child is diagnosed with CHD in one of our hospitals in the eastern region of Libya, the parents usually face difficulties, especially if the lesion is severe and requires immediate treatment because there are no available surgeons. Due to our reliance on cardiac surgical missions from other countries and the resulting delayed timing of cardiac surgery for all types of CHD, the number of cases requiring surgery increased significantly, and critical cases requiring urgent surgery have passed away. Timing is critical for cardiac surgery in children with CHD since delayed surgical intervention can cause a variety of morbidity and mortality, including AVC and VSD, there is a risk of developing early pulmonary hypertension, which raises the possibility of a longer stay in the intensive care unit and an increased mortality rate. A number of factors have been implicated in the delayed timing of cardiac surgery in Libya, including an insufficient continuous cardiac surgery program and the delayed detection of CHD in the periphery cities due to a lack of a competent pediatric cardiac survey. The local team must be capable of managing CHD patients on their own, as these patients require extensive care. To be able to manage a child with CHD independently, we need a comprehensive program, and the government must facilitate an atmosphere that encourages local

teams to receive training.

Patients and Methods

This is a prospective descriptive study of (91) CHD patients who underwent cardiac surgery (between May 2022 to March 2023) to analyze demographics, age and sex distribution, and the type of congenital heart abnormality. The operations were performed at the Benghazi National Heart Center is a Referral center in Eastern region of Libya formerly Benghazi Cardiac Center (BCC) offers service to the whole of children with CHD from different cities of Libya. Patients from various parts of Libya have been referred by neighborhood pediatric cardiologists, or the patient has traveled to Benghazi from a remote location for diagnosis or medical follow-up. Patients from the southern region of Libya experienced delays in diagnosis and have been referred due to a lack of pediatric cardiac services in this area. Age ranged from 33 days to 28 years old for such old patients considered Adult with Congenital Heart Disease (ACHD). Physical examination, a pulse oximeter, a chest X-ray, an ECG, and echocardiography were used to confirm the diagnosis. In some cases, cardiac CT or diagnostic catheterization were also indicated. This study excludes operations including thoracic duct ligation, pacemaker installation, pacemaker removal, fixing an unstable sternum. Following 30 days of open-heart surgery, death was included in this study. Patients from Benghazi and Jebel Akadar area, which includes Derna, Jabal al-Akhader, Marj, and Albeda. Ajdadia, the southern region including Sabha, Alkofra, Jalu, and Awjilah; and the western region including Tripoli and nearby cities, as well as the Western Mountain. Due to the excessive number of pediatric patients with CHD on the waiting list for surgery, patients from the Western Area who had a single local cardiac surgery at Tripoli Medical Center came to this visiting team. These missions caring on by Italian team from Ospedale Pediatrico Bambino Gesù to resume surgery on CHD patients after it was stopped in 2012 which was depended on mission visits. This mission will also serve to train the local team. The local population appreciated these trips. Many success stories involving children and their families exist, some sad ones involving those whom we were unable to assist and whose families had to wait for the following visit for their children. By bringing up the destinies and sufferings of their children six of whom died while their families hoped for any surgical solution we revived their sadness, and all we could find for them were our sincere regrets and condolences. We hope that this work will be successful and that the local team will be able to treat these patients independently in the near future. The descriptive data was analyzed in Microsoft Excel and presented as percentages in tables and charts.

Results

Ninety-one CHD patients had heart surgery. There were females (48%) and males (52%). (Table 1, Figure1). The operating age

ranged from 33 days to 28 years. (Table 2). 85% of the patients were normal children, and 12% had Down syndrome. (Table 3).

Gender	Frequency (N)	%
Female	44	48%
Male	48	52%

Table 1: Total Gender Distribution

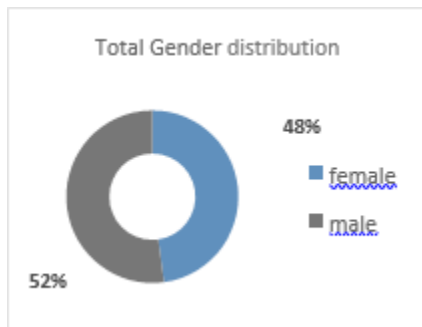


Figure 1: Total Gender Distribution.

Age (Years)	Frequency (N)	(%)
<1	17	18%
1_5	49	53%
5_10	21	23%
10<	5	5%

Table 2: Total Age Distribution at time of operation.

Genetic condition	Frequency (N)	%
Normal Child	77	84%
Down Syndrome	11	12%
Turner Syndrome	1	1%
Noonan syndrome	1	1%
William Syndrome	1	1%
Total =	= 91	-

Table 3: Genetic condition in operated patients with CHD.

Most patients come from Benghazi (52%) then Jebel Akadar (22%). (Table 4) Jebel Akadar including: Derna, marj, Albeda. Western Region including: Tripoli and city near to it, and Western mountain. Southern region including: Sabha, Alkofra, Jalu, Awjilah.

Region	Frequency (N)	Percentage (%)
Ajdabiya	7	8%
Albayda	6	7%
Almarj	5	5%
Alqubah	1	1%
Benghazi	48	52%
Derna	3	3%

Jikharra	1	1%
Shahat	3	3%
Sirte	3	3%
Suluq	1	1%
Susah	1	1%
Tobruk	13	14%

Table 4: Total Region Distribution.

32 surgeries were performed during the first mission. TOF (n = 9, 28%) was the most common type of CHD, followed by VSD (n = 7, 21%). Males outnumbered females 53% to 47% (Table 5). The mortality rate was 9% (Tables 6 and 7).

Gender	1 st Workshop		2 nd Workshop		3 rd Workshop	
	F	M	F	M	F	M
N	17	15	9	15	17	18
%	53%	47%	38%	62%	49%	51%
M:F	1:1.1		1.6:1		0.9:1	

Table 5: Gender distribution throughout the workshops

The second mission included 24 surgeries, with TOF accounting for 41.6% and VSD accounting for 29.1% of the total. With a male-to-female ratio of 1.6:1 (Table 5). The mortality rate was 13%. (Table 7) The third mission included 35 surgeries, with VSD accounting for 34.2% and TOF accounting for 17.1%. with a male- female ratio of 0.9:1 (Table 5). and an 8.5% mortality rate. (Table 7)

Over the course of a year, three separate missions performed 91 cardiac surgeries (Table 8,9). VSD (n=26, 29%) and TOF (n=25, 27.4%) were the most common types of surgery (Table 9). The 30-day post- operative mortality rate was 9/91 (9.8 %) (Table 7).

The most common post-surgical complications were wound infection (n=6, 6.6%) and sepsis (Table 6). Sepsis is a significant factor that has a negative impact on the outcomes of the second mission. (Table 7)

Complications	Frequency (N)	Percentage %
Acute Kidney injury	4	4.3%
Unstable sternum	4	4.3%
Wound infection	6	6.6 %
Limb ischemia	2	2.1%
Transient Complete heart block	2	2.1%

Table 6: Post-Operative Complications.

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	No of operated Patients	No of Moralties	Mortality Rate %
May 2022 (1 st mission)	3	3	9%
September 2022 (2 nd mission)	24	3	13%
March 2023 (3 rd mission)	35	3	8.5%

Table 7: Total Patients, Mortality Rate.

Types of CHD	Types of operative corrections	N	(%)
PDA *associated with other anomalies	PDA ligation *ligation was done with other corrections.	6	6.5%
ASD As single lesion or association with other CHD	Closure with a patch / direct suture closure	15	16%
VSD	Patch closure of the defect	26	29%
TOF	Total Correction	22	24%
Persistent left superior vena cava-unroofed coronary sinus	Total Correction	1	1%
Coarctation of Aorta	End-to-end anastomosis	6	6.5%
AVCD	Total Correction	8	8.7%
Aortic stenosis-sub aortic membrane	Aortic membrane excision/Aortic repair	1	1%
Sub aortic membrane	Sub aortic membrane resection	1	1%
Aortic stenosis (supra valvular)	Augmentation of ascending aorta aortoplasty	1	1%
MR-Mitral valve cleft	Mitral valve reconstruction	1	1%
Pulmonary stenosis	valvoplasty	1	1%
Critical Pulmonary stenosis	Valvotomy	3	3%
Double Outlet Right ventricle(DORV)-pulmonary stenosis - transposition of great artery	Rastelli procedure	1	1%
Double Outlet Right ventricle(DORV)-Fallot type	Total Repair double patch technique	2	2%
Double Outlet Right ventricle(DORV)- Dextro cardia-interrupted aortic arch (Complex CHD) left phrenic nerve palsy	Diaphragm fundoplication Lt side	1	1%

Table 8: Total Operative Corrections.

NO	1 ST Mission May-2022: Frequency (N)/total	2 ND Mission September-2022: Frequency (N)/total	3 RD Mission March-2023: Frequency (N)/total	Total Number of Cases: Total frequency (N)/ total number of cases
TOF	9/32	10/24	6/35	25/91
AVC	2/32	4/24	3/35	9/91
ASD	5/32	1/24	10/35	16/91
VSD	7/32	7/24	12/35	26/91
CoA	3/32	1/24	2/35	6/91

PS	1/32	1/24	1/35	3/91
TGA Senning repair	1/32	0	0	1/91
SAM Resection	1/32	0	1/35	2/91
Diaphragm fundoplication	1/32	0	0	1/91
TAPVD	1/32	0	0	1/91
TAPVR(total anomalous pulmonary venous return)	total anomalous pulmonary venous return repair	1	1%	TAPVR(total anomalous pulmonary venous return)
Transposition of great artery ASD PDA	Mustered operation	1	1%	1

Table 9: Distribution of CHD, Mortality rate.

Discussion

In Libya, and there are a few community- based data on the incidence and prevalence of CHD across the country, which necessitates further investigation. Which requires government and Ministry of Health assistance only patient's data from one medical center is analyzed in this study. Surgical ASD closure and surgical PDA ligation have been replaced by trans catheter closure, which has fewer complications and a shorter hospital stay than surgical intervention. In the western part of Libya, we began trans catheter intervention for ASD and PDA, and only large ASD and sinuous venous ASD are referred to surgery. According to the results of our study, VSD was the most often performed CHD (29%), followed by TOF (27.4%), and ASD (17.5%). (Maryam Mirzaei et al., 2016) [3] 15who evaluated 203 patients who underwent open heart surgery in Iran and discovered that the most common CHD are VSD (25%), ASD (13%), and PDA (11%) ,in a study of 72 patients undergoing CHD surgery in Nigeria (Ikechukwu A. Nwafor et al., 2019)13[4], VSD was the most common lesion (27.16%), followed by PDA (24.6%), and ASD (17.28%) , which is comparable to previous research in Guatemala (Kowalsky RH et al., 2006; Egypt Ahmed H. Gamala, 2020; and Twiam (Courtney McCracken, 2018)11,2,5 [5,6,7]. The previous study selected similarities with our study and represented that such CHD is common in these countries. According to another study aortic valve replacement was the most common surgical procedure, which may have contributed to a higher prevalence of some types of CHD (Jacobs JP et al., 2019) [8]. Appropriate timing of cardiac surgery in children with CHD is critical because delayed surgical intervention can result in a variety of morbidities and mortality, such as AVC, VSD where there is a risk of early pulmonary hypertension, which increases the risk of a longer stay in the intensive care unit and an increased mortality rate (Beghetti M et al., 2009, RezaRiasi., et al., 2015)16 [9,10]. In a study conducted in 2020 by (Iyad Al- Sammouri et al. 2020)9

[11], the mortality rate for Syrian refugee infants with cardiac disease while waiting for surgery was 17%. Despite regional and international efforts, it is difficult to treat Syrian refugee children with heart disease, resulting in delays and mortality in those children. According to, (Forud Salehi Abarghuie et al. 2015)7 [12], a study of 789 patients revealed that 75.8% were under the age of three and 22% were over the age of three. In Nigeria, where foreign cardiac missions are also carried out, 75% of patients undergoing cardiac surgery were children under the age of ten (Ikechukwu A. Nwafor et al., 2019)13 [4]. In a previous study in the eastern part of Libya, 52.2 percent of patients with TOF were operated on at the age of 2 years or older (Mariam M. Almadany el-Attiya, 2020)14 [13]. The median age for TOF surgery in a 2010 study was 5 years (Khosrow Hashemzadeh et al. 2010)11 [14], and in a 2001 study (Emile Ael at el2001) 6 [15], 57% of patients underwent primary TOF surgery before the age of 2 years (median 8 months). And this study, six (25%) cases of TOF were operated on before the age of a year and a half. In our study, the mortality rate was 9.8%. The most common cause of death was AVC, PS (25%), followed by TOF (12%). According to other studies, the mortality rate in Egypt (Ahmed H. Gamala et al., 2020)2 [6] was 4.8%, Brazil (Jacobs JP et al., 2019)9 [8] was 13.4%, Lebanon (Arabi M, Majdalani M et al., 2018)3 [16] was 2.6%, and in Sudan (Osama Yousif Algibali et al., 2018)16 [17] was 6.3%. (Khosrow Hashemzadeh 2020; Country et al. 2018)11,5 [14, 7] revealed that the TOF mortality rates were 6.9% and 7.4%, respectively, which is close to our findings. In our study, the limited number of CoA, AC channel, and PS cases results in a higher mortality rate when compared to other studies with a larger number of cases. The time for referring a complete AV channel must refer to surgery by 3-6 months of age in our patients who delayed surgery to age above 1 year with a 25% mortality rate in comparison to a study conducted by(Hirata Y., Hirahara et al.,2021)8 [18], in which the mortality rate in patients was 2%, and in a North American study

(Logan G. Spector et al., 2018) [7], the mortality rate was 1.9%. The only chance for survival in newborns with Transposition Of The Great Artery (TGA) or other critical CCHD is the availability of a surgical team within the first few weeks of life. Because no babies with TGA were present during the mission studied, no TGA or other critical neonatal CHDs were included in this study. The challenges of managing CHD through foreign cardiac surgery including Patients arrive late.

There are many patients to see in a short period of time ,Inadequate postoperative management, particularly In certain situations, lengthy postoperative recovery times and a lack of a trained local team to handle certain cases after the mission teams left and a lack of necessary equipment and drugs, such as nitric oxide, which is not available throughout the country, the ECMO machine, and the preparation of teams for critical care ECMO close to our findings.

Conclusion

Pediatric cardiac surgery and cardiac surgical intensive care in eastern Libya continue to rely on foreign cardiac surgery missions for the management of children born with Congenital Heart Disease (CHD). With the support of such a mission surgical team for training of local team, we can plan comprehensive treatment for these patients and ensure the ability of the local team to manage CHD patients independently this needs immediate attention from government and public-spirited individuals, nongovernmental organizations, and international agencies in order to bring about a properly structured pediatric cardiac program. While international cardiac surgery missions are providing a lot of assistance, their efforts are clearly insufficient and focus more on the educational program of the local team, which will allow them to expand and care for a larger number of patients.

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