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OUTCOMES OF CARDIAC CATHETERIZATION FOR CONGENITAL HEART DISEASES IN MOSUL CARDIAC CENTER

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ABSTRACT

Background: Cardiac catheterization is the evaluation and manipulation of the heart and related vessels by catheters placed through peripheral vessels. Most commonly access is now obtained by the femoral artery and vein, which involves placing a sheath and catheter over a wire. **Aim of Study:** To assess success rate and complications of cardiac catheterization for congenital heart diseases in Mosul Cardiac Center. **Patients and Methods:** in this descriptive retrospective study aimed to evaluate 647 patients with different congenital heart disease who received cardiac catheterization in Mosul cardiac center over a period of 2 years from 2nd of January 2022 to 17th of January 2024. **Result:** Out of 647 patients, success rate was reported in (95.0%), complications occurred in 32 patients (4.94%), with complication frequency increased among patients aged ≤ one year (62.5%). Total of children presented with transcatheter VSD closure, complications occured in (6.8%),while patients with transcatheter ASD closure complications occur in (6.6%), the transcatheter PDA closure complication occur in(2.9%), with Rashkind atrial septostomy, complication reported in (36.0%), with transcatheter pulmonary valvuloplasty complication developed in (6.6%),with transcatheter CoA angioplasty complication developed in (2.8%), with transcatheter Aortic valvuloplasty (10.0%). **Conclusion:** Therapeutic catheterization patients have a higher risk of complications, with younger patients reporting a higher incidence of death (62.5%) and other complications, primarily in patients with complex congenital heart disease.

KEYWORDS: Cardiac Catheterization, Congenital Heart Diseases, Outcomes.

INTRODUCTION

Cardiac catheterization is the evaluation and manipulation of the heart and related vessels using catheters placed through peripheral vessels. It has evolved from a diagnostic tool to a modality of therapy, performing a wide range of therapeutic procedures such as embolization and device closure of vessels, stenting for vascular stenosis, balloon angioplasty of stenotic lesions and valvuloplasty of stenotic valves, and even percutaneous pulmonary valve implantation.[1,2] Cardiac catheterization reduces the risk of complications and shortens recovery time compared to traditional open-heart surgery.

Cath labs are examination rooms in hospitals or clinics with diagnostic imaging equipment. [3] They consist of a patient table, image intensifier/flat panel detector, viewing monitors, injector pump, angioplasty balloons, and defibrillator. There are two types of cardiac catheterization: diagnostic study, therapeutic catheterization intervention, and complications.[3,4]

Acyanotic congenital heart disease (CHD) is a congenital cardiac anomaly characterized by an abnormal connection between the upper chambers of the heart, allowing for the mixing of oxygenated and deoxygenated blood. There are four types of atrial septal defects, and patients with smaller defects may not develop symptoms. Diagnosis involves chest radiography, echocardiography, and transcatheter closure of ASD.[5,6]

Cyanotic congenital heart disease, including tetralogy of Fallot (TOF) and transposition of the great vessels, is a common condition affecting newborns. It involves a

right ventricular outflow tract obstruction, malalignment ventricular septal defect, an overriding aorta, and right ventricular hypertrophy. Treatment varies depending on the severity of the condition and the presence of associated anatomic lesions.[7,8]

Coarctation of the aorta is a narrowing of the aorta, often occurring just beyond the left subclavian artery. Unrepaired coarctation can lead to premature coronary artery disease, ventricular dysfunction, aortic aneurysm/dissection, and cerebral vascular disease by the third or fourth decade of life. Treatment depends on the anatomy of the coarctation.[9] Aortic stenosis is the obstruction of blood flow across the aortic valve, which can be congenital, calcific, or rheumatic. Diagnosis is done using two-dimensional (2D) Doppler echocardiography. The only definitive treatment for aortic stenosis in adults is aortic valve replacement, performed surgically or percutaneously.[10,11]

In pediatric patients, the common clinical presentations of isolated AS requiring balloon aortic valvuplasty include newborns with critical AS, children with resting peak-to-peak systolic gradient >50 mmHg, children or adolescents with resting peak-to-peak systolic gradient >40 mmHg without symptoms, and asymptomatic patients with peak-to-peak systolic gradient of <50 mmHg (via catheter under anesthesia).[12,13]

AIM OF STUDY

The aim of the current study is to assess the success rate and complications of cardiac catheterization for congenital heart diseases in Mosul Cardiac Center.

PATIENTS AND METHODS

This is a retrospective descriptive study was carried out during the period from the 2nd of January 2022 to the 17th of January 2024. The study was established at Mosul cardiac center. The total number of patients involved were 647 who diagnosed with congenital heart disease by echo-study and referred from other hospitals or outpatient clinics to Mosul Cardiac Center consultation clinic at which the patients are examined and evaluated if they need cardiac catheterization and classified as emergency and not urgent, the emergency cases underwent cardiac catheterization as soon as possible and the not urgent one given an appointment, each patient received cardiac catheterization admitted to ward for one day for observation and discharged on the second day in case of no complication, otherwise the patient stayed in ward for follow up and management till complete recovery.

Data collection was done by questionnaire formula obtained from patients records at Mosul Cardiac Center, containing inquires about age, sex, residence, date of cardiac catheterization, type of cardiac catheterization if it is diagnostic or therapeutic, and its results if successful or there is any complication happened.

Inclusion criteria: patient with congenital heart disease diagnosed by echo-study who attended Mosul cardiac center and received cardiac catheterization in the mentioned period.

Exclusion criteria: Patients with congenital heart diseases who attended cardiac center but did not undergo cardiac catheterization and patients received cardiac catheterization after this period were excluded.

Ethical consideration

1-This study was submitted to the Ethics and Scientific Committee of Pediatric Medicine of the Arab Board of Medical Specialties for scientific and ethical approval.
2-Ethical approval was obtained from Nineveh health directorate and director of Mosul Cardiac Center to collect important data from patients records.

Statistical analysis: The data collected during the study were summarized in sheets of Microsoft Excel 2010. The statistical analysis performed by using IBM-SPSS 26. The data were expressed in frequencies and percentages.

RESULTS

The study sample included 647 patients; the most frequent age group was 5-15 years involving 226 patients and representing 34.9% of the all the studied sample. The least frequent age group was 60-70 years involving 1.1% of the all studied sample (mostly ASD closure). The distribution of the study sample according to age groups was demonstrated in table (1)

Table 1: Distribution of the study sample according to age groups.

Age groups	Number	Percentage
< 7 days	16	2.5
7-30 days	19	2.9
1-12 months	71	11.0
1-5 years	172	26.6
5-15 years	226	34.9
15-30 years	86	13.3
30-40 years	22	3.4
40-50 years	19	2.9
50-60 years	9	1.4
60-70 years	7	1.1
Total	647	100.0

Table (2) showed the distribution of the study sample according to gender and demonstrated that 315 were males (48.9%) and 332 were females (51.1%).

Table (2): Distribution of the study sample according to gender.

Gender	Frequency	Percentage
Males	**315**	48.9
Females	**332**	51.1
Total	**647**	100.0

The distribution of the study sample according to the residence was demonstrated in figure (1). This figure elicited that among the studied sample 600 patients were from the Nineveh governorate who distributed as 325 patients from rural and 275 patients from urban. Only 47 patients were from other governorates including Salahaldeen, Kirkuk, Erbil, Duhoke, and Diyala.

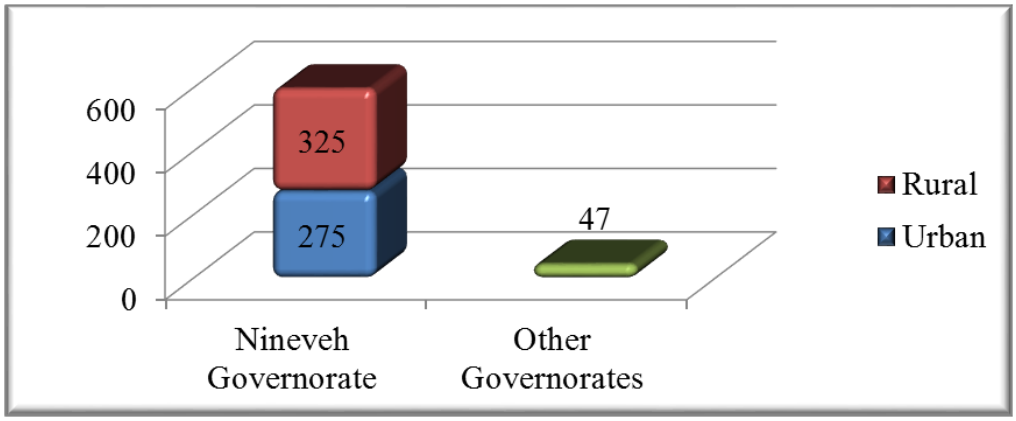

Figure (1): The distribution of the study sample according to the residence.

The distribution of the studied sample according to the types of intervention was demonstrated in figure (2) which showed that 46.8% was diagnostic and 53.2% was therapeutic.

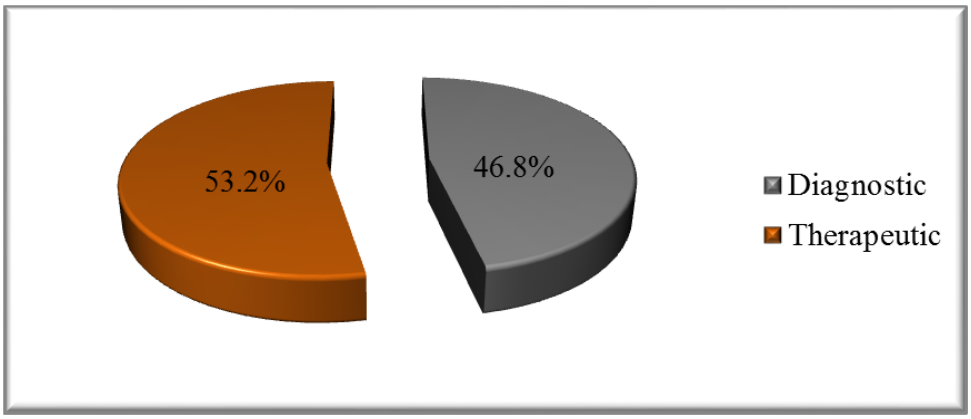

Figure (2): The distribution of the studied sample according to the types of intervention.

The time linked numbers of the both diagnostic and therapeutic interventions was shown in figure (3). The diagnostic intervention involved 116 patients at 2022 reaching the highest number 187 at 2023 while the therapeutic was lower than the diagnostic starting with 87 patients at 2022 and raised up higher than the diagnostic reaching up to 277 patients at 2023.

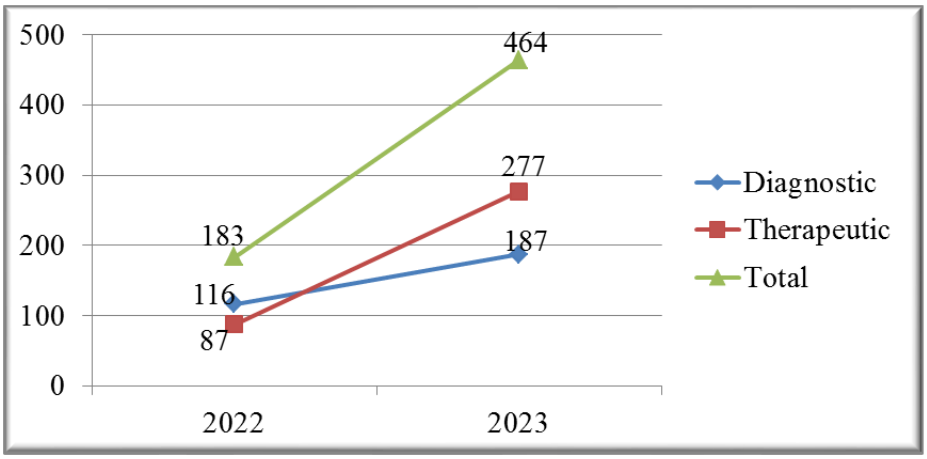

Figure (3): The numbers of the both diagnostic and therapeutic interventions over the time.

Success rate in cardiac catheterization is 95 % among the studied group sample as shown in table (3)

Table (3): Success and complication rates among the studied groups.

	Frequency	Percentage
Success	615	95.0
Complications	20	3.1
Death	12	1.9
Total	647	100.0

Transcatheter VSD closure had a success rate of 93.2 % out of 59 patients; the complications were in 4 patients. The success rate of transcatheter ASD closure found in 93.4% of this intervention was succeed and the device embolization was developed among only five patients. Success, complications, and types of complications among Trans-catheter PDA closure was 97.1% and the complication of device embolization was occurred among two patients. Rashkind atrial septostomy was done among 25 patients, the success rate was 56.0% while the complications were occurred in 9 patients (36.0%) including leg ischemia and 7 death. Transcatheter Balloon pulmonary valvuloplasty was performed for 76 patients, out of them 72(93.4%) showed success and the remaining 4 patients developed infective endocarditis and re-stenosis and 1 death. Transcatheter CoA angioplasty which was done in 36 patients with success rate of 97.2 %, the complication of leg ischemia was developed in only one patient. Regarding Transcatheter Aortic valvuloplasty was done among 10 patients with 100.0% success rate, as shown in table (4).

Table (4): Success, complications, and types of complications among Trans-catheter closure.

Disease defect intervention*	Total number	Success No. (%)	Complicated No. (%)	Types of complications
Trans-catheter VSD closure	59	55(93.2)	4(6.8)	1 early complete heart block within 5 days 1 complete heart block late presentation after 4 months 1 device embolization 1 hematuria
Trans catheter ASD closure	76	71(93.4)	5(6.6)	device embolization
Trans-catheter PDA closure	62	60(96.7)	2(3.2)	device embolization
Rashkind atrial septostomy	25	16(64.0)	9 (36.0)	2 Leg ischemia 7 Death
Transcatheter pulmonary valvuloplasty	76	71(93.4)	5(6.6)	1 infective endocarditis 3 re-stenosis 1 Death
CoA balloon angioplasty	26	25(96.1)	1(3.8)	Leg ischemia
Transcatheter Aortic valvuloplasty	10	9(90.0)	1(10.0)	Death
PDA stent	6	3(50.0)	3(50.0)	Death

Complications including death occur in age less than 1 year is 62.5 % as shown in table (5).

Table (5): Complications including death in relation to age.

Complication and death	Age		Total Number	p-value *
	<1 year	≥1 year		
	No.(%)	No.(%)		
	20(62.5)	12(37.5)	32	0.157

DISCUSSION

The cardiac catheterization over the last three decades has undergone a transformation from primarily a diagnostic tool to a modality of therapy performs a wide range of therapeutic procedures.[2]

Our study showed that younger patients having prolonged interventional procedures are more likely to experience adverse outcomes. Due to the very diverse case mix, variations in the definition of adverse events, data collecting, and observation period length, it may be challenging to compare the results with those of other research. However, in line with previous research, we found that adverse event rates were greater in neonates and infants as well as in interventional case.[14-16]

Fortunately, deaths are rare. Death following cardiac catheterization appears to be more closely linked to the

patient's overall condition than the procedure itself, despite the fact that the deceased were younger and had undergone prolonged procedures. Those who are severely diseased prior to catheterization will have minimal probability of survival.[17]

In this study 647 (332 females, 51.1%) patients were included, complication occurred in 32 (5 %) patients, and this is similar to study done in Baghdad at Ibn Al-Bittar Hospital by Sinan Abdulrazzaq et al at 2020 in which 32 (5.2%) complications happened in 612 patients included in their study.

In this study total 59 patient with transcatheter VSD closure, success rate was (93.2%) most common complication was arrhythmia followed by device embolization this is similar to study in Iraq at 2020 by Sinan abdulrazaq et al most common complication of transcatheter VSD closure was arrhythmia, followed by device embolization.[18]

While in Egypt at 2023 by Hala Elmarsafawy et al identified patients with transcatheter VSD closure. The closure success rate was (95.7%) and the most common complication was heart block.[19]

In this study transcatheter ASD closure success rate was (93,4%) and the most common complication was device embolization, in comparison with Egypt at 2018 by Safaa H Ali et al ASD device closure implanted successfully in (98.5%) and most common complication was device erosion with haemopricardium followed by device embolization.[20]

In our study transcatheter PDA closure was done successfully in (97.1%), most common complication was device embolization, In Iran at 2017 a study done by Faranak Behnaz et al revealed successful closure of PDA totally with no major complication apart from benign arrhythmia.[21]

In our study Rashkind atrial septostomy done with a success rate was (64.0%) most common complication was death followed by leg ischemia, high mortality rate here seems to be more associated with the patient's general status than the procedure itself, all dead patients born w cyanotic complex congenital heart disease, in Egypt at 2011 a study done by Mohamed Matter et al most common complications encountered were arrhythmia (premature ectopic, supraventricular tachycardia) followed by venous thrombosis, ballon rupture and death.[22]

In the present study transcatheter aortic valvuloplasty was done successfully in (90.0%) and 1 patient died, in USA 2010 a study done by Itsik Ben-Dor et al, Serious adverse events occurred in (15.6%), intraprocedural death in (1.6%), followed by stroke, coronary occlusion, severe aortic regurgitation, resuscitation/ cardioversion.[23]

In this study transcatheter CoA angioplasty done successfully in (97.2%) patients and leg ischemia developed in (2.8%) patient, in Iraq 2020 by Maitham Qasim Mohammed et al a study revealed a complications were reported in (13.3%) patients. there was one procedure related death (2.2%).[24]

Transcatheter pulmonary valvuloplasty was done successfully in our study to (93.4 %) of patients, most common complication developed was restenosis, In Spain 2014 a study by Raquel Merino-Ingelmo et al. The immediate success rate was 73.58% and the most common complication was late pulmonary regurgitation followed by severe right ventricular dilatation.[25]

Limitations of study

- The most important limitation of this study is that it is conducted to one center as there is one cardiac catheterization center in our city which is opened recently and has only two of cardiologist.
- Limitation of time of study as it is retrospective done over the period started from January 2022 to January 2024.

CONCLUSIONS

Transcatheter closure of VSD, ASD, PDA is the treatment modality of choice in many cases as it has a high success rate. Ballon valvuloplasty for aortic stenosis and pulmonary stenosis and CoA angioplasty has a high success rate in our center, with little bit more complication in BVP for AS than the others. Patients with therapeutic cardiac catheterization had higher risk of complication than those with diagnostic cath. There is a significant association between the frequency of complication and patient with age below 1 year with a higher mortality rate in age below 1 month in D-TGA patients with Rashkind atrial septostomy. Death after cardiac catheterization more associated with patient general status including medical disease and complication of GA than procedure itself.

Recommendations

1-The planning and implementation of programs related to early detection of congenital heart disease in children by screening test for any suspected case of CHD with echo study and referral to pediatric cardiologist to receive their proper management in the pediatric cardiac center.

2- The planning of programs in Ministry of Health and Ministry of Higher Education and Scientific Research to open another cardiac center in our city due to large number of patients with congenital heart disease need cardiac catheterization.

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