

The prevalence and types of coronary artery abnormalities in pediatric patients with Tetralogy of Fallot

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Research

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Abstract

Objectives:

Tetralogy of fallot (TOF) is one of the most common diseases among cyanotic congenital heart diseases which is associated with 2-23% of coronary artery abnormalities. Pre-operation knowledge the anatomy of coronary arteries in patients with TOF eliminates damage to them during surgery and prevents post-operative complications such as myocardial ischemia and heart failure.

Materials and methods:

This retrospective study was done on all patients with TOF who were referred for diagnostic catheterization and angiography before total surgical correction from 2006-2016. All patients entered the study and all angiographic views including extreme caudal, LAO cranial , and selective coronary artery angiography were evaluated and reviewed accurately.

Results:

332 cases of patients with TOF including from one month to 36 years old were reviewed. The prevalence of coronary artery abnormalities among them was 11.4% (38 from 322 individual). 9.1% and 15.3% of males and females had abnormal coronary anomalies but it was not significant statically (p-value: 0.064). In 13 of 38 patients with coronary anomalies , coronary arteries crossed right ventricular out flow tract (RVOT)(3.4%). The most common coronary abnormality was origin of the both main coronary arteries from left sinus of Valsalva.

Conclusion:

Compared with other populations, the abnormal arteries among the patients with TOF in our study is significant (11.4%) and accurate assessment of their courses is necessary before surgery. Single origin of coronary arteries from the left side was the most common finding in our study too.

Introduction:

Congenital heart disease is the most common Congenital defect in newborns (1). Coronary artery anomalies (CAA) are common in many congenital heart diseases (2) such as those that cross the entire face of ventricular infundibulum superficially in patients with tetralogy of Fallot (TOF) (3).

According to different studies based on diagnostic angiography, surgery and atopies the prevalence of coronary abnormalities vary from 2-14% to 2-23% (1,4).

Based on one metanalysis study on the patients with TOF, the most anomalous coronary arteries were those that crossing the RVOT, large conus artery , crossing behind the aorta, coronary arteriovenous fistula , left or right coronary artery from the pulmonary trunk or left or right pulmonary artery , coronary

tree hypoplasia and anastomoses between coronary and branchial arteries. The combined risk of encountering an anomalous coronary artery or a large conus artery crossing the RVOT was reported 10.3%(5).

Knowing the origin and course of coronary arteries is essential for surgeon before starting the operation.

Today in most centers the coronary anatomy is delineated by echocardiography. Rarely in patients with TOF, heart catheterization is used as primary indication to study of coronary pattern (6).

Because of the several types of coronary anomalies in the patients with TOF, this study was done for another investigation of these anomalies in TOF before corrective surgery.

Methods:

This retrospective study was carried on all patients with TOF who were referred for diagnostic cardiac catheterization and angiography before total surgical correction in 2006-2016.

All patients entered the study and all angiographic views including extreme caudal, LAO cranial and in some cases, selective coronary artery views were evaluated accurately .

Results:

The records of 322 patients with TOF were reviewed. The patients including 318 children and 18 adults were between 1 month to 36 years old(table No. 1). Of 322 patients, 208 were male (62.65%) and 124 were female (37.35%).

Table No.1: patients and age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1month	23	6.0	6.0	6.0
	2month	4	1.0	1.0	8.0
	3month	5	1.0	1.0	9.0
	4month	1	.0	.0	9.0
	5month	12	3.0	3.0	13.0
	6month	11	3.0	3.0	16.0
	7month	20	6.0	6.0	22.0
	8month	27	8.0	8.0	31.0
	9month	22	6.0	6.0	37.0
	10month	16	4.0	4.0	42.0
	11month	19	5.0	5.0	48.0
	12month	23	6.0	6.0	55.0
	13month	3	.0	.0	56.0
	14month	5	1.0	1.0	57.0
	15month	2	.0	.0	58.0
	16month	2	.0	.0	58.0
	17month	8	2.0	2.0	61.0
	18month	2	.0	.0	61.0
	19month	4	1.0	1.0	62.0
	20month	2	.0	.0	63.0
	21month	2	.0	.0	64.0
	22month	1	.0	.0	64.0
	23month	1	.0	.0	64.0
	2years	28	8.0	8.0	73.0
	3years	15	4.0	4.0	77.0
	4years	6	1.0	1.0	79.0
5years	10	3.0	3.0	82.0	

6years	3	.0	.0	83.0
7years	6	1.0	1.0	85.0
8years	4	1.0	1.0	86.0
9years	6	1.0	1.0	88.0
10years	2	.0	.0	88.0
11years	2	.0	.0	89.0
12years	2	.0	.0	90.1
13years	1	.0	.0	90.0
15years	7	2.0	2.0	92.0
16years	3	.0	.0	93.0
17years	2	.0	.0	93.0
18years	6	1.0	1.0	95.0
19years	3	.0	.0	96.0
21years	1	.0	.0	96.0
22years	2	.0	.0	97.0
23years	2	.0	.0	98.0
26years	2	.0	.0	98.0
31years	2	.0	.0	99.0
32years	1	.0	.0	99.0
36years	1	.0	.0	100.0
Total	332	100.0	100.0	

Coronary artery abnormalities were found in 38 patients totally(11.4%), 9.1% and 15.3% in males and females respectively (table No.2).

Table No.2: Prevalence of coronary abnormalities in patients with TOF

Gender	Normal	Abnormal	Total
Male	189 (90.9%)	19 (9.1%)	208 (100.0%)
Female	105 (84.7%)	19 (15.3%)	124 (100.0%)
Total	246 (88.6%)	38 (11.4%)	332 (100.0%)

Despite the apparent difference between the percentages of coronary abnormalities in two genders, the P-value was not significant (P-value=0.064).

Abnormal coronary arteries were found in 38 patients (11.4%).

Coronary arteries crossing RVOT, RCA and LCA originated from LCC and RCC respectively, and single origin of coronary arteries from left side without crossing the RVOT were the most common abnormalities that found in 13, 1 and 24 patients respectively.

Among them with coronary arteries crossing RVOT (13 of 38 (34%)) several varieties were detected; single origin of coronary arteries from left side accompany with LAD passed over the RVOT, single origin of coronary arteries from left side accompany with RCA passed over the RVOT, single origin of coronary arteries from left side accompany with both RCA and LCA passed over RVOT, and also single origin of coronary arteries from right side accompany with LAD passed over the RVOT were found in 3, 2, 2, and 4 patients respectively. In one patient with single origin of coronary arteries from left side LCA passed RVOT.

Despite the normal course of coronary arteries, passing the both RCA and LAD was detected in one patient. (table.3).

Table:3: prevalence and types of coronary artery anomalies :

	Frequency	percent	Valid percent	Cumulative percent
Normal	246	88	88	88
Single origin from left side (SOFLS)	24	7	7	45
Single origin from left side (SOFLS) + LAD Passing RVOT	3	.0	.0	46
SOFLS+ RCA passing RVOT	2	.0	.0	47
RCA from LCC and LCA from RCC	1	.0	.0	47
SOFLS+ RCA and LCA passing RVOT	2	.0	.0	98
RCA and LAD passing RVOT	1	.0	.0	98
SOFLS + LAD passing RVOT	4	1.0	1.0	99
SOFLS+ LCA passing RVOT	1	.0	.0	100
Total	332	100	100	

Discussion:

Having knowledge about abnormalities of coronary arteries in patients with TOF is an important key to avoid them getting damage during surgical correction (4-11-12).

Damaging coronary arteries may led to hemi block conduction in patients with dominate right sided coronary circulation or post-operative myocardial infarction (9). As such coronary anomalies may not be seen during operation because of epicardia fat and their position , this pre-operative recognition helps surgeons to get the best strategies before and during surgical correction in patients with TOF.

Although today in most centers the coronary anatomy is delineated by echocardiography, angiography is used as an accurate method before this purpose yet (6, 2,10,13,14).

The prevalence of coronary anomalies in paints with TOF was reported in 77 of 607(12%) individual with TOF or TOF like anatomy(14). The other reports by Shirvastava and et al(10), Dabizzi et al(7), Hekmati et al (18), Farsani et al (16) and Gupta et al (17) on similar patients, showed the same prevalence of coronary anomalies among the patients with TOF(11.4%). In our study, the prevalence of anomalous coronary arteries crossing the RVOT was 3.4% (13 from 38 individuals among the patients with TOF and abnormal coronary artery) which was lower than the Turkish population (14).

Distribution rate of coronary anomalies based on the sex in our study was similar with Turkish population (66.2% male and 33.8% female in Turkish study (14) versus 62.65% male and 37.35% in our study).

The most coronary artery anomaly which reported by Gupta et al, Dabizzi et al, Humes et al, Li et al, Ruzmetov et al, was anomalous origin of LAD from RCA(17,15,18,19,20 respectively). In our study , single origin of coronary arteries from left side (about 84% of coronary anomalies and 9.6% of all involved individuals) was the most common coronary abnormalities in patients with TOF .

Conclusion:

The prevalence of coronary artery abnormalities among the patients with TOF is significant and in order to eliminate damage to coronary arteries during surgical correction, an accurate evaluation of their courses before operation is inevitable.

In our population it seems this prevalence is at the upper range of worldwide references (11.4% versus 2-12% reported in references). Having knowledge about abnormalities of coronary arteries in these patients helps to surgeons to draw a best strategy before operation.

Declarations

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Authors' contributions

N.M: design and analysis and manuscript preparation. K.S: Sample collection and data preparation, manuscript preparation. K.K : Design, analysis, statistics and manuscript preparation. All authors read and approved the final manuscript.

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Availability of data and materials

We state that the data used and/or analyzed during the current study are available from the corresponding author on reasonable request. Data sharing is applicable to this article and datasets were

generated and analyzed during the current study and data sharing is allowed.

Ethics approval and consent to participate

All procedures performed in this study were in accordance with the ethical standards of the “Research Ethics Committee of Shiraz University of Medical Sciences” and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was submitted to and approved by the “Research Ethics Committee of Shiraz University of Medical Sciences” .

Consent for publication

This manuscript does not contain any personal data, and the consent for publication is applicable.

Competing interests

The authors declare that they have no competing interests.

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