Journal of Research in Medical and Dental Sciences
2018, Volume 6, Issue 3, Page No: 368-381

Available Online at: www.jrmds.in
eISSN No. 2347-2367: pISSN No. 2347-2545

Evaluating the Prevalence of Non-Ischemic and Ischemic Coronary Artery Anomalies Using Multi Slice CT Angiography 384 in Shahid Rajaee Hospital in 2016 and 2017

Maryam Ghasemi[1*], MarziehMotavali[2], Ali Mohammadzadeh[3]

[1]Special Assistant in Iran University Radiology, Iran
[2, 3]Assistant Professor of Radiology, Iran University of Medical Sciences, Iran

DOI: 10.24896/jrmds.20186357

ABSTRACT

Given high prevalence of coronary artery diseases and multiple risk factors involved in these diseases, we decided to evaluate the less common but influential causes of these diseases. This study is a descriptive cross-sectional study. In this study, we examined 10413 patients, admitted to Shahid Rajaee Hospital from July 2016 to July 2017 and underwent coronary artery CT angiography by using census method. Only 72 patients were admitted due to coronary artery diseases, and the rest of the patients underwent CT angiography due to atherosclerotic diseases of the coronary arteries. In our research, non-atherosclerotic heart diseases were classified into five general groups in terms of disease prevalence: 36.1% of patients had coronary artery anomaly, 29.2% had congenital coronary artery fistula, 5.6% had post-operative coronary artery fistula, 19.4% congenital heart disease, 6.9% had Kawasaki and 2.8% had vasculitis. The most common type of congenital coronary anomaly was an anomaly with opposite crusp origin and the most common involved arteries were left circumflex arteries and right coronary arteries. The coronary artery fistula was the next disease. The most common arteries, as anomaly, were right coronary artery and left circumflex artery, and the most common site of fistulization was reported in right ventricle, pulmonary artery, and left atrium. The next non-atherosclerotic disease was congenital heart disease, which was associated with coronary artery anomalies in 78.5% of cases. The most common congenital heart disease in our study was ventricular septal defect, associated with coronary artery anomalies in right coronary artery in 83% of cases. The fourth disease was Kawasaki, associated with coronary artery aneurysm in 40% of patients. The next non-atherosclerotic disease was vasculitis, which involved the ascending aorta and coronary artery and caused symptoms. Non-atherosclerotic coronary artery disease is an uncommon disease, accounting for less than 1% of the patients admitted due to heart disease symptoms and causing sudden deaths at lower ages. These diseases should be considered in younger patients with heart disease symptoms. Coronary artery anomalies should be also examined in patients with congenital heart disease, since they are significantly correlated. Coronary artery aneurysm should be also considered in patients with Kawasaki infected at their childhood and adolescence.

Key words:fistula, coronary artery anomalies, congenital heart diseases

HOW TO CITE THIS ARTICLE: Maryam Ghasemi , MarziehMotavali, Ali Mohammadzadeh, Evaluating the prevalence of non-ischemic and ischemic coronary artery anomalies using Multi Slice CT Angiography 384 in Shahid Rajaee Hospital in 2016 and 2017, J Res Med Dent Sci, 2018, 6(3): 368-381, DOI: 10.24896/jrmds.20186357

Corresponding author: Maryam Ghasemi
e-mail✉: ghasemimaryam.dr@gmail.com
Received: 15/01/2018
Accepted: 10/04/2018

INTRODUCTION

Cardiovascular disease is the most common chronic non-communicable disease and the most important cause of death in the world, which affects the quality of life of patients. The mentioned diseases have many complications and problems for patients and high costs for the community and the country. Based on the latest data reported by Ministry of Health and Medical Education, cardiovascular disease is one of the most important causes of death and inability in Iran. By 2020, heart disease is expected to be the leading cause of 40% of deaths in world. In Iran, ischemic heart disease is the leading cause of death and disability in people aged over 35 years.

Coronary artery diseases are classified into two main groups of atherosclerotic and non-atherosclerotic diseases. The causes of atherosclerotic disease are often controlled and prevented by proper and healthy lifestyle, but non-atherosclerotic cardiovascular diseases should be diagnosed and treated accurately before development of the symptoms and disability of the people in community. Prevention of these causes is important throughout the world. Non-atherosclerotic diseases include several general classes, including anomaly, aneurysm, congenital diseases, dissection, and secondary involvement of coronary arteries. Coronary artery anomalies are also classified into two general classes of significant hemodynamic and non-significant hemodynamic impairments [1]. The causes of impaired hemodynamic diseases include fistula, coronary artery anomalies originating from the pulmonary artery, coronary artery anomalies originating from opposite crusp and intra-arterial [2]. No study has been conducted so far to investigate the prevalence of non-ischemic coronary artery disease using multi slice CT angiography 384 device. Conducting a study to evaluate the prevalence of these diseases is valuable since timely identification and using a less invasive method can help us in preventing short-term and long-term complications of these diseases, and finally, in enhancing the community health indicators and reducing the high cost of treating these diseases in our country. Given the importance of this issue and the prevalence of cardiovascular disease in Iran and the lack of timely admission of the patients, we decided to evaluate the frequency of causes of coronary artery disease in patients admitted to Shahid Rajaee Heart Hospital using non-invasive CT Angiography 384 Method.

General objective of study

Evaluating the prevalence of non-ischemic and ischemic heart disease anomalies using Multi slice coronary CTA 384 in Shahid Rajaee Hospital in 2016 and 2017.

Specific objectives

Descriptive specific objectives

1. Evaluating the prevalence of non-ischemic cardiovascular anomalies using Multi Slice Coronary CTA 384 in Shahid Rajaee Hospital in 2016 and 2017

2.Evaluating the prevalence of ischemic heart disease anomalies using Multi Slice Coronary CTA 384 in Shahid Rajaee Hospital in 2016 and 2017

Analytical specific objectives

1. The relationship between prevalence of non-ischemic and ischemic heart disease anomalies using Multi Slice Coronary CTA 384 in Shahid Rajaee Hospital in 2016 and 2017 based on age.

2-Relationship between prevalence of non-ischemic and ischemic heart disease using Multi Slice Coronary CTA 384 in Shahid Rajaee Hospital in 2016 and 2017 based on gender.

Review of literature

In a study conducted by Fabre et al. (2012) on 450 cardiovascular diseases in the UK, non-atherosclerotic coronary artery disease was diagnosed and impaired in 21 patients (4.6%). Out of them, 6 cases were related to coronary artery anomalies (5 cases with origin of opposite crusp and 1 case of origin of single coronary artery). Six cases related to coronary artery spasm and 4 cases related to myocardial bridging and 3 cases related to vasculitis and 2 cases related to spontaneous dissection coronary artery [3]. In a study conducted at Mazandaran University by Dr. BabakBagheri et al., in 2013, the separation of the left coronary artery from right valsalva sinus was examined. This study reported that anomalies in the site of separation of coronary arteries from the valsalva sinus is rare and its manifestation varies from without clinical symptoms to sudden death, and its incidence is estimated to be between 0.3 to 10 percent in the normal population. To diagnose the anomaly type, CT angiography is highly helpful. The number of separation of left coronary from right valsalva sinus is very rare and includes four types.

Type a (Pre-pulmonic): The left coronary artery passes through anterior pulmonary artery. Type b (inter-arterial): left coronary artery originates from pulmonary and aorta artery. Type C (septal): The left coronary artery passes through the Cristina Supra Terminalis. Type D (retro aortic): The left coronary artery moves from the posterior aorta. Coronary anomalies are associated with an increased risk of myocardial infarction or ischemia and sudden heart death. Although the mechanism of sudden heart death is not known, evidence on entrapment and compression of coronary between aorta and the right ventricle has been found. One another cause is intramural course and acute angle beginning of arteries. It seems that the most common cause of sudden heart death to be the inter-arterial course, since corrects and recovers it. If left coronary artery

course is posterior is aorta, conservative treatment would be recommended [4].

In a study conducted by Ahmad Noor Abdi *et al*., in Hormozgan in 2013, myocardial bridge as an anomaly of coronary artery disease was discussed. The myocardial bridge is a congenital disease, in which large epicardial coronary arteries pass through myocardial muscles. This disease affects the middle part of the left anterior artery, which can have various heart manifestations, ranging from sudden chest pain to sudden death. One female 59-year-old female patient with a history of diabetes mellitus and high blood pressure suffered from shortness of breath and chest pain admitted to the center. No specific pathologic case was observed in primary examinations and echocardiography. However, in the angiography, the left major artery stenosis (lm) was diagnosed with severe stenosis of all three coronary arteries and Multiple Myocardial Bridge at the end of the right coronary artery.

Myocardial bridge conclusion: Although myocardial bridge is a rare disease, it is recommended in evaluating the patients with a history of recurrent chest pain given its complications and manifestations [5]. In a study conducted by Iran MarziehParvar *et al*., in Hormozgan in 2011, coronary artery aneurysm was considered as a coronary artery anomaly in a patient. In this study, it was reported that multiple coronary arteries aneurysm is a rare anomaly, which may be congenital or acquired. Some of its complications include sudden heart death, formation of clots, incidence of distal embolism, rupture and bleeding, or fistula formation. Making decision on its treatment depends on aneurysm status and the clinical condition of the patient. Patient introduction: the patient was a 55 years of old man with unstable angina who had multiple coronary artery aneurysms along with severe stenosis in coronary angiography. After about two years of follow up, the patient was asymptomatic and had normal activity. Conclusion: In this case report, in addition to explaining the multiple coronary aneurysm as a rare disease, its treatment was discussed [6]. In a study conducted by Dr. Seyed Jalal Saeedi *et al*., in Tehran in 2007, the prevalence of coronary artery disease in patients with valvular and congenital disease was investigated.

The studied population included patients with congenital and valvular heart disease, who admitted to Baghiato Allah Al-Azam Hospital in Tehran for coronary artery catheterization and angiography. They were physically and paraclinically examined using questionnaires. Results: Out of 196 patients, 89 (45.4%) were male and 107 (54.6%) were female. The mean age of subjects was 49.8 ± 16 years. The most common diagnoses were mitral stenosis along with aortic stenosis (25.5%), mitral stenosis alone (24%), and aortic failure (10.7%) .Angiography was anomaly in 13.3% and 3.8% of those aged less than or equal to 40 years, 14.3% of those aged 41 to 60 years and 20.3% of those aged more than or equal to 61 years had coronary arteries disease.

Conclusion: based on the results, it is better to re-think on the need for angiography in congenital and valvular patients without symptoms of coronary artery disease and without indications. As coronary artery disease is associated with congenital and valvular heart disease in people younger than 40 years is very low and there is no prevalence in the age range of 41 to 60 years, angiography is an invasive method, it is not necessary for all patients, and it is recommended when patients are clinically suspected of coronary artery disease or when the patient has several risk factors or the patient has age over 60 years [7].

In a study conducted by Salehi *et al*., in Tehran in 2014, the prevalence of coronary anomalies in infants with large arteries was examined. The objective of this study was to evaluate the patterns of coronary artery in a population of infants with displacement of large vessels. This study was a descriptive cross-sectional and prospective study. After a precise diagnosis of the type of heart disease, the patients were introduced for cardiovascular surgery. The medical records of 63 patients with large arteries displacement were examined and coronary artery position was extracted from the medical record.

Results: The results of this study showed that prevalence of normal coronary prevalence was 90.47%, prevalence of coronary arteries reverse form was 6.32%, and prevalence of LAM intramural and single RCA was 1.58 in patients. In addition, no significant correlation was observed between coronary artery anatomy and its complications, including mortality. Conclusion: based on the results of the study, the prevalence of coronary arteries anomalies in infants with large vessels was 9.53%, which is less than global statistics (33.1%). The mortality rate is 8.7 in the

subjects with normal coronary and 33.4% in the subjects with a coronary anomaly, which was not significantly different from similar studies. It is probably due to the more difficulty of the operation technique in these cases [8].

Foreign studies

In a study conducted by A.Yildiz *et al*., in Turkey in 2010, the prevalence of coronary artery anomalies was estimated from 0.2 to 1.3% in patients who underwent angiography and 0.3% in patients underwent an autopsy. These data were retrospectively collected from about 12457 patients underwent angiography from 2002 to 2007. Out of them, 112 of them had coronary artery anomalies, which 100 (89.3%) of them had anomalies in the distribution and origin of coronary artery. The age of the patients was from 22 to 79 years. The most common anomalies were the separate origin of LAD and LCX from left valsalva sinus (63.4%) and the second anomaly was RCA from left sinus of ten patients (9.8%). LCX from the right sinus was seen in 10 patients. LMCA from the right sinus was seen in one patient. Single coronary artery was seen two people. Recognizing coronary artery anomalies is very important for the development of the potential for serious heart disease, so recognizing the type of anomaly is helpful for treatment). In a study conducted by South Korea June Namgung *et al*., in June 2014 on coronary artery anomalies found that coronary artery anomalies are rare. Approximately 81864 patients underwent CTA from 2005 to 2011 had about 103 coronary arteries anomalies. About 87.4% of these patients had impairment in origin and distribution. About 13 of these people were fistula. The highest anomaly in 41 cases was anomaly with RCA origin, which 3 of them had bypass grafting. The mean age of them was 59.7 ± 14 and the ratio of female to male was 36 to 67. The prevalence of RCA from left sinus was seen in 41 people. The prevalence of LCX from the right sinus was seen in 5 people. The prevalence of LMCA from the right sinus was seen in one person. Single coronary artery was seen in one person. Arterial duplication was found in 4 people. Fistula was seen in 13 people, which the most common fistula was from LAD to pulmonary artery in 5 patients. [10]. In a study conducted by Sirasapalli, Chinnar Naidu et al in India in 2018 on 8021 patients, 838 had coronary artery anomaly disease and the most common anomaly was myocardial bridging anomalies seen in 728 people, followed by RCA originating from left sinus in 41 people. The LCX originating from the right sinus was reported in 16 cases [11]. In a study conducted by Paolo Angelini et al in Turkey in 2002, the prevalence of coronary anomaly was about 1% in 18950 patients underwent CTA. The most common anomalies were split RCA in 24 people, RCA originating from the left sinus in 18 people, the coronary fistula in 17 people, and the single coronary artery in13 people [12], respectively. In a study conducted by Christos Graidis et al in Turkey in 2015, coronary anomaly was seen in about 1% in 2572 patients underwent CTA. The most common anomalies were high tack of RCA in 16 patients, separately originating of LAD and LCX from the left sinus in 15 people and RCA originating from the left sinus in 9 people and Lcx originating from the right sinus in 6 patients [13]. In a study conducted by Tuzcuem et al in Japan in 1990, 66884 patients underwent angiography were examined. It was found that 1000 patients had coronary artery anomaly, which 101 of them were associated with congenital heart disease. The prevalence of these cases was as follows: 29 patients had mitral valve prolapse, 18 patients had bicuspid aortic valve, and 16 patients had TOF, 11 patients had TGA and 3 patients had VSD. The most common associated coronary anomaly was the ectopic coronary artery, which the most common site was from opposite sinus and absent LMCA and fistula [14]. In a study conducted by Kato et al in Japan in 1986, 130 patients with coronary aneurysm underwent angiography, which 21 patients with a mean age of 34 years had a positive Kawasaki childhood history, and it was believed that another 109 patients had Kawasaki disease in their childhood, but they were not diagnosed. The study stated that Kawasaki disease in childhood causes a high risk of developing ischemia and heart disease in adulthood [15]. In a study conducted by Fang Yu et al in China in 2015, 417 patients with congenital heart disease underwent CTA, which 35 of them did not have coronary anomaly. The most common anomalies in the following diseases were as follows: 41 patients had single ventricle, 15 of them were associated with coronary anomaly, 84 patients had a double outlet ventricle, which 18 of them had coronary anomaly. Tetralogy of fallot was observed in 108 patients, which 6 of them had coronary anomaly, 36 had TGA, which 7 of them had coronary anomaly, and 12 had Truncus arteriosus, which 4 of them had coronary anomaly [16].

Procedure

This is a retrospective descriptive-cross sectional study conducted to examine the prevalence of non-atherosclerotic ischemic coronary artery disease. The type of research is fundamental.

Research population

The study population included all patients admitted to Shahid Rajaee Heart Hospital in Tehran to perform CT angiography during 2016 and 2017. In order to conduct this study, the pre-determined input and output variable was not necessary.

Place and time of study

The place of the study was radiology unit of Shahid Rajaee Heart Hospital in Tehran, and the time of the study 2016 and 2017.

Sampling method and sample size determination

Sampling method is census.

Method of implementation of the plan

1. Researcher referred to research place and collected reports of CT angiography in years 2016 and 2017.

2. In the statistical analysis, results of CT angiographic reports were first prepared to examine the prevalence of different classes of analysis and related statistical tables. Statistical analysis was performed to determine the relationship between age and gender variables in the two groups of atherosclerotic and non-atherosclerotic with SPSS software. Inferential results were analyzed using Chi-square test and the level of significance was considered 0.05.

3-Reporting the research results

Data collection methods and tools

A retrospective review of CT Angiography reports was performed using SPSS software. It should be noted that the variables of age and gender are available in these reports. The research results are divided into two sections including descriptive statistics and inferential statistics. Accordingly, in the first section of descriptive results, the demographic characteristics of patients are presented in the form of tables and charts. In the second section, the inferential results, the hypotheses were examined using the Chi-square test and the significance level is considered to be 0.05.

RESULTS

Based on the results of Table 1, the highest number of patients was in the two age groups of up to 5 years old and 61 to 70 years (20.8%) and the lowest number was in the age group of 81 to 90 years (1.4%).

Table 1: Distribution of absolute and relative frequency of the age group of patients studied

Age group	f	(%)
Up to 5 years	15	20/8
6 to 10 years	4	5/6
11 to 20 years	2	2/8
21 to 30 years	2	2/8
31 to 40 years	9	12/5
41 to 50 years	5	6/9
51 to 60 years	12	16/7
61 to 70 years	15	20/8
71 to 80 years	7	9/7
81 to 90 years	1	1/4
Total	72	100

Based on the Table 2, 58.3% of the patients were male and 41.7% were female.

Table 2: Distribution of absolute and relative frequency of patients studied based on gender

Gender	f	(%)
Male	42	58.3
Female	30	41.7
Total	72	100

Table 3: Distribution of absolute and relative frequency of non-atherosclerotic disease in the patients studied

Non-atherosclerotic disease	f	(%)
Coronary artery anomaly	26	36/1
Maternal coronary artery fistula	21	29/2
Postoperative Coronary Artery Fistula	4	5/6
Congenital heart disease	14	19/4
Kawasaki	5	6/9
Vasculitis	2	2/8
Total	72	100

Based on the results of Table 3, in terms of non-atherosclerotic disease, 36.1% of the patients had coronary artery anomaly, 29.2% had congenital coronary artery fistula, 5.5% has post-operative coronary artery, 19.4% had congenital heart diseases, 6.9% of Kawasaki disease, and 2.8% had vasculitis .The most common non-atherosclerotic coronary artery disease: Arterial anomaly, Coronary fistula, and congenital heart disease.

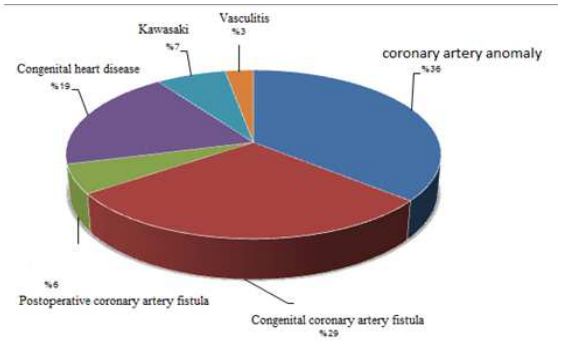


Table 4: Distribution of absolute and relative frequency of coronary artery anomaly in patients studied

Coronary artery anomaly	f	(%)
anomalyLCX	13	50
RCA anomaly	6	23/1
SINGLE CRONARY OSTIUM	1	3/8
DOUBLE LAD	1	3/8
ALL CAPA	5	19/2
Total	26	100

Based on tables 4, out of 26 patients with coronary artery anomaly, 50% related to LCX and RCA.
Given the results of Table 4-8, out of 14 patients with congenital heart disease, 7.1% had VSD, 35.7% had VSD+ANOMALI CRONARY, 21.4% had TOF + ANOMALY RCA, 7.1% had TGA+ANOMALY LCX, 7% had PFO + ANOMALYRCA, 7.1% had TA TYPE 1+ANAMALY CRONARY, and 701% had ASD + TAPVC.

Table 5: Distribution of absolute and relative frequency of congenital heart diseases in patients studied

Congenital heart diseases	f	(%)
VSD	1	7/1
VSD+ANOMALI CRONARY	5	35/7
TOF + ANOMALY RCA	3	21/4
TGA+ANOMALY LCX	1	7/1
TGA+ANOMALY LAD	1	7/1
PFO + ANOMALYRCA	1	7/1
TA TYPE 1+ANAMALY CRONARY	1	7/1
ASD + TAPVC	1	7/1
Total	14	100

According to Table 6, out of 5 patients with Kawasaki, 40% coronary aneurysms and 60% did not have coronary aneurysms.

Table 6: Distribution of absolute and relative frequency of Kawasaki in the studied patients

Kawasaki	f	(%)
With coronary artery aneurysm	2	40
Without coronary artery aneurysm	3	60
Total	5	100

According to the results of Table 4.10, 4 patients had postoperative coronary artery fistula, 25% had graft fistula to right atrium, 25% had fistula graft to right ventricle, 25% had fistula graft to pulmonary artery and 25% had graft fistula to bronchial artery.

Table 7: Distribution of absolute and relative frequency of postoperative coronary artery fistula in patients studied

Postoperative coronary artery fistula	f	(%)
Fistula graft to the right atrium	1	25
Fistula graft to right ventricle	1	25
Fistula graft to pulmonary artery	1	25
Graft fistula to bronchial artery	1	25
Total	4	100

In the second section, we analyze the data. As described in the statistical methods section, we will examine the two hypotheses using chi-square.

1- Examining the relationship between MUSCLE_BRIDGING and gender

Table 8: Examining the relationship between MUSCLE_BRIDGING and gender

			MUSCLE_BRIDGING		Total
			SUPERFACIAL	DEEP	
Gender	Male	n	3	1	4
		%	75	25	100
	Female	n	5	1	6
		%	83/3	16/7	100
Total		n	n	2	100
		%	%	20	100
chi-square test			P= 0/7	df= 1	X^2= 0/104

The result of chi-square test showed that there is no significant relationship between MUSCLE_BRIDGING variable and gender (p <0.05).

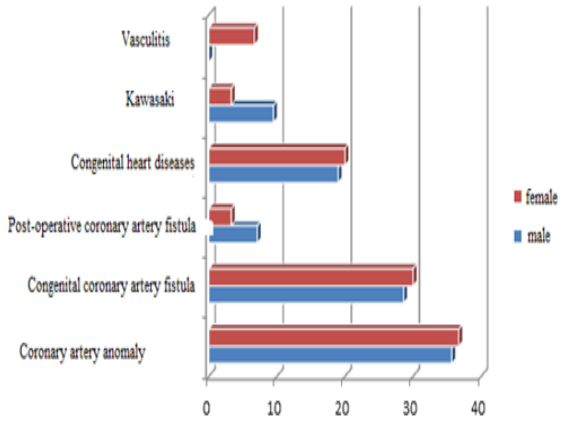


Table 9: Relationship between Non-atherosclerotic disease and gender

		Non-atherosclerotic (separate fistula)						
		Coronary artery anomaly	Congenital coronary artery fistula	Postoperative coronary artery fistula	Congenital heart disease	Kawasaki	Vasculitis	Total
gender male	n	15	12	3	8	4	0	42
	%	35/7	28/6	7/1	19	9/5	0	100
gender female	n	11	9	1	6	1	2	30
	%	36/7	30	3/3	20	3/3	6/7	100
total	n	26	21	4	14	5	2	72
	%	36/1	29/2	5/6	19/4	6/9	2/8	100
Chi-square test		P= 0/5			df= 5		X^2= 2/248	

The result of chi-square test showed that there was no significant relationship between non-atherosclerotic variable and gender (p <0.05).

2- Examining the relationship between coronary artery anomaly and gender

The result of Chi-square test showed that there was no significant correlation between coronary artery anomaly and gender (p <0.05).

Table 10: The Relationship between coronary artery disease and gender

		coronary artery anomaly					
		Anomaly LCX	RCA anomaly	SINGLE CRONARY OSTIUM	DOUBLE LAD	ALL CAPA	Total
gender male	n	7	4	0	1	3	15
	%	46/7	26/7	0	6/7	20	100
gender female	n	6	2	1	0	2	11
	%	54/5	18/2	9/1	0	18/2	100
total	n	13	6	1	1	5	26
	%	50	23/1	83	3/8	19/2	100
Chi-square test		P= 0/6		df= 4		X^2= 2/385	

3-Examining the relationship between congenital coronary artery fistula and gender

The result of chi-square test showed no significant relationship between congenital coronary artery fusion and gender (p <0.05).

Table 11: Relationship between congenital coronary artery fistula disease and gender

		congenital coronary artery fistula					
		LEFT MAIN CRONARY ARTERY	LAD + RCA	LCX	RCA	LAD	total
gender male	n	2	3	1	4	2	12
	%	16/7	25	8/3	33/3	16/7	100
gender female	n	2	0	3	3	1	9
	%	22/2	0	33/3	33/3	11/1	100
total	n	4	3	4	7	3	21
	%	19	14/3	19	33/3	14/3	100
Chi-square test		P=0/3		df= 4		X^2= 4/132	

4- Examining the relationship between congenital heart diseases and gender

The result of chi-square test showed no significant relationship between congenital heart disease and gender (p <0.05).

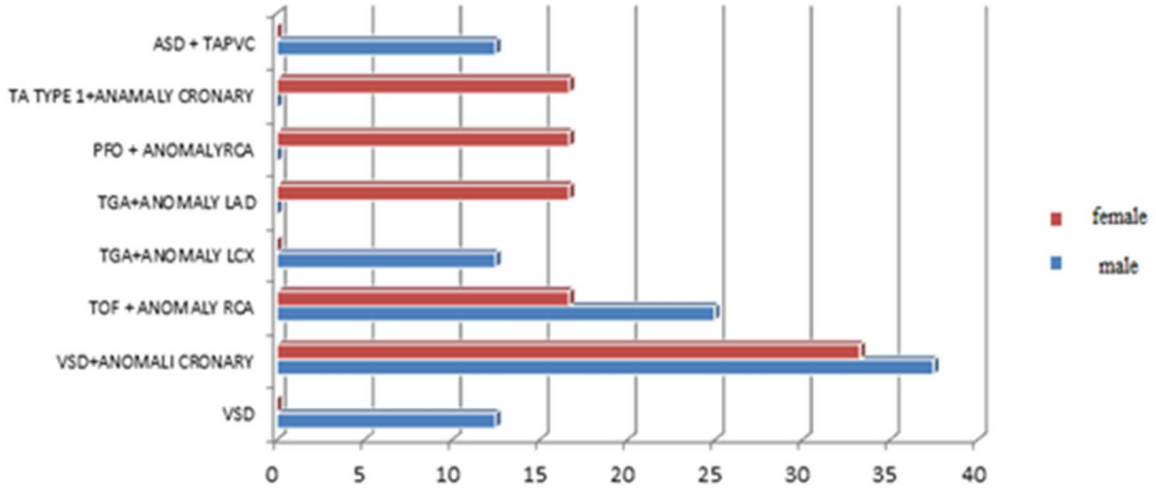


Table 12: Relationship between congenital heart disease and gender

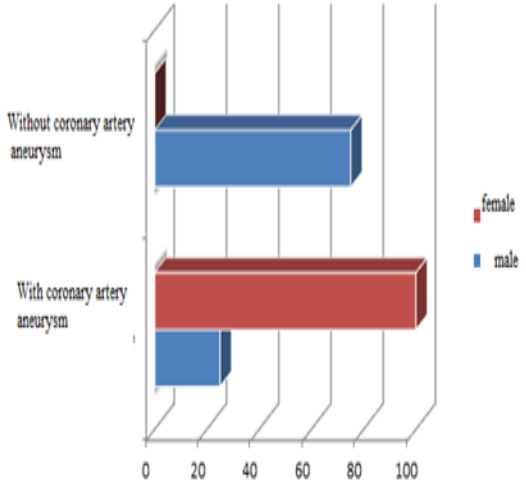
			congenital heart diseases								
			VSD	VSD+ANOMALI CRONARY	TOF + ANOMALY RCA	TGA+ANOMALY LCX	TGA+ANOMALY LAD	PFO + ANOMALYRCA	TA TYPE 1+ANAMALY CRONARY	ASD + TAPVC	total
gender	male	n	1	3	2	1	0	0	0	1	8
		%	12/5	37/5	25	12/5	0	0	0	12/5	100
	female	n	0	2	1	0	1	1	1	0	6
		%	0	33/3	16/7	0	16/7	16/7	16/7	0	100
total		n	1	5	2	1	1	1	1	1	14
		female	7/1	35/7	21/4	7/1	7/1	7/1	7/1	7/1	100
Chi-square test					P=0/4		df= 7		X2= 6/378		

5-Examining the relationship between Kawasaki and gender

Table 13:Relationship between Kawasaki and gender

			Kawasaki		
			With coronary artery aneurysm	Without coronary artery aneurysm	total
gender	male	n	1	3	4
		%	25	75	100
	female	n	1	0	1
		%	100	0	100
total		n	2	3	5
		%	40	60	100
Chi-square test			P=0/1	df= 1	X^2= 1/875

The result of chi-square test showed that there is no significant relationship between Kawasaki's variable and gender (p <0.05).



6- Examining the relationship between postoperative coronary artery fistula and gender

The result of chi-square test showed that there is not a significant relationship between post-operative coronary artery fistula variable and gender (p <0.05).

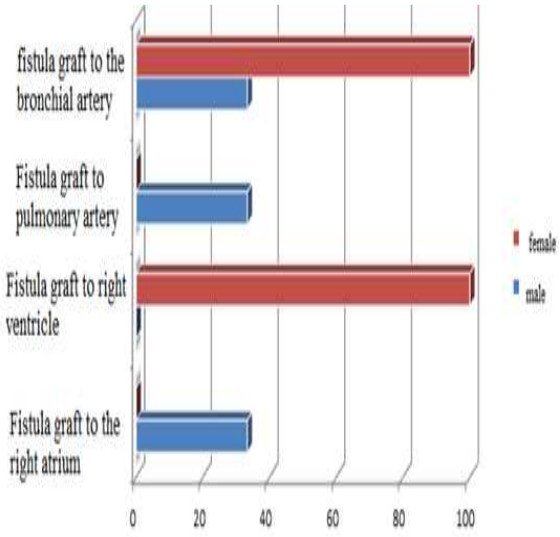


Table 14: Relationship between postoperative coronary artery fistula and gender

			postoperative coronary artery fistula				Total
			Fistula graft to the right atrium	Fistula graft to right ventricle	Fistula graft to pulmonary artery	fistula graft to the bronchial artery	
gender	male	n	1	0	1	1	3
		%	33/3	0	33/3	33/3	100
	female	n	0	1	0	0	1
		%	0	100	0	0	100
total		n	1	1	1	1	4
		%	25	25	25	25	100
Chi-square test			P=0/2		df= 3	X^2=4	

Table 16: Relationship between non-atherosclerotic disease and age group

			non-atherosclerotic						total
			Coronary artery anomaly	Congenital coronary artery fistula	Post-operative coronary artery fistula	Congenital heart disease	KawasakiVasculitis		
Age group	Up to 5 years	n	0	2	0	11	2	0	15
		%	0	13/3	0	73/3	13/3	0	100
	6-10	n	0	1	0	1	2	0	4
		%	0	25	0	25	50	0	100
	11-20	n	1	0	0	0	1	0	2
		%	50	0	0	0	50	0	100
	21-30	n	0	1	0	1	0	0	2
		%	0	50	0	50	0	0	100
	31-40	n	2	6	0	1	0	0	9
		%	22/2	66/7	0	11/1	0	0	100
	41-50	n	2	2	1	0	0	0	5
		%	40	40	20	0	0	0	100
	51-60	n	7	4	0	0	0	1	12
		%	58/3	33/3	0	0	0	8/3	100
	61-70	n	9	4	1	0	0	1	15
		%	60	26/7	6/7	0	0	6/7	100
	71-80	n	5	1	1	0	0	0	7
		%	71/4	14/3	14/3	0	0	0	100
	81-90	n	0	0	1	0	0	0	1
		%	0	0	100	0	0	0	100
	total	n	26	21	4	14	5	2	72
		%	36/1	29/2	5/6	19/4	6/9	2/8	100
Chi-square test			P= 0/000			df= 45		X^2= 99/769	

7. Examining the relationship between MUSCLE_BRIDGING and age

Table 15: C the relationship between MUSCLE_BRIDGING and age

			MUSCLE_BRIDGING		total
			SUPERFACIAL	DEEP	
Age group	Up to 5 years	n	1	0	1
		%	100	0	100
	21-30	n	1	0	1
		%	100	0	100
	31-40	n	2	0	2
		%	100	0	100
	41-50	n	0	2	2
		%	0	100	100
	51-60	n	1	0	1
		%	100	0	100
	61-70	n	2	0	2
		%	100	0	100
	71-80	n	1	0	1
		%	100	0	100
total		n	8	0	2
		%	80	20	100
Chi-square test		P=0/1	df= 6	X^2=10	

The Chi-square test showed no significant relationship between MUSCLE_BRIDGING and age group ($p > 0.05$).

8- Examining the relationship between non-atherosclerotic disease and age group

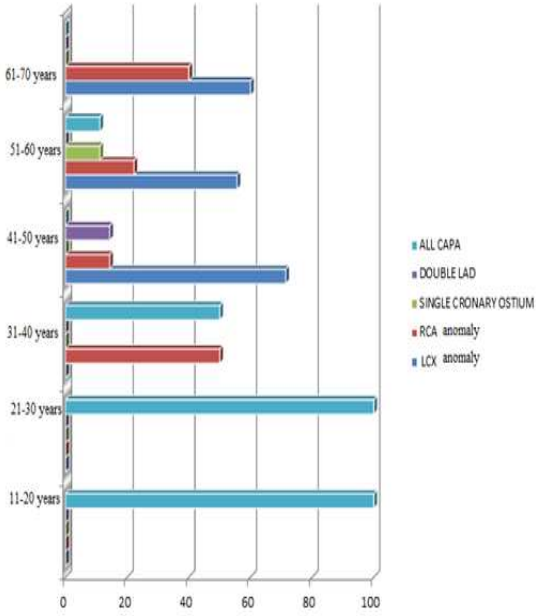
The result of chi-square test showed a significant relationship between non-atherosclerotic variable and age group ($p < 0.05$).

9- Examining the relationship between coronary artery anomaly and gender

Table 17: The relationship between coronary artery anomaly and gender

			Coronary artery anomaly					
			Anomaly LCX	RCA anomaly	SINGLE CRONARY OSTIUM	DOUBLE LAD	ALL CAPA	total
Age group	11-20	n	0	0	0	0	1	1
		%	0	0	0	0	100	100
	31-40	n	0	0	0	0	2	2
		%	0	0	0	0	100	100
	41-50	n	0	1	0	0	1	2
		%	0	50	0	0	50	100
	51-60	n	5	1	0	1	0	7
		%	71/4	14/3	0	14/3	0	100
	61-70	n	5	2	1	0	1	9
		%	55/6	22/2	11/1	0	11/1	100
	71-80	n	3	2	0	0	0	5
		%	60	40	0	0	0	100
Total		n	13	6	1	1	5	26
		%	50	23/1	3/8	3/8	19/2	100
Chi-square test			P= 0/2		df= 20		X^2= 23/858	

The result of chi-square test showed no significant correlation between coronary artery anomaly and age group (p <0.05).

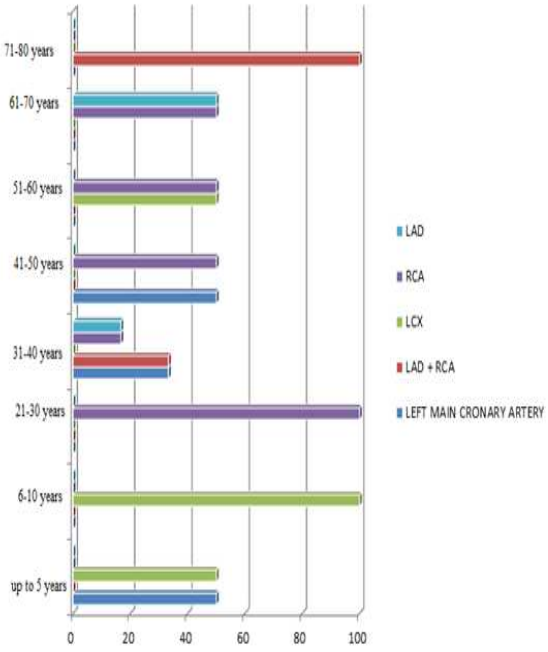


10-Examining the relationship between congenital coronary artery fistula and gender

Table 18: Relationship between congenital coronary artery fistula and gender

			congenital coronary artery fistula						
			LEFT MAIN CRONARY ARTERY	LAD + RCA	LCX	RCA	LAD		total
Age group	Up to 5 years	n	1	0	1	0	0	2	
		%	50	0	50	0	0	100	
	6-10	n	0	0	1	0	0	1	
		%	0	0	100	0	0	100	
	21-30	n	0	0	0	1	0	1	
		%	0	0	0	100	0	100	
	31-40	n	2	2	0	1	1	6	
		%	33/3	33/3	0	16/7	16/7	100	
	41-50	n	1	0	0	1	0	2	
		%	50	0	0	50	0	100	
	51-60	n	0	0	2	2	0	4	
		%	0	0	50	50	0	100	
	61-70	n	0	0	0	2	2	1	
		%	0	0	0	50	50	100	
	71-80	n	0	1	0	0	0	1	
		%	0	100	0	0	0	100	
total		n	4	3	4	7	3	21	
		%	19	14/3	19	33/3	14/3	100	
Chi-square test			P=0/2			df= 28		X^2= 31/708	

The result of chi-square test showed no significant correlation between congenital coronary artery fistula and age group (p> 0.05).

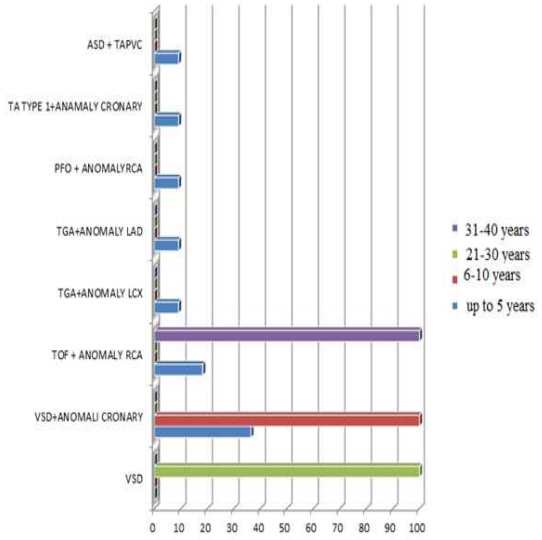


11- Examining the relationship between congenital heart disease and age group

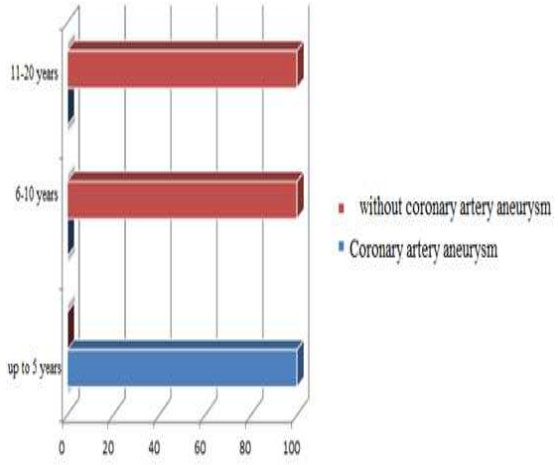
Table 19: Relationship between congenital heart disease and age group

			congenital heart disease								
			VSD	VSD+ANOMALI CRONARY	TOF + ANOMALY RCA	TGA+ANOMALY LCX	TGA+ANOMALY LAD	PFO + ANOMALYRCA	TA TYPE 1+ANAMALY CRONARY	ASD + TAPVC	total
Age group	Up to 5 years	n	0	4	2	1	1	1	1	1	1
		%	0	36/4	18/2	9/1	9/1	9/1	9/1	9/1	100
	6- 10	n	0	1	0	0	0	0	0	0	1
		%	0	100	0	0	0	0	0	0	100
	21-30	n	1	0	0	0	0	0	0	0	1
		%	100	0	0	0	0	0	0	0	100
	31-40	n	0	0	1	0	0	0	0	0	1
		%	0	0	100	0	0	0	0	0	100
total		n	1	5	3	1	1	1	1	1	14
		%	7/1	35/7	21/4	7/1	7/1	7/1	7/1	7/1	100
Chi-square test				P=0/5			df= 21		X^2= 19/6		

The result of chi-square test showed no significant relationship between congenital heart disease and age group ($p < 0.05$).



The result of chi-square test showed no significant relationship between Kawasaki variable and age group ($p < 0.05$).



13- Examining the relationship between Kawasaki and age group

Table 20: Relationship between Kawasaki and the age group

			Kawasaki		total
			Coronary artery aneurysm	without coronary artery aneurysm	
Age group	Up to 5 years	n	2	0	2
		%	100	0	100
	6-10 years	n	0	2	2
		%	0	100	100
	11-20 years	n	0	1	1
		%	0	100	100
total		n	2	3	5
		%	40	60	100
Chi-square test			P=0/08	df= 2	X^2=5

14- Examining the relationship between post-operative coronary artery fistula and age

Table 21: Relationship between post-operative coronary artery fistula and age

		post-operative coronary artery fistula				
		Fistula graft to the right atrium	Fistula graft to right ventricle	Fistula graft to pulmonary artery	Fistula graft to the bronchial artery	total
Age group	41-50 n	0	1	0	0	1
	41-50 %	0	100	0	0	100
	61-70 n	0	0	1	0	1
	61-70 %	0	0	100	0	100
	71-80 n	1	0	0	0	1
	71-80 %	100	0	0	0	100
	81-90 n	0	0	0	1	1
	81-90 %	0	0	0	100	100
total	n	1	1	1	1	4
	%	25	25	25	25	100
Chi-square test		P=0/2		df= 9	X^2=12	

The result of the Chi-square test showed that there was no significant relationship between the postoperative coronary artery fistula and age group (p>0.05).

DISCUSSION

Out of 10413 patients underwent CTA due to coronary artery disease since July 2016 to July 2017, 72 admitted due to non-atherosclerotic artery diseases include the following cases. Twenty and sixpatients with coronary artery anomaly were diagnosed which the most common anomaly in 13 patients related to Lcx artery, which seven of them were separated from opposite sinus to and 6 of them were separated from right coronary artery in the form of pre-pulmonic. The second most common anomaly was the separation of RCA from the left sinus in the six patients and the third anomaly related to the separation of the left coronary artery from the pulmonary artery in five patients (ALCAPA), followed by SINGLE CRONNY OSTIUM and DOUBLE LAD, each of which was seen in one patient. Our study showed different results compared to previous in terms of prevalence: In a study conducted in South Korea in 2014, the highest prevalence of anomalies related to the separation of the RCA arteries from the left coronary sinus and then the separation of the LCX artery from the right sinus. In a study conducted in Turkey in 2010, the most common anomaly was respectively absent LMCA RCA artery originating from left sinus and LCX artery originating from right sinus. In a study conducted in 2018 in Turkey, the most common anomaly was split RCA and RCA originating from the left sinus. In the study conducted in 2011, the most common anomaly was high-tack RCA, followed by absent LMCA, RCA originating from the left sinus and LCX originating from the right sinus, respectively. The prevalence of coronary anomalies from the opposite sinus was the most common anomaly in our study and previous studies, while in our patients, in contrast to previous studies, the prevalence of left coronary artery anomaly was higher than that in right coronary artery. Additionally, ALCAPA anomaly, as seen in 5 patients of Shaheed Rajai Hospital, was not considered in previous studies.

In our study, as in previous studies, the prevalence of coronary anomaly was higher in males than that in females and its ratio was 15 and 11, and was the highest age range was 61 to 70 years. The second disease was non-atherosclerotic coronary artery fistula heart disease, which we separated it from coronary artery anomalies in this study, and the coronary artery fistula was divided into two congenital and postoperative groups .Out of 21 patients with congenital coronary artery fistula, 19% had LEFT MAIN CRONARY ARTERY, 14.3% had LAD + RCA, 19% had LCX, 33.3% had RCA and 14.3% had LAD. The most common place to fistulization in the respective arteries: right ventricle, left atrium, and pulmonary artery, each with five cases. In the previous study performed in South Korea in 2014, as our study, the most common place of fistulization was pulmonary artery and most involved coronary arteries was LAD artery and the joint fistula LAD + RCA, which it is in line with our study. In our study, the ratio of male to female was 12 to 9, with the prevalence of this type of disease was higher in males than that in previous studies. The highest age range of congenital fistula diagnosis was in the age range of 31 to 40 years. The second type of fistula was the postoperative fistula in four patients, which the most involved artery was in two cases in the LAD artery, and the sites of the pulmonary artery fistulization was the right ventricle, the bronchial artery, was ascending aorta. The ratio of male to female was 3 to 1. The third non-atherosclerotic coronary artery disease is congenital heart disease which is seen 14 cases in our study.

Among the 14 patients with congenital heart disease, 7.1% had VSD, 35.7% had VSD + ANOMALI CRONARY, 21.4% had TOF + ANOMALY

RCA, 7.1% had to TGA + ANOMALY LCX, 1.7% had TGA + ANOMALY LAD, 1.7% had PFO + ANOMALYRCA, 1.7% had TA TYPE 1 + ANAMALY CRONARY, and 7.1% had ASD + TAPVC .Twelve patients had concomitant coronary artery anomaly. The most common congenital heart disease was VSD, which five of the six patients had coronary artery anomaly, and the anomalies were most in RCA artery. The next disease was tetralogy of fallot seen in three patients, all of whom had concomitant coronary artery anomaly, two cases was bonding anomaly in RCA, and one case was RCA fistula. There next disease was TGA in two patients, both of which had bonding anomaly in the left coronary artery. Two cases of ASD were seen, one case was accompanied by a left coronary artery fistula and one case was accompanied with TAPVC, which the coronary anomaly was not observed in the second case. The last anomaly was Truncus Arteriosus in a patient, accompanied by left coronary artery anomaly. In our study, the highest age range belonged to age range of birth to 5 years of old. In a study conducted in Japan in 1990, coronary artery anomalies were clearly associated with congenital heart disease. The most common congenital heart diseases in this study were the mitral valve prolapse, bicuspidaortic valve, and tetralogy of fallot, respectively. However, in a study conducted by Salehi et al in Tehran in 2014, the prevalence of coronary anomaly in infants with the displacement of large vessels was examined.

The prevalence of uncommon patterns of coronary arteries in infants with large vessel displacement was 53.9%, which was less than global statistics (33.1%). In our study, although the sample size was low, both cases were associated with coronary artery anomalies. The fourth diagnosed disease was vasculitis aorta. In two cases, the thoracic aorta wall was thickened and coronary artery disease involvement caused symptoms. Both patients were female, aged 56 years and 69 years. As previous studies, in our study, the prevalence of vasculitis was higher in females. The fifth coronary artery non-atherosclerosis disease was Kawasaki. In our study, two patients had concomitant coronary artery. One patient had aneurysm in two LAD + RCA arteries and one patient had LMAIN + RCA + LAD in three arteries. Four patients were male and one patient as female, and the most common age range was 1 to six years. In a study conducted in Japan in 1980, out of 130 patients with coronary artery aneurysm, 21 had Kawasaki disease, and Kawasaki's disease was reported as a significant risk factor for ischemic heart disease in adulthood. The results of the mentioned study were in line with those of our study. In addition to the mentioned diseases, MUSCLE BRIDGING of coronary artery was seen in ten of these 72 cases, which they were associated with these anomalies. They included the following cases: five cases were associated with fistula, and 4 cases with developmental coronary artery anomalies, and one case was associated with Kawasaki disease with aneurysm formation. Each of 10 cases occurred in LAD coronary artery, which 5 cases were in distal LAD and 5 cases were in the middle of LAD MUSCLE BRIDIGING. Eight cases were superficially muscle-bridged and 5 cases were deeply muscle-bridged. Five patients were female and 5 were male. In a study conducted in India in 2018, MUSCLE BRIDGING was a common coronary artery anomaly, which was highly associated with a coronary artery disease and it was in line with result of study.

CONCLUSION

Non-atherosclerotic coronary artery disease is an uncommon disease, which is seen in less than 1% of patients and leads to sudden death at lower ages. It should be considered seriously in younger patients with heart disease symptoms. Moreover, the concomitant coronary artery disease should be examined in patients with congenital heart disease, since they are associated with each other significantly. Coronary artery aneurysm should be also considered in Kawasaki disease. Various studies have shown that the prevalence of coronary artery anomalies varied, but right coronary artery was more common than other coronary arteries in majority of studies. The prevalence of non-atherosclerotic diseases was more in males than that in females, although it was not statistically significant.

REFERENCES

1. Cohen P, O'GaraPT. Coronary artery aneurysms: a review of the natural history, pathophysiology, andmanegment. cardiol Rev.2008 nov-dec;16(6):301-4
2. Coyle L,Thomas WJ .Anomalous left anterior desending coronary artery: malignant hospital course of a not so benign anomaly. Cathetercardiovasc Interv. 2000; 51(4):468-70

3. Fabre A, Sheppard MN. Suddena adult death syndrome and other nonischemic cause of sudden cardiac death. Heart 2006
4. Bagheri B, Mokhberi V ,Akbari N , Golshani S ,Tabiban S .Origin of left coronary artery arising from the right coronary cusp:vJ GorganUni Med Sci. 2013; 15(3): 123-125.Article in Persian
5. NorabdiA,Rahimi SH. Multiple Myocardial Bridge : J HormozganvUni Med sci.2009;13(7)129-132. Article in Persian
6. Marziehparvar I, Omid O. Multiple Aneurysms of coronary artery: Hormozgan Uni Med sci.2011;15(1)69-73. Article in Persian
7. SaeediJ, Kazemi D, Hoseyni M. Coronary artery disease associated with congenital heart disease:J mciri.2007;25(1)39-43. Article in Persian
8. Salehi F, Ahmadi B, Zaherara M, Riasi H. Coronary Artery Patterns in Neonates with Transposition of the Great Arteries in Tehran. J Mazandaran Univ Med Sci. 2015; 24 (121):368-373. Article in Persian
9. Yildis A, Okcun B, Peker T, Arslan C, Olcay A, Bulent Vatan M. Prevalence of coronary artery anomalies in 12,457 adult patients who underwent coronary angiography. Clin Cardiol. 2010; 33(12): E60-4. doi: 10.1002/clc.20588.
10. June Namgung, Jeong A Kim. The prevalence of coronary anomalies in a single center of Korea: BMC Cardiovasc Disord. 2014; doi: 10.1186/1471-2261-14-48
11. Sirasapalli Chinnam, Naidu, Johann Christopher, Vishnu Ravilla. Prevalence and spectrum of coronary artery anomalies in 8021 patients: Cardiological Society of India. j.ihj.2018.01.035
12. Paolo Angelini. Coronary Artery Anomalies: Tex Heart Inst J 2002;29:271–8)
13. Christos G, Dimokritos D, Vasileios K, Georgios D. Prevalence and characteristics of coronary artery anomalies in an adult population : BMC Cardiovascular Disorders 2015**(15)**:112
14. Tuzcu EM, Moodie DS, Chambers JL, Keyser P, Hobbs RE. Congenital heart diseases associated with coronary artery anomalies:Cleve Clin J Med. 1990; 57(2):147-52
15. Kato H, Ichinose E, Kawasaki T. Myocardial infarction in Kawasaki disease: J Pediatr. 1986; 108(6): 923-27.
16. Fang-fang Yu,BinLu,Yang Gao,.MZhi-hui Hou. Congenital anomalies of coronary arteries in complex congenital heart disease: Jcct 2013 (6):383-90.