

Coronary Artery Spasm; Frequency and Angiographic Findings in the Iraqi center for heart diseases (Single Centre experience)

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Abstract:

Background: Coronary artery spasm occurs spontaneously leading to the syndrome of variant angina. It occurs in about 15 % of patients undergoing coronary angiography.

Objectives: This study sought to estimate the rate of coronary artery spasm that occurs during coronary angiography and percutaneous coronary intervention with their risk factors in patients admitted to the Iraqi center for heart disease.

Methods: This is a cross sectional observational study, We prospectively collected the data of patients over six months period (from August 2014 till February 2015) who developed coronary artery spasm during cardiac catheterization (diagnostic and therapeutic).

Results: Out of 1274 patients, 106 patients developed coronary artery spasm(8.3%). 71.6% of patients were adult aged 50-69 years.74.5% patients were males (P.V 0.0001).

Smoking was a strong risk factor for the coronary artery spasm (P.V<0.0005).

Engagement of catheter in the coronary artery ostia during angiography was the most common cause of spasm (P.V0.0001).

Spasm was induced by stents (31.1%), by guide wire (16%), by balloon (3.7%) while spontaneous spasm occurred in 6.6% only.

The frequency of spasm in apparently disease - free vessels was more in the right system (65.4%) compared to the left system (34.6%). In diseased vessels the frequency is comparable in both systems.

Conclusions: This study has shown that the CAS is frequent during diagnostic cardiac catheterization and percutaneous coronary intervention procedures.

Keywords: coronary artery spasm, cardiac catheterization.

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Introduction

The term coronary artery spasm (CAS) refers to a sudden, intense vasoconstriction of an epicardial coronary artery, it is either idiopathic (primary) which represents the usual cause of variant angina or induced by drugs, or instrumentation during coronary angiography. The variant form of angina was first described in 1959 by Prinzmetal et al(1). Coronary spasm represents one of the pathophysiological mechanisms of myocardial ischemia, not only in variant angina, but also in ischemic heart disease in General, including stable angina, unstable angina, acute myocardial infarction and sudden death (2), and in patients with no obstructive coronary artery disease at all (3, 4). The site of vasospasm leading to angina may not only be in a fixed location within a coronary artery but may also shift involving different segments of the same coronary

artery or more than one vessel in the same patient (5). Even if rare, fluctuating vasospasm in multiple segments of the coronary vessels may be the basis for recurrent and persistent angina. Nevertheless, spontaneous multivessels or multi segment spasm, mimicking a severe obstructive coronary artery disease, has been infrequently described (6). Secondary coronary spasm is usually limited to the site of instrumentations during coronary angiography and/ percutaneous coronary intervention whether it is caused by catheter, wire, balloon or stent (7). The classification of coronary artery spasm include: - Focal coronary spasm is limited to a localized segment of the coronary artery. Multifocal coronary spasm involves several localized segments of the same coronary artery. Multivessels coronary spasm involves several coronary arteries (8). Diffuse coronary spasm :-involving long segment of one or multiple coronary arteries(9). The pathophysiology of coronary spasm divided in to primary and secondary causes, the primary causes(10) include: The endothelial dysfunction, Polymorphisms of eNOS gene, Oxidative stress. Chronic low-

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grade Inflammation, Hypercontractility of coronary smooth muscle. The secondary causes include: Catheter: Catheter-induced vasospasm is produced by mechanical stimulation of a vessel by contact with a catheter it must be distinguished from true organic narrowing's of a vessel. The left main coronary artery segment may also be involved in either spontaneous or catheter-induced spasm(11) . Friedman et al. reported angiographic criteria to distinguish between the spasm of variant angina and catheter-induced spasm. Catheter-induced spasm is usually asymptomatic, almost invariably in the RCA, occurs at the catheter tip, is smooth, concentric, and less than 2 mm in length along the vessel. In contrast, spontaneous spasm occurs in any coronary artery, at a distance from the catheter tip, is usually irregular and eccentric, and is associated with angina, ST segment elevation, hypotension, and dysrhythmia (12). Balloon angioplasty: Coronary artery spasm has been reported in 1-5% of balloon angioplasty procedures. Spasm of the distal vessel is common after percutaneous intervention (13,14) . Predisposing factors include non-calcified lesions, eccentric lesions (15) . Stents: It is common for vascular spasms to occur due to mechanical stimulation in a remote segment of a coronary artery stent during implantation.(7) There have also been studies reporting spontaneous spasms at the stent edges following several months of use (16) . guide wire: spasm induced solely by guide wire insertion is rare. In a study of 906 patients undergoing intracoronary Doppler flow measurement using 0.014'' or 0.018'' Doppler Flow Wire, 1% of the patients were reported to develop coronary spasm during the passage of the wire (17). Coronary vasospasm can lead to life-threatening arrhythmias, depending on the vessel that is involved. Specifically, right coronary artery spasm can lead to sinus arrest or complete heart block, while left anterior descending artery spasm can lead to ventricular tachycardia or fibrillation. Multivessels spasm can also lead to ventricular arrhythmias (8).

Aim of the study: To study the frequency, type of CAS and its relation to traditional risk factors and the relation of CAS with presence of atherosclerosis.

Patients and Methods: We received the collected data of patients with history of ischemic heart disease who were admitted to Iraqi center for heart disease in which they undergoing cardiac catheterization (diagnostic and therapeutic procedures) over six months period (from August 2014 till February 2015) who developed coronary artery spasm .

Inclusion criteria: Coronary artery spasm is considered to be present if the following criteria are present: Appearance of significant transient narrowing in coronary segment/segments.

Prompt relief of the spasm spontaneously or via intracoronary administration of nitroglycerin.

Catheter-induced spasm phenomenon must be located within 1 - 2 mm of the coronary ostium .Spasm caused by other interventional tools (balloon, stent, wire) were included. Spasm occurring far away from instrumentation was regarded as spontaneous according to Friedman et al angiographic criteria (12) .

Exclusion criteria: Muscle Bridge, patients receiving I.C nitroglycerin prior to study, coronary artery dissection.

Statistical analysis: Chi-square test was used to assess the relation of different factors P values of less than 0.05 was considered significant.

Results:

One thousands two hundreds seventy four (1274) patients underwent coronary angiography and/or percutaneous coronary intervention at Iraqi center for heart disease from August 2014 till February 2015. Seven hundreds thirty one(731)underwent diagnostic coronary angiography and 543 patients underwent PCI .Eight hundreds thirty five (835) patients were males and four hundreds thirty nine (439)were females. One hundred six developed coronary arterial spasm.

Table -1- distribution of CAS with age and gender.

Age group	Numbers	percentage
Young <50y	21	19.8%
Adult50-69y	76	71.6%
Elderly>69 y	9	8.4%
Males	79	74.52%
Females	27	25.47%
Total	106	100%

Table 2- Relation of CAS to the clinical presentation of patients

Clinical presentation	CAS	Percentage
Chronic stable angina	77	72.6%
NSTEMI	7	6.6%
STEMI	22	20.7%
Total	106	100%

As far as the frequency of CAS in relation to the risk factors of ischemic heart disease there is a significant relation with smoking (p value <0.0005) and no significant relation of CAS with the HT and D.M.

Table -3-Relation of risk factors to the frequency of CAS.

Risk factor	Pt. with spasm	Percentage%	Total	p. value
Non smokers	47	4.8%	976	<0.0005
Smokers	59	19.7%	298	
Non HT	41	8.6%	475	P=0.835 NS
HT	65	8.1%	799	
Non DM	72	8.6%	833	P=0.654 NS
DM	34	7.7%	441	

Spasm was related to instrumentations in 99 patients, (93.4%), Spontaneous spasm has occurred in seven patients 6.6% in 6 of them the spasm was in the RCA the spasm in the last patient involved left main and the LAD. The CAS was focal in all most all patients 100 patients,(94.3%), diffuse in only 3 patients (2.8%) and multifocal in other 3 patients (2.8%).The multifocal and diffuse spasm occurs only in RCA.

Table -4- Causes of spasm showing significant relation with catheter.

CO.A	catheter	Wire	Stent	Balloon	p.vale
LMS	13				0.0001
LAD	0	7	20	2	
LCX	0	5	6	2	
RCA	39	6	7	0	
TOTAL	52(49%)	17(16%)	33(31.1)	4(3.77%)	

The spasm was ostial in 48 patients (45.2%), most of them was in the RCA 34 patients in the RCA compared to 13 patients with ostial LMS spasm, and one patient has ostial LCX spasm. Spasm of the proximal segment of coronary arteries occurred in 18 patients (16.9%), mid segment spasm occurred in 11 patients (10.3%), and distal segment spasm occurred in 29 patients 27.3%. Multivessel spasm occurred in three patients. Two patients of them involved the LAD and RCA, while the third of them was involving the ostium of LMS and proximal segment of LAD. CAS has occurred in atherosclerotic coronary arteries in 80 patients (75.5%), and it occurred in 26 patients (24.5%) with apparently normal vessels, in 17 patients of them. As far as manifestations of CAS spasm was manifested with clinical and electrocardiographic signs in 40 patients (37%). Table 7 showed that chest pain and hypotension has occurred in almost 1/5 of patients.

Table (5): CAS distribution according to coronary artery segment and type of spasm.

	OSTIAL	PROXIMAL	MID	DISTAL	TOTAL	TYPE OF SPASM
LMS	13	0	0	0	13(12.2%)	Focal
LAD	0	0	10	19	29(27.3%)	Focal
LCX	1	6	0	6	13(12.2%)	Focal
RCA	34	12	1	4	51(48.1%)	3 multifocal,3diffuse
	48(45.2%)	18(16.9%)	11(10.3%)	29(27.3%)	P= 0.0001	

Table -6-Relation of spasm to whether the artery is diseased or not.

	DISEASED Vessel.		APPARENTLY not diseased		p. value
	No.	%	No.	%	
LMS	4	3.7%	93	4.6%	0.0001
LAD	29	27.3%	0		
LCX	13	12.2%	0		
RCA	34	32.7%	17	65.4%	
Total	80	75.5%	26	24.5%	

Table -7- manifestation of CAS spasm during coronary angiography

Symptoms	Freq.	percentage
Chest pain	18	16.9%
Hypotension	21	19.8%
Arrhythmia	1 VF	0.9%
Transient ST elevation	3	2.8%
Total	43	100%

Discussion:

The frequency of CAS in our study was 8.3%. while the Coronary spasm has been less frequent in the Western countries 1-5% (13,14). This is probably due to the facts that Ca-channel blockers (CCBs), have been widely used for chest pain and/or hypertension and lower incidence of smoking (18,19). In this study we found that the CAS is more prevalent among men than women. This finding agrees with other studies which showed that CAS was more frequent in males (20,21). Our study has shown that the frequency of CAS peaks in patients age 50 - 69 years and decline after the age of 70 years. This finding is consistent with finding of the Japanese Circulation Society and Hung MY et al (20,21). Regarding the risk factors for CAS our findings are similar to Sugiyama S et al, Hung MJ et al, Takaoka K et al (22,23,24) who showed that CAS was more frequent in smokers and there is no significant association of HT, and D.M and CAS. In our study the atherosclerotic coronary arteries was more frequently involved by spasm than apparently normal vessels, this finding was supported by Bertrand ME et al (59%)(25). Catheter induced spasm was the most common in our study than other causes which also widely reported by other study; Persian GA et al, Chang KS et al (26,27). In our study we found that the frequency of spasm involving the LMS was considered higher 13 patients (12.2%) than that recorded in other literature in which only a few cases of LMS was reported (28,29,30) this is might be attributed that we included larger number of patients or trainer doctors who paid great attention to the identification of LMS spasm. Although catheter tip irritation may account for the majority of instances of spasm, it cannot be implicated in every case. In seven patients of our cases, spasm occurred in locations remote from the catheter tip and hence it is unlikely that spasm resulted from catheter tip irritation. Many researchers believe that coronary spasm that develops during catheterization is partly spontaneous and partly catheter-induced (31). Like catheter instrumentation by wire, balloon, or stent has induced spasm in our study which is common as in other reports of CAS, which is showing that intervention related vascular spasms are common in percutaneous coronary intervention (PCI) due to the mechanical stimulation caused by balloon dilatation or stent release (7). The implantation of a drug-eluting stent is more likely to induce a vascular spasm (32,33). The observation that wiring is associated with higher frequency of spasm has been also reported by Qian J, Ge J, Baumgart D, et al. (17) who show that 1% of the patients were reported to develop coronary spasm during the passage of the wire (17).

Conclusion:

CAS during coronary angiography and percutaneous coronary intervention was more common in male patients, ostial right coronary artery was the most common site of spasm, CAS

was more common in diseased vessels than normal coronary arteries.

Author contributions:

Study conception, Study design, Dr. Prof. Hassan Al-Najjar
Acquisition of data analysis, Interpretation of data, Dr. Ammar Zidan Omran
Drafting of manuscript, Critical revision, Dr. Zaid Abedel-Elah Mustafa Al-Najjar.

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