Correlation Between Regional Wall Motion Abnormalities via 2-Dimensional Echocardiography, and Coronary Angiographic Findings

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ABSTRACT:

BACKGROUND:
Ischemic heart disease induce changes in myocardial performance and there are different ways to study this performance as using echocardiography and cornary angiogram

OBJECTIVE:
Correlate the findings of regional wall motion abnormalities assessed by 2D echocardiography, to the coronary artery lesions detected by coronary angiogram.

METHODS:
This study included 101 patients who attended the Iraqi Center of Heart Disease between March 2010 and April 2011. In addition to routine investigations, echocardiography and coronary angiography were done to them.Patients were grouped according to segments of regional wall motion abnormalities into 3 groups :group A (segments 1,2,7,8,13,14), group B (segments 3,4,9,10,15), and group C (segments 5,6,11,12,13,16).These groups were correlated according to the score of regional wall motion abnormalities, with each coronary artery lesions detected by coronary angiogram.

RESULTS :
(47.5%) of patients in group(A) had hypokinesia, Akinesia in (14.9%), and dykinesia in (21.8%), majority of these abnormalities were correlated with LAD lesions (P-value 0.0001).(44.4%) of patients in group(B) had regional wall motion abnormality in form of hypokinesia(35.6%), akinesia(7.9%), and dyskinesia(1%) .There was a strong correlation between group(B) and LCX lesions (P-value=0.0001)

(27.8%) of patients in group(C) showed hypokinesia ,(5%) Akinesia, and (8 %) dyskinesia ,majority were associated with RCA lesions in form of critical and total occlusions.

CONCLUSION:
Regional wall motion abnormalities detected by 2D-echocardiography can be correlated with the lesions of the affected coronary vessel, in terms of the site and severity.

KEY WORDS: regional wall motion, coronary angiography.

INTRODUCTION:

Coronary artery disease (CAD) is the most prevalent cardiac disease. Routine evaluation of patients with CAD includes echocardiography.

Echocardiography is a versatile, low-cost, and portable technique that is available clinically in nearly all medical centers and subsequently is the most widely utilized cardiac imaging modality[1].The diagnosis of CAD by echocardiography is based on the concept that acute myocardial ischemia or infarction produces a detectable impairment in regional left ventricular (LV) mechanical function. Identification of patients with suspected CAD and acute coronary syndrome is one of the primary indications for echocardiography [2,6]. Assessment of global LV systolic function and detection of the presence and extent of regional myocardial dysfunction are routine clinical indications for echocardiography.This method also has an important prognostic value in patients with acute and chronic CAD [3,7].

Experimentally, immediately after coronary artery occlusion abnormalities in diastolic function occur and can be detected with echocardiographic and doppler techniques.The easiest and most commonly identified abnormality is abnormal mitral valve inflow, with reduction in E-wave velocity and an increase in A-wave velocity (grade 1 diastolic dysfunction) occuring within seconds of total

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coronary occlusion[1]. Additionally, there may be a visibly abnormal relaxation pattern to the wall, mimicking a conduction abnormality.This is followed almost immediately by loss of systolic wall thickening and decreased endocardial excursion in the region perfused by the obstructed coronary vessel.If coronary artery obstruction persist for a threshold period, myocardial necrosis ensues and persistant wall motion abnormality will develop[1,3,5].

From the parasternal, apical, and sometimes subcostal imaging windows, 2D-echocardiography can visualize all LV wall segments. For purposes of regional wall motion analysis, the American Society of Echocardiography has recommended a 16-segment model or, optionally, a 17-segment model with an addition of the apical cap (Fig. 1-1) [3] .The following numerical score is assigned to each wall segment on the basis of its contractility as assessed visually: 1=Normal (>40 percent thickening with systole),2=Hypokinesis (10 to 30 percent thickening),3=Severe hypokinesis to akinesis (<10 percent thickening),4=Dyskinesis ,5=Aneurysm.Moreover, the myocardium may remain akinetic for a period of time after successful coronary reperfusion in patients with acute myocardial infarction. Therefore knowledge of both myocardial contractility and perfusion is vital for the management of patients with coronary artery disease [4] .

The absence of LV wall motion abnormalities during chest pain usually, but not always, excludes myocardial ischemia or infarction, and the presence of regional wall motion abnormalities has a high sensitivity for detecting myocardial ischemia or infarction, although it is not specific[1] .A 2D echocardiographic analysis of regional wall motion abnormalities is helpful even in patients with ST-elevation myocardial infarction (STEMI). When a patient presents with a STEMI, the affected myocardium is usually akinetic or dyskinetic [3,8]. After the myocardium has been reperfused successfully within an appropriate time, it becomes

more contractile. The improvement in regional myocardial contractility is evident within 24 to 48 hours and continues for several days to months.Therefore follow-up 2D echocardiographic imaging is useful in detecting reperfused myocardial segments or infarct expansion [1] [9].The segmental numerical model of regional wall motion score can be matched and corresponds well with coronary artery distribution. From this, various indices of coronary artery territory involvement may be derived [1].

PATIENTS AND METHODS:

101 patients attending The Iraqi Center of Heart Disease, from April 2010 to March 2011 were included in the study. In addition to routine investigations, echocardiography and coronary angiography were performed for all the patients.The parameters measured at 2D echocardiography included the assessment of regional wall motion numerical score, and evaluation of systolic function, diastolic function, LV end diastolic pressure and presence or absence of mitral regurgitation. Coronary angiographic studies evaluated and assessed the abnormalities seen in the affected coronary artery.Segmental wall motion areas were grouped into 3 groups:

GROUP A= which involves the anterior and antero-septal segments [1,2,7,8,13,14].

GROUP B= which involves the posterior and postero-lateral segments[3,4,9,10,15].

GROUP C= which involves the inferior and infero-septal segments [5,6,11,12,13,16].

These groups were compared to each coronary artery which had been studied and evaluated using coronary angiogram.

All patients were asked about the presence or absence of symptoms (chest pain, and dyspnea), and whether they had risk factors like smoking, diabetes mellitus, hypertension, and dyslipidemia.
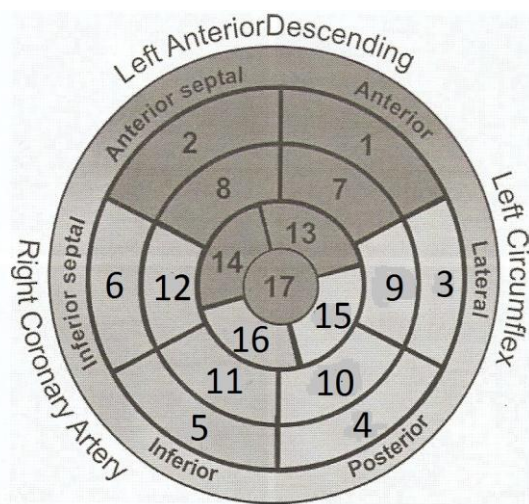
A diagram showing the correlation between regional wall motions and the coronary arteries

Statistical Analysis:
Analysis of Data was carried out using the available statistical package of SPSS-18 (Statistical package of social sciences-version 18).The significance of differences of different percentages were tested using Chi-square test.Statistical significance was considered whenever P-value was less than 0.05.

RESULTS:
Of 101 patients who attended the Iraqi Center of Heart Disease, 79(78.2%) of them were males, and 22(21.8%) were females.The parameters of echocardiographic assessment which included (ejection fraction, diastolic dysfunction, mitral regurgitation, LVDD, and groups of regional wall motion score), are shown in table (1) and table (2)

Table1: Parameters of echocardiography.

E.F	<50%		>50%				Total	
	No.	%	No.	%			No.	%
	41	40.6	60	59.4			101	100
Diastolic dysfunction	No D.D		Grade 1		Grade 2		Grade 3	
	No.	%	No.	%	No.	%	No.	%
	21	20.8	76	75.2	2	2	2	2
Mitral regurge.	No MR		Mild		Moderate-severe			
	No.	%	No.	%	No.	%		
	48	47.5	36	35.6	17	16.8	101	100
LVDD	Normal		Dilated					
	No.	%	No.	%				
	58	57.4	43	42.6			101	100

From table (1), we can see that the majority of patients had good systolic function(59%) with ejection fraction > 50%.Grade one diastolic

dysfunction was present in 75.2% of the patients.Majority of patients had no left ventriculat dilatation (57.4%), while (47.5%) of them had no mitral regurgitation.

Table 2: Regional wall motion abnormalities according to groups.

Groups	Normal		Hypokinesia		Akinesia		Dyskinesia		Total
	No.	%	No.	%	No.	%	No.	%	%
Group A	16	15.8	48	47.5	15	14.9	22	21.8	100
Group B	56	55.4	36	35.6	8	7.9	1	1	100
Group C	62	61.4	26	25.7	5	5	8	7.9	100

From table (2), we can see that most of the patients had regional wall motion abnormality involving group A (anterior and antero-septal segments), while group C (inferior and infero-septal segments) were the least affected.The most frequent regional wall motion abnormality being encountered was hypokinesia.The affected groups of regional wall motion abnormality then were correlated with coronary artery lesions which had been assessed by coronary angiogram.Each group was compared with 3 coronary vessles (LAD, LCX, RCA), as shown in table (3).

Table 3: Groups in relation to each coronary artery affected.

Groups	Coronary artery	P-VALUE
Group A	LAD	0.001
	LCX	0.248
	RCA	0.118
Group B	LAD	0.008
	LCX	0.0001
	RCA	0.523
Group C	LAD	0.678
	LCX	0.207
	RCA	0.0001

From table (3), we can see that p-value is highly significant in the LAD-Group A, while is not significant in the LCX-Group A and RCA-Group A.

We can see also that there is significant p-value in LAD-Group B, but it is highly significant when compared with LCX-Group B patients, and not significant in RCA-Group B patients.The only significant finding in Group C is seen in the RCA-Gorup C patients, and not significant in the other patients of Group C.

DISCUSSION:

Going through medline and internet journal access, there were limited studies concerning the relation between regional wall motion abnormalities and coronary artery lesions, most of them were done using the dobutamine stress echocardiography.Results of our study is similar to a study which was done by Christian Berthe et al, in the Civil Hospital, Verviers, Belgium, in July 2004.This study predicted the extent and location of coronary artery disease in acute myocardial infarction by echocardiography during dobutamine infusion. The study showed that in patients with multivessel CAD, new wall motion abnormalities were identified in the segments corresponding to the arterial lesions diagnosed by angiography (sensitivity 85%) [10].Determination of global ventricular function can provide both diagnostic and prognostic information on patients with ischemic syndromes. The most commonly used assessment of LV systolic function is the ejection fraction.In our study we found that majority of patients (59.4%) had ejection fraction above 50%.Obviously if a regional wall motion abnormality is not visualized in the plane of

examination, the usual technique of measuring EF, will overestimate it. For this reason, when dealing with patients with coronary disease in whom regional abnormalities are anticipated, biplane methodology and volume determination of LV are necessary, if precise measurement are required [1,11] A study which was done in Hillel-Yaffe Medical Center, Hadera, Israel, by Blondheim DS et al, reveals that among experienced readers using contemporary echocardiographic equipment, interobserver and intraobserver reliability was reasonable for the visual quantification of normal and akinetic segments but poor for hypokinetic segments. Reliability was good for the visual assessment of global left ventricular function by WM score index and ejection fraction [12].Another study correlating the importance of diastolic dysfunction in coronary artery disease, was done by Charles Bankhead et al, University of Pennsylvania School of Medicine, 2007.

Reviewing the background of the study, diastolic dysfunction is a common finding after acute MI, and left-ventricular diastolic dysfunction predicts in-hospital heart failure, and long-term mortality.Echocardiographic exams of the 199 patients showed that 78% of patients were having diastolic dysfunction, and were rehospitalized after ischemic heart disease due to heart failure[11] .In our study, there were similar results, as 79% of patients having grade one diastolic dysfunction, while 4% of them had grade 2 and3.Impaired diastolic relaxation can also be a finding with old age patients even without ischemic syndromes [1,4,11].

CONCLUSION:
Regional wall motion abnormalities detected by 2D echocardiography can be correlated with the lesions of the affected coronary vessel studied angiographically, in terms of the site and severity.

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