The Effect of Precordial ST-Segment Depression in Inferior ST-Segment Elevation Myocardial Infarction on Left Ventricular Systolic Function :Two-Dimensional Echocardiographic Study.

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ABSTRACT

Background and Objective: The importance of precordial ST-segment depression in patients with early inferior ST-segment elevation myocardial infarction remain unclear. Many studies have reported that patients with precordial ST-segment depression appear to have large infarctions. The objectives of this study was to evaluate the effect of precordial ST-segment depression in patients with early inferior ST-segment elevation myocardial infarction on the left ventricular systolic function and left ventricular regional wall abnormalities.

Methods: Fifty eight patients with first inferior ST-segments elevation myocardial infarction (37 male, 21 female), their ages ranged from 30-91year,mean age 60.59±11.21 who underwent thrombolysis in the Coronary Care Unit of Erbil Teaching Hospital for the period from August 2008 to August 2009 were included in this study. Two-dimensional echocardiography was performed in the first week of acute inferior myocardial infarction. Patients were classified according to the absence (group I,30 ,51.72%) or presence (group II ,28 , 48.28%) of precordial ST- segment depression .

Results: Group-II patients had a higher significant incidence of left ventricular systolic dysfunction (8,28.57%) than group I (2,6.67%),P=0.027 ,despite thrombolytic therapy (alteplase). Group-II patients had higher significant incidence of left ventricular regional wall abnormalities (12,42.9%) than group-I (3,10%), P 0.00 ,despite thrombolytic therapy (alteplase).

Conclusions: Early two-dimensional echocardiography is recommended for patients with inferior ST-segment elevation myocardial infarction associated with precordial ST-segment depression for the earliest detection of regional wall abnormalities and left ventricular systolic dysfunction.

Key words: Left ventricular systolic function .

INTRODUCTION:

Researchers have proposed that precordial ST segment depression is purely an electrocardiography (ECG) consequences of ST segment elevation in the inferior limb leads, without physiologic importance[1]. Shah et al first reported that precordial ST segment depression was a marker for increased risk in patients with an inferior myocardial infarction .since then, its pathogenesis and prognostic importance have been heavily debated[2]. Urgent two -dimensional echocardiography can play a crucial role in establishing the diagnosis of acute myocardial infarction[3]. Studies based on echocardiographic diagnosis of heart failure after acute myocardial infarction ,suggest a prevalence rate of 2–3% of the population aged 45 years and older.[4] Population-based studies suggest that the one-year mortality rate is of the order of 30–40%.[5] The EuroHeart Failure study found that 9% of patients in the UK died during an admission, while almost a third of survivors were re-admitted within 12 weeks of discharge[6]. Eric D et al found that patients with acute inferior myocardial infarction with reciprocal ST-segment

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frequently developed congestive heart failure and cardiogenic shock than those with little or no precordial ST segment depression [7]. No previous studies done to study the effect of reciprocal ST- segment depression in the early phase of ST segment elevation myocardial infarction (STEMI) on the left ventricular systolic function and left ventricular regional wall abnormalities as compared to those without reciprocal ST segment depression. The objectives of this study were to evaluate the effect of precordial ST-segment depression on left ventricular systolic function and left ventricular regional wall abnormalities in the first weak of inferior ST-segment elevation myocardial infarction.

PATIENTS AND METHODS:

We had studied 58 patients ,37 (53.79%) male and 21 (36.21%) female, their ages (30-91yr), mean age 60.59±11.21 who had been diagnosed to have first inferior STEMI for the period from October 2008 to October 2009 in the Coronary Care Unit of Erbil Teaching Hospital. The inclusion criteria was those patients who had been admitted within 6 hour of onset of symptoms with chest pain lasting >30minutes accompanied by ECG signs ≥ 0.1 mv ST segment elevation in at least two leads (II,III, or aVF) associated with typical rise of troponin [8].Precordial reciprocal ST-segment depression, defined as more than 1 mm,measured 80 ms after the J point in at least 2 of the leads V1-V4. Patients were classified according to the absence (group I) 30 patients (51.72%) or presence (group II) 28 patients (48.28%) of precordial ST-segment depression (Table-1). Patients who had left or right bundle branch block ,previous angina pectoris ,previous non STEMI, cardiogenic shock, severe persistent tachycardia , persistent serious arrhythmias, evidence of old infarction (significant Q waves in leads that had no ST segment elevation), ventricular paced rhythm, ventricular rhythm, ECG evidence intraventricular conduction defects were excluded from this study. The presence or absence of the following risk factors were recorded :history of hypertension, diabetes mellitus, smoking, alcohol, family history of ischemic heart disease. Body mass index had been taken for all of the patient which is equal to weight of the patient/meter square of the length of the patient, obesity defined as BMI≥30 [9]. Data on the hospital course were available for all patients. All patients received alteplase (tissue Plasminogen Activator) within 6 hours from the onset of symptoms of inferior STEMI, the dose given over 90 minutes bolus dose (15 mg) followed by 0.7 mg/kg body weight ,but not exceeding50 mg over 30 minutes and then 0.5 mg /kg body weight not exceeding 35 mg over 60 minutes[10]. Complete two-dimensional and Doppler echocardiography were performed within the first week of admission to the Coronary Care Unit in order to determine the left ventricular systolic function. All echocardiographic examinations were performed with an Philips Machine (Envisor USA),using a 2.5MHz trasducer. Left ventricular ejection fraction was determined from apical and four chamber view using the Simpson's biplane formula, left ventricular systolic dysfunction (LVSD) defined as left ventricular ejection fraction ≤50% [11]. Left ventricular segmental wall motion abnormalities was graded as follows: Normal at rest(1); hypokinetic-marked reduction in endocardial motion and systolic thickening (2), akinetic-virtual absence of inward motion and systolic thickening (3). and dyskinetic-paradoxical wall motion away from centre of the left ventricle in systole (4)[12]. All possible transthoracic echocardiographic views were obtained for each patients including parasternal long axis,parasternal short axis,apical four chamber,two chamber and apical long axis view to check for the presence of hypokinesia , akinesia and dyskinesia.

Statistical methods: Chi square test used for the differences of proportion between

the different groups and p value < 0.05 considered as significant, SPSS version 16.0 (statistical package for social sciences) computer system by assistant of expert statistics.

RESULTS:

The total study group consisted of 58 patients with first inferior STEMI, 37 male (63.79%), 21 female (36.2 %) their ages ranged from 30-91 year, the mean ages was 60.59 SD ± 11.21). The average age was nearly equal in group I & II, the proportion of men was higher in group I (21,70%) versus (16,57.1%) without statistical significant difference ,as shown in (Table1). There was no statistical significant difference in the incidence of obesity, hypertension, diabetes mellitus, current smoking, and family history of Disease between the two groups, (Table1). Group-II patients had a higher significant incidence Of LVSD (8,28.57%) than group I (2,6.67%), P=0.027 ,despite thrombolytic therapy. as shown in (able-2), (Figure-1). Group-II patients had higher significant incidence of left ventricular regional abnormalities (12,42.9%) than group-I (3,10%), P 0.00, despite thrombolytic therapy, as shown in (Table-2), (Figure-2). Despite thrombolytic therapy basal inferior lateral akinesia was observed in 7 patients (25%) in group II versus 1 patients (3.3%) in group I (P 0.02), while there was no statistical significant difference in the I ncidence of basal inferior wall hypokinesia , apical dyskinesia between group II and group I as shown in (Tabe3), (Figure2).

Table 1: Baseline characteristics of two patient groups

Risk factors	Total patients with inferior STEMI 58		
	Group-I* No 30(51.72%)	Group-II** No28(48.28%)	P value
Men	21 (70%)	16 (57.1)	0.31
Age (yr)	60±11.2	61±11.2	0.54
Obesity	17 (56.67%)	18 (64.29%)	0.6
Hypertension	10 (33.33%)	11 (39.29%)	0.64
Diabetes mellitus	5(16.67%)	5 (17.86%)	0.9
Current smoking	9 (30%)	7 (25%)	0.7
Family history	7 (23.33%)	8 (28.57%)	0.64

*Group-1=Inferior ST-segment elevation myocardial infarction with out reciprocal ST-segment depression

**Group-2=Inferior ST-segment elevation myocardial infarction with reciprocal ST-segment depression

Table 2: Comparison of left ventricular systolic function between group-I & group-II patients.

Total patients with inferior STEMI No=58 (32.95%)			
	Group-I No=30(51.72%)	**Group-II No=28(48.28%)**	**P value**
LVSD in patients with inferior STEMI 10 (17.24%)	**2 (6.67%)**	**8 (28.57%)**	**0.027***
LV regional WMA in patients with inferior STEMI 15(25.9%)	**3 (10%)**	**12(42.9%)**	**0.00***

LVSD= Left ventricular systolic dysfunction,LV=left ventricle,WMA=wall motion abnormalities * p value significant

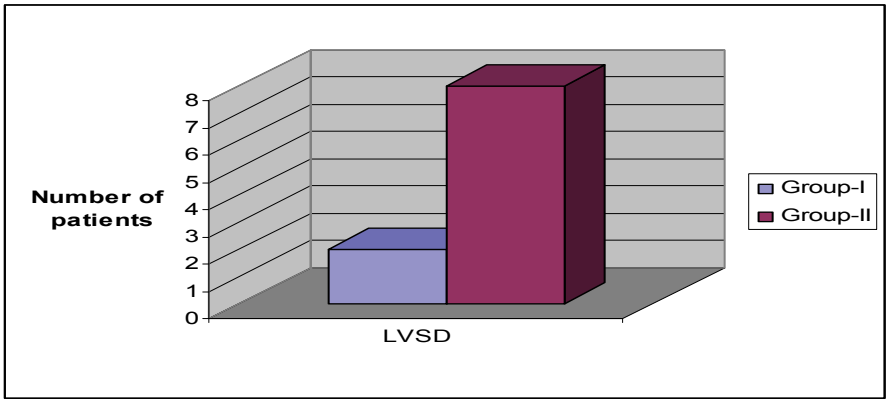

Figure 1: Comparison of the incidence of left ventricular systolic dysfunction(LVSD) between group I & II patients

Table 3: Comparison of grades of left ventricular regional wall abnormalities between group-I & II.

Left ventricular RWA	**Site of left ventricular RWA**	**Group – I 30 (51.71%)**		**Group-II 28 (48.28%)**		**P**
		No	**%**	**No**	**%**	
Hypokinesia	Basal inferior lateral	2	6.7	4	14.3	0.34
Dyskinesia	Apical	0	0	1	3.57	0.3
Akinesia	Basal inferior lateral	1	3.3	7	25	0.02*

RWA= Regional wall abnormalities, * = P value significant

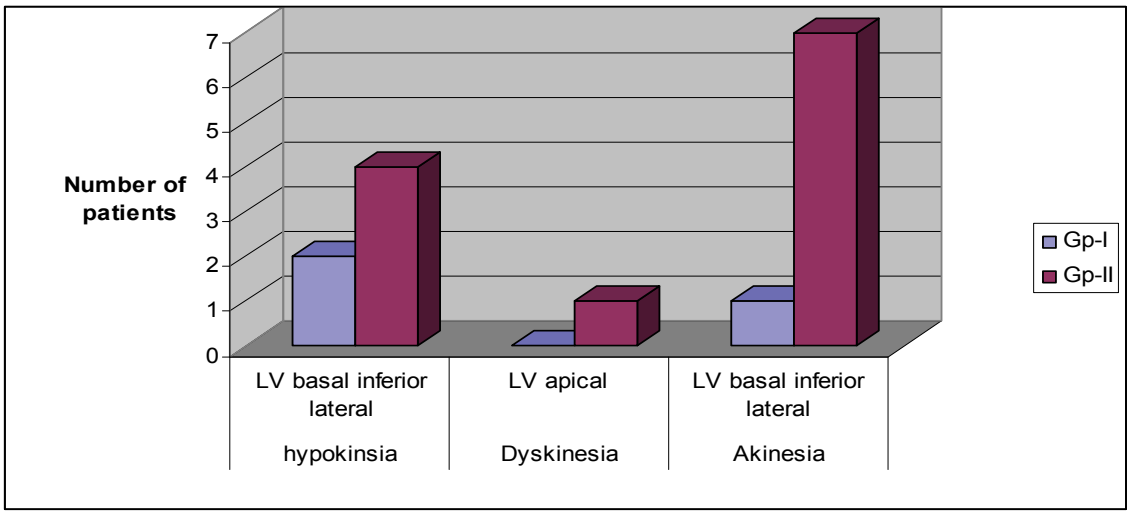

Figure 2: Comparison of left ventricular regional wall abnormalities between group-I & II patients

DISCUSSION:

Patients with inferior STEMI with precordial (reciprocal) ST-segment depression (group-II) had statistically significant incidence of LVSD 8 (28.57%) as compared with those without precordial (reciprocal) ST-segment depression (group -II) 2 (6.67%), P=0.027 as shown in (Table-2) & (Figure-1).Our results was similar to paterson et al study which found that left ventricular ejection fraction was significantly lower in patients who had ST segment depression in leads V1to V3 or widespread ST segment depression than in those who had no ST segment[7]. Some studies have proposed that precordial ST segment depression during an inferior infarction signifies anterior wall ischemia and thus is a marker for left anterior descending coronary artery or multivessel disease [13,14,15] . Tendera et al found that in patients with acute inferior myocardial infarction the presence and duration of ST-segment depression in leads v2 correlated with the presence of the left anterior descending coronary artery stenosis and depressed left ventricular ejection fraction [16.] We found a higher frequency rate of left ventricular regional wall abnormalities in patients with inferior STEMI who had reciprocal ST segment (group-II) on 12-lead ECG 12 patients (42.9%) as compared with those patients with inferior STEMI without reciprocal ST-segment depression (group-I) 3 patients (10%),p value 0.00 , as shown in (Table 2), Pierard et al found a higher statistical significant incidence of posterolateral wall akinesia in patient with acute inferior myocardial infarction with precordial reciprocal depression in the ECG versus those without reciprocal precordial ST depression.which is similar to our study[1]. In conclusion early two-dimensional echocardiography is recommended for patients with inferior ST-segment elevation myocardial infarction associated with precordial ST-segment depression for the earliest detection of regional wall abnormalities and left ventricular systolic dysfunction. In order to provide appropriate early therapeutic decision before more deterioration in the left ventricular systolic function and a more conservative approach for those patients with inferior STEMI without precordial ST- segment depression.

STUDY LIMITATIONS:

Our study had excluded those patients with severe persistent tachycardia, serious persistent arrhythmias because of difficulty

function in these situations.The results of this study should be confirmed in a larger number of unselected patients with inferior STEMI.

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REFERENCES:

1-Croft CH,Woodward, Nicod P,et al.clinical implications of anterior ST segment depression in patients with acute inferior myocardial infarction.AM J Cardiol 1982;50:428-336.

2-Shah PK, Pichler M,Berman DS,et al .Noninvasive identification of a high risk subset of patients with acute inferior myocardial infarction.Am J Cardiol 1980;46:915-21

3-Harvey Feigenbaum, William F,Armstrong, Thomas Ayan .Coronary Artery Disease. In Feigenbaums´s Echocardiography,Edited by Harvey Feigenbaum, William F,Armstrong, Thomas Ayan.6th edition.Lippincott Williams & Wilkins,A wolker kluner Company,2005,pp1 38 -469.

4-Davies MK, Hobbs FDR, Davis RC et al. Prevalence of left-ventricular systolic dysfunction and heart failure in the Echocardiographic Heart of England Screening study: a population based study. Lancet 2001;358: 439-44.

5-Cowie MR, Wood DA, Coats AJ et al. Survival of patients with a new diagnosis of heart failure: a population based study. Heart 2000;83:505-10.

6-Cleland JG,Swedberg K,Folath F, The Study Group on Diagnosis of the Working Group on Heart Failure of the European Society of cardiology. The EuroHeart Failure survey programme , a survey on the quality of care among patients with heart failure in Europe. Part 1: patient characteristics and diagnosis.Eur Heart J 2003;24:442-63

7-Peterson ED,Hathaway WR,Zabel M,Pieper KS,Grancer CB,Wagner GS,Bates ER,Silmons ML,Califf RM,Prognostic significance of precordial ST Deptression during inferior myocardial infarction in the thrombolytic era:results in 16521 patients.JACC,Vol.28,No2 August 1996:305-12.

8-Elliot M.Antman,Eugen Braunwald, ST-elevation myocardial infarction: pathology, pathophysiology, and clinical features, In Braunwald s Heart Disease,a Textbook of Cardiovascular Medicine,Edited by: Douglas P.Zipes, Peter libby, Robert O.Bonow,Eugene Braunwald.7th Edition. Elsevier Sauders Company,2005,pp1141-1165.

Davidson's Principles and Practice of Medicine. Edited by Bloomfield P,Bradbury A,Grubb N.20th Edition,London, Churchill livingstone, 2006,pp111-112.

10-Jeffrey L.Anderson, Fibrinolytic therapy of ST elevation myocardial infarction, In Cecil Text Book of Medicine, Edited by Lee Goldman, Dennis Ausiello,23rd edition. Saunders Elsevier, 2007,PP 508.

11-Ramdas G,Pai and Pravin M.Shah, Assessment of left ventricular function . in Imaging in Cardiovascular Disease, Edited by Gerald M. pohost,Robert A.O,Daniel S, Berman,Pravin m,Lippincott Williams & Wilkins.2000,pp23-41.

12-Schiller N,Shah PM,Crawford M. Recommendation for quantitation of the left ventricle by two-dimensional echocardiography.J Am Soc Echocardiography 1989;2:358-68.

13-Salcedo JR, Baird MG, Chambers RJ, Beanlands DS. Significance of reciprocal S-T segment depression in anterior precordial leads in acute inferior myocardial infarction: concomitant left anterior descending coronary artery disease? Am J Cardiol 1981;48:1003–8

14-Haraphongse M, Jugdutt BI, Rossall RE. Significance of precordial ST segment depression in acute transmural inferior infarction: coronary angiographic findings. Cathet Cardiovasc Diagn 1983;9:143–51

15-Roubin GS, Shen WF, Nicholson M, Dunn RF, Kelly DT, Harris PJ. Anterolateral ST segment depression in acute inferior myocardial infarction: angiographic and clinical implications. Am Heart J 1984;107:1177–82.

16-Tendera M, Campbell B. Significance of early and late anterior precordial ST-segment depression in inferior myocardial infarction. Am J Cardiol 1984;54:994–6.

17-Pierard LA,Sprynger M,Gilis F,Carlier J.significance of precordial ST segment depression in inferior acute inferior myocardial infarction as determined by