Evaluation of Multi Vessel Disease and its Impact on Reperfusion Success in Patients Undergoing Primary Percutaneous Coronary Intervention for Acute Myocardial Infarction

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ABSTRACT

Objective: To investigate the frequency multi vessel disease and its impact on reperfusion success in patients undergoing primary percutaneous coronary intervention for acute myocardial infarction.

Study Design: Cross sectional study

Place and Duration of Study: This study was conducted at the Chaudhary Pervaiz Ellahi Institute of cardiology, Multan from June 2021 to May 2022.

Materials and Methods: Visually estimated stenosis of more than or equal to 50% for left main stem and more than or equal to 70% stenosis for epicardial branches of other major arteries was considered as significant atherosclerosis. Rentrop classification was used for analysis of presence of collateral artery to infarct artery. Extent of coronary vessel involvement and reperfusion success was main outcomes variables of study. SPSS version 23 was used for data analysis. P value ≤ 0.05 was considered significant statistically.

Results: Three hundred patients with mean age 54.45 ± 10.47 and majority of male 171 (57%) patients were included in this study. Baseline characteristics of single, double and triple vessel were compared. ST segment resolution was achieved in >70% in 51.9% of triple vessel diseased patients after PCI that is small proportion as compared to double vessel 56% and single vessel 67.7%. Difference was statistically significant (p=0.012).

Conclusion: Reperfusion success and ST resolution is directly associated with extent of coronary artery disease. Success rate of PCI is higher in single and double vessel diseased patients and low in triple vessel diseased.

Key Words: Primary percutaneous intervention, Reperfusion success, ST Resolution, Acute myocardial Infarction.

INTRODUCTION

In cases of acute myocardial infarction primary percutaneous coronary intervention (PCI) provides more patent infarct related artery with very low incident of re-infarction, mortality and stroke as compare to cases of fibrinolysis alone[1]. But after successful PCI and restoration of antegrade blood flow a large number of AMI patients' remains on great risk of mortality and complications[2].

Identification of such type of patients before discharge from hospital become more easy with use of demogra-

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phic characteristics, bedside observations and other clinical findings which may include invasive and noninvasive modalities[3].

Percutaneous Coronary Intervention (PCI) is catheter based non-surgical procedure consist of angioplasty with stent[4]. This procedure used to place a small stent in sclerosis artery narrowed by plaque buildup to open blood flow. Usually concomitant atherosclerosis was observed in almost all coronary vessels other than infarct related artery during PCI[5]. In 50% of cases triple vessel disease was reported after acute myocardial infarction (AMI) in multicenter as well as institutional based studies[6].

Pharmacological reperfusion was considered only in few studies as prognostic impact of multivessel coronary artery disease[7]. Possible benefit of primary PCI when used as reperfusion procedure is instant recognition of level of coronary artery disease which is an essential marker in risk recognition[8]. Level of CAD when considered as marker of plaque burden and diffuse atherosclerosis put direct or inverse impact on prognosis of disease after AMI[9].

Coeval reperfusion procedures are glycoprotein inhibitors (IIb/IIIa) and stents have ability to extenuate

the complications that are reducing the implications of prognosis in multivessel disease[10]. No previous study was conducted in our region on this topic before; our study will help to evaluate local reference gap and early decision about treatment of diseased vessels according their severity.

MATERIALS AND METHODS

Study was conducted at Chaudhary Pervaiz Ellahi Institute of Cardiology Multan from June 2021 to May 2022 in one year duration. Written informed consent was taken from patients after complete information and purpose of study. Patients were assured about their confidentiality. Ethical approval was obtained from hospital ethical and review board. Non probability consecutive sampling technique was used.

A total of 300 non shock patients with symptoms of acute myocardial infarction from last 12 hours were enrolled in study. Patients of triple vessel disease requiring angioplasty of 2 or 3 major coronary arteries and who were planned for bypass surgery within 30 days were excluded from study. Follow up was planned at 1, 6 and 12 month duration after procedure. Rentrop classification was used for analysis of presence of collateral artery to infarct artery (Grade-0 means no collateral filling, Grade-2 means collateral filling but epicardial coronary not filling, Grade-3 means collateral filling with incomplete epicardial coronary filling and Grade-4 means collateral filling plus complete epicardial coronary filling. Visually estimated stenosis of more than or equal to 50% for left main stem and more than or equal to 70% stenosis for epicardial branches of other major arteries was considered as significant atherosclerosis. Counting of diseased vessels was determined by viewing three main arteries (left anterior descending artery, left circumflex artery and right coronary artery). Atherosclerosis in left main stem with right dominance was labeled as double vessel disease and left dominance considered as triple vessel disease. Main outcomes of study were frequency of diseased vessel and reperfusion success. Reperfusion success was measured in terms of TIMI flow (baseline and final) and achievement of myocardial blush.

SPSS version 23 was used for data analysis. Numerical variables were assessed for mean and standard deviation like age and BMI. Categorical data like frequency of diseased vessel and reperfusion success was analyzed for frequency and percentages. Test of significance were applied to see association among variables. P value less than or equal to 0.05 was considered as significant.

RESULTS

Three hundred patients were included in this study. Baseline characteristics of single, double and triple vessel were compared in table. I. Higher frequency found in double and triple vessel as compared to single vessel patients in anterior myocardial infarction, killip (classification) class <1, diabetes mellitus, insulin-requiring, current smoker, hyperlipidemia, hypertension, history of myocardial infarction, renal insufficiency, peripheral vascular disease, prior by-pass graft surgery, beta-blockers, statins, calcium blockers, ace inhibitors/ARBs and thienopyridines. The differences were statistically significant, ($p<0.05$). (Table. I).

Comparison of angiographic and procedural characteristics of single, double and triple vessel disease patients presented in table-II. No difference was statistically significant. (Table. II).The distribution of ST-segment resolution and extent of coronary artery was shown in table. III. The difference was statistically significant, ($p=0.012$).

Table No.I: Baseline characteristics of the patients

Variable	Single vessel n=100 (33.3%)	Double vessel n=100 (33.3%)	Triple vessel n=100 (33.3%)	P-value
Age (years)	55.92±9.91	53.26±10.35	54.19±11.16	0.193
Gender				
Male	n=66 (66%)	n=45 (45%)	n=60 (60%)	0.008
Female	n=34 (34%)	n=55 (55%)	n=40 (40%)	
Anterior myocardial infarction	n=41 (41%)	n=45 (45%)	n=63 (63%)	0.004
Symptom onset to reperfusion	4.11±1.99	4.44±2.11	4.39±1.95	0.428
Killip class <1	n=12 (12%)	n=10 (10%)	n=30 (30%)	0.000
Left anterior descending infarct vessel	n=39 (39%)	n=42 (42%)	n=42 (42%)	0.883
Left ventricular ejection fraction	56.06±14.34	65.89±14.45	54.27±13.76	0.664
Diabetes mellitus	n=23 (23%)	n=24 (24%)	n=51 (51%)	0.000
Insulin-requiring	n=6 (6%)	n=6 (6%)	n=41 (41%)	0.000
Current smoker	n=3 (3%)	n=7 (7%)	n=47 (47%)	0.000
Hyperlipidaemia	n=31 (31%)	n=43 (43%)	n=56 (56%)	0.002
Hypertension	n=42 (42%)	n=49 (49%)	n=67 (67%)	0.001
History of myocardial infarction	n=15 (15%)	n=14 (14%)	n=32 (32%)	0.002
Renal insufficiency	n=11 (11%)	n=19 (19%)	n=36 (36%)	0.000

Peripheral vascular disease	n=6 (6%)	n=11 (11%)	n=36 (36%)	0.000
Prior by-pass graft surgery	n=2 (2%)	n=8 (8%)	n=31 (31%)	0.000
Aspirin	n=27 (27%)	n=22 (22%)	n=33 (33%)	0.217
Beta-blockers	n=21 (21%)	n=12 (12%)	n=34 (34%)	0.001
Statins	n=9 (9%)	n=10 (10%)	n=20 (20%)	0.038
Calcium blockers	n=15 (15%)	n=12 (12%)	n=33 (33%)	0.000
Acne inhibitors/ARBs	n=10 (10%)	n=4 (4%)	n=29 (29%)	0.000
Thienopyridines	n=7 (7%)	n=6 (6%)	n=20 (20%)	0.002

Table No.2: Angiographic and procedural characteristics of the patients

Variable	Single vessel n=100 (33.3%)	Double vessel n=100 (33.3%)	Triple vessel n=100 (33.3%)	P-value
Reference vessel diameter (mm)	2.91±1.02	2.78±1.18	2.77±1.09	0.622
MLD (mm)	0.0076±0.027	0.0076±0.03	0.0125±0.028	0.386
Collateral score(Rentrop)				
Grade 0	n=62 (62%)	n=26 (26%)	n=65 (65%)	0.094
Grade 1	n=5 (5%)	n=20 (20%)	n=10 (10%)	
Grade 2	n=13 (13%)	n=50 (50%)	n=8 (8%)	
Grade 3	n=20 (20%)	n=4 (4%)	n=17 (17%)	
Baseline TIMI flow (%)				
0/1	n=71 (71%)	n=85 (85%)	n=70 (70%)	0.085
2	n=12 (12%)	n=9 (9%)	n=25 (25%)	
3	n=17 (17%)	n=6 (6%)	n=5 (5%)	
Maximum device diameter (mm)	4.03±2.61	4.43±2.33	4.13±2.72	0.519
Maximum balloon/artery ratio	1.43±1.08	1.44±1.56	1.25±1.37	0.532
Maximum pressure (atm)	11.92±3.69	12.27±3.66	12.02±3.53	0.776
Stent implanted	n=59 (59%)	n=71 (71%)	n=63 (63%)	0.197
2>stents implanted	n=13 (13%)	n=17 (17%)	n=16 (16%)	0.716
Abciximab used	n=52 (52%)	n=56 (56%)	n=62 (62%)	0.356
Final MLD(mm)	2.60±1.56	2.51±1.49	2.34±1.56	0.474
Final TIMI flow				
0/1	n=9 (9%)	n=10 (10%)	n=13 (13%)	0.158
2	n=17 (17%)	n=20 (20%)	n=27 (27%)	
3	n=74 (74%)	n=70 (70%)	n=60 (60%)	
Final myocardial blush				
0/1	n=74 (74%)	n=23 (23%)	n=41 (41%)	0.084
2	n=25 (25%)	n=33 (33%)	n=27 (27%)	
3	n=1 (1%)	n=44 (44%)	n=32 (32%)	
Procedural success	0.91±0.28	0.88±0.32	0.85±0.35	0.429

Table No.3: Comparison of extent of coronary artery disease and ST-segment resolution

ST-segment resolution	Single vessel	Double vessel	Triple vessel	P-value
<30%	12.2	13.4	22.5	0.012
30-70%	20.1	30.6	25.6	
>70%	67.7	56.0	51.9	

DISCUSSION

Primary outcome of this was Investigate the incidence of diseased vessel and reperfusion success after primary percutaneous intervention that can be measured by ST resolution. Severity of atherosclerosis affects reperfusion success rate directly[11,12].

Multi vessel disease associated with poor reperfusion success and ST resolution is also difficult. In our study we enrolled equal number of patients in all kind of vessels group single, double and triple (100 patients in each group).

A study by Sorajja et al[13] in 2007 included 7.4% patients with single vessel disease, 11.1% double vessel disease and 18.4% with triple vessel disease. Among these patients after PCI 53.1% patients achieved >70% reperfusion in triple vessel disease that is small

proportion as compared to double vessel 60.6% and single vessel 65.7%.

After PCI very low rate of ST resolution was observed in triple vessel group that indicate poor reperfusion success of these patients. Costantini et al[14] conducted a study in 2004 and concluded that restoration of tissue level flow is a powerful predictor of survival after PCI in acute myocardial infarction patients but unfortunately it was achieved in minority of patients specifically in triple vessel diseased. Normal perfusion was achieved in 17.4% of patients only.

McLaughlin et al[15] also reported similar findings that a ST resolution or reperfusion success is main predictor of survival from 30 days mortality but associated with targeted vessel patency. Number of vessel directly involves in success rate of procedure and achievement of tissue level perfusion. Triple vessel disease always considered as high risk catheterization. In a study Antman et al[16] observed that reperfusion achievement is the main predictor of survival that can be achieved successfully with PCI. Among number of reperfusion strategies primary PCI is the procedure of choice.

McCartney et al[17] conducted a study on reperfusion after PCI and reported concluded that restoration of coronary blood flow with PCI is the treatment of choice for ST elevation myocardial infarction patients. In this study 50% of cases achieved normal coronary blood flow which is a high proportion of as compared any other reperfusion strategy. Huynh et al[18] conducted a comparative study between PCI and fibrinolytic therapy and concluded that PCI is better choice as compared to fibrinolytic therapy to achieve coronary blood flow and and to reduce mortality.

Montalescot et al[19] conducted a study on achievement of reperfusion with primary PCI and reported PCI as most urgent procedure for achievement of reperfusion after AMI. American heart association recommended PCI as gold standard method for normal coronary blood flow in AMI patients. Recently PCI defined as invasive procedure to enhance blood flow in coronary arteries after acute myocardial infarction.

CONCLUSION

Reperfusion success and ST resolution is directly associated with extent of coronary artery disease. Success rate of PCI is higher in single and double vessel diseased patients and low in triple vessel diseased.

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Concept & Design of Study: Muhammad Ramzan
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Conflict of Interest: The study has no conflict of interest to declare by any author.

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