Original Article

Effects of Primary PCI on Acute Inferior ST-Elevation MI With Complete Heart Block

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ABSTRACT

***Background*:** Complete heart block is a common complication among patients with acute inferior myocardial infarction (MI) and leads to increased mortality. The aim of this study was to evaluate complete atrioventricular block after mechanical revascularization (primary percutaneous coronary intervention [PCI]) in acute inferior MI.

Methods: This retrospective study enrolled 418 patients with acute inferior MI, who underwent primary PCI in Rajaie Cardiovascular, Medical, and Research Center between 2011 and 2014. Thirty-eight (9%) patients had complete heart block. Three patients expired < 14 days after PCI and were excluded from the study due to lack of follow-up. The restoration of the sinus rhythm, need for permanent pacemaker (PPM) implantation, and heart-block recovery time were compared between the other 35 patients.

***Results*:** Among the 35 patients, the sinus rhythm was restored in 34 cases after a mean time of 50 hours. In 1 case, 14 days after primary PCI, PPM implantation was done due to the persistence of the heart block. Neither the restoration of the sinus rhythm and nor PPM implantation had a statistically significant correlation with primary PCI. Among the 34 patients, the heart-block recovery time was significantly longer ($P < 0.05$) in the diabetics and in those with QRS > 120 ms in the initial ECG. This time was significantly shorter in the patients undergoing successful stenting and the patients undergoing balloon angioplasty and was very significantly shorter in the patients with a TIMI flow of 3 after revascularization. In this study, the block recovery time was not correlated with the location of the lesions in the coronary arteries, with thrombosuction, and with IIb/IIIa inhibitor infusion. Age; gender; history of hypertension, dyslipidemia, and smoking; and very severe left ventricular dysfunction did not have any effect on this time.

***Conclusions*:** In light of the results of the current study, it can be concluded that mechanical revascularization in patients with acute inferior MI complicated with complete heart block is not effective on the restoration of the sinus rhythm and need for PPM implantation. Nonetheless, the heart-block recovery time is significantly decreased and correlated with successful stenting and balloon angioplasty. *(Iranian Heart Journal 2017; 17(4): 21-25)*

Keywords: Mechanical revascularization● Inferior MI● Complete heart block

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Pathophysiological and clinical studies have recently shown that acute myocardial infarction (MI) is one of the major causes of atrioventricular (AV) conduction blocks. Conductive defects are relatively common after acute MI and play a role in survival. Major conductive defects after MI include 1st-, 2nd- and 3rd-degree AV blocks and left and right bundle branch blocks. Inferior wall MI often results in heart block due to perfusion defects in the supra-nodal or intra-nodal parts and so presents mostly with 1st- and 2nd-degree AV blocks, which are usually transient and return to the normal sinus rhythm spontaneously or pharmacologically with the use of adenosine antagonists such as methylxanthine in most patients. Nevertheless, they sometimes progresses to complete heart block due to the hypoperfusion of the nodal artery and AV nodal ischemia. [7] The incidence of complete heart block, in turn, increases the mortality rate and if not restored to the sinus rhythm in the coming days, it requires permanent pacemaker (PPM) implantation. This issue increases the hospitalization course and costs as well as complications following prolonged hospitalization. The effects of coronary revascularization on conduction blocks and block durations after revascularization have yet to be fully elucidated.

Therefore, in the present study, we surveyed the effects of mechanical revascularization on the resolution of heart blocks as well as the block recovery time and need for PPM implantation in patients with inferior MI. If successful reperfusion has a significant impact on heart block, we can choose the most appropriate method for reperfusion and reduce the need for PPM implantation, hospitalization course, and complications after PPM implantation.

METHODS

This cross-sectional study was performed in Rajaie Cardiovascular, Medical, and Research Center, Tehran, Iran. All patients with acute inferior MI that underwent emergent angiography and primary PCI between 2011 and 2014 were enrolled in the study. Patients with inferior MI complicated with complete heart block were selected for evaluation, and their medical records were studied.

Patients with anterior or anterolateral acute MI, positive history of previous AV blocks, or PPM implantation as well as those who were impossible to follow up were excluded.

A P value < 0.05 was considered the level of significance in the statistical analyses. Demographic data were obtained by reviewing the hospital charts of the patients. Acute inferior MI was diagnosed according to the standard definition of inferior MI in the inferior leads (II, III, and AVF) in the standard 12-lead ECG. Angiographic findings were collected. The presence of heart block was determined according to ECG, and then the effects of successful or unsuccessful revascularization on heart block, block recovery time, and final ECG were investigated. SPSS, version 13, was used for data analysis. The t-test and the χ^2 test were applied for the analyses.

RESULTS

Totally, 418 patients with acute inferior MI were enrolled. Among them, 38 (9%) patients had AV blocks. Three patients expired < 14 days after MI and were excluded owing to lack of follow-up. Only 35 patients were studied. The mean age of the patients was 60 years old. Also as regards age, 71.4% (n = 25) of the patients were younger than 65 years old and 28.6% (n = 10) were older than 65. In terms of gender, 51.4% (n = 18) of the patients were male and 48.6% (n = 17) were female. In addition, 65.7% of the patients were diabetic, 60% had hypertension, 45.7% had dyslipidemia, and 34.3% were smokers (Table 1).

Of the 35 patients, in 34 cases after a mean time of 50 hours, the sinus rhythm was

restored. The minimum block recovery time was about 20 minutes, and the maximum time was 216 hours. In 1 case, 14 days after primary PCI, PPM implantation was done due to the persistence of the heart block. In the 34 patients, the block recovery time was not correlated with gender and age. In the diabetic patients and in those with QRS > 120 ms in the initial ECG, the block recovery time was significantly longer ($P < 0.05$). Nonetheless, a positive history of hypertension, dyslipidemia, and smoking had no effect on this time. With severe left ventricular dysfunction, this time was slightly longer; the difference, however, failed to constitute statistical significance.

Of the 35 patients, 30 (85.7%) cases successfully underwent stent placement (successful primary PCI); in all these cases—after a mean time of 34 hours—the sinus rhythm was restored. In the other 5 (14.3%) cases, due to lack of coronary blood flow with a thrombolysis in myocardial infarction (TIMI) flow of 3 after primary PCI (failed PCI), stenting was not done. In these 5 patients, the block was resolved in 4 (80%) cases after a mean time of 180 hours and 1 (20%) case was subjected to PPM

implantation due to the persistence of the block after 14 days. The restoration of the sinus rhythm and need for PPM implantation were not correlated with successful primary PCI ($P = 0.143$), whereas the mean block recovery time had a significant correlation with successful primary PCI ($P = 0.01$). Additionally, 65% of the patients underwent balloon angioplasty during revascularization, so the block recovery time was significantly shorter in them ($P = 0.027$). Thrombosuction and IIb/IIIa inhibitor infusion had no significant effect on the block recovery time.

The location of the lesion was in the distal portion of the right coronary artery in 48.5% of the patients, in the proximal portion of the right coronary artery in 40%, and in the left circumflex artery in 11.1%. There was no significant correlation between the different locations of the lesions and the block recovery time.

Finally, after primary PCI, about 80% of the patients had a TIMI flow of 3. The mean time to the restoration of the sinus rhythm in these patients was 24 hours, and the remaining 20% of the patients had a TIMI flow < 3 with a block recovery time of about 168 hours ($P = 0.001$).

Table 1. Heart-block recovery time based on the patients' demographic data

Patients		Number	Percentage	Block Recovery Time (h)	P
Age	>65 y	10	28.6	56	0.16
	<65 y	25	71.4	47	
Gender	male	18	51.4	58	0.70
	female	17	48.6	41	
DM	diabetic	23	65.7	67	0.049
	nondiabetic	12	34.3	17	
HTN	hypertensive	21	60	67	0.22
	normotensive	14	40	24	
DLP	positive	16	45.7	45	0.20
	negative	19	54.3	54	
Smoking	smoker	12	34.3	39	0.08
	nonsmoker	23	65.7	57	
LV dysfunction	LVEF ≤35%	11	31.4	60	0.09
	LVEF >35%	24	68.6	47	
First QRS	QRS >120	11	31.4	107	0.003
	QRS <120	24	68.6	26	

DM, Diabetes mellitus; HTN, Hypertension; DLP, Dyslipidemia; LV, Left ventricle; EF, Ejection fraction

Table 2. Heart-block recovery time based on the treatment groups

		Number	Percent age	Block Recovery Time (h)	P
Thrombosuction	yes	21	60	66	0.39
	no	14	40	26	
Balloon angioplasty	yes	23	65	24	0.027
	no	12	35	63	
Stenting	yes	30	85.7	34	0.01
	no	5	14.3	180	
IIb/IIIa I	yes	19	54	44	0.67
	no	16	45	56	

Table 3. Heart-block recovery time based on the location of the lesions and the TIMI flow

		Number	Percentage	Block Recovery Time (h)	P
Primary PCI	With stenting	30	85.7	34	0.01
	w/o stenting	5	14.3	180	
Location of lesion	RCA distal	17	48.5	72	0.62
	RCA proximal	14	40	33	
	LC$_X$	4	11.5	16.5	
TIMI flow	=3	28	80	24	0.001
	<3	7	20	168	

TIMI, Thrombolysis in myocardial infarction; PCI, Percutaneous coronary intervention; RCA, Right coronary artery; LC$_x$, Left circumflex artery

DISCUSSION

We showed that the incidence of complete heart block in patients with acute inferior MI in our center was less than that reported in previous studies (9% vs 25%). [1,4]

There was no correlation between successful reperfusion and heart-block recovery. Even in the absence of successful reperfusion, in 80% of the cases, the block resolved itself with the passage of a longer time, and revascularization did not reduce the rate of PPM implantation in the patients.

There was a significant correlation between successful reperfusion and the block recovery time. The patients who had successful PCI entirely returned to the sinus rhythm within 34 hours after PCI, while in the patients with failed PCI, this time was 180 hours. Our results also demonstrated that in the patients with diabetes and in those with wide complexes of QRS in the initial ECG, the block recovery time was longer and statistically significant. In our patients with diabetes, this finding may have been due to microvascular disease and in our patients with wide QRS, due to the severity and extent of infarction. This time was longer in the patients with severe left ventricular dysfunction and hypertension; the difference, however, did not constitute statistical significance. The block recovery time did not show any difference between the male and female patients, between the patients aged > 65 years and those aged < 65 years, and between the smokers and the patients with dyslipidemia and those without these risk factors.

Considering the considerable impact of heart block (especially high-grade AV block) on the prognosis of acute inferior MI, any help to improve this complication might mean a great deal for the outcome. The restoration of the sinus rhythm in our study tallied with that in a study by Lee et al, [3] who reported that all their patients had experienced the return of the sinus rhythm after successful PCI. Our results are similar to those reported by Sadr-Ameli et al [7] in that both studies showed that after successful PCI, the block recovery time will be much shorter.

CONCLUSIONS

According to the results of our study and considering the results of the previous observations, it can be concluded that mechanical revascularization with successful stent placement for patients suffering from inferior MI with complete AV block significantly reduces the block recovery time. However, compared with no stenting, in terms of the restoration of the sinus rhythm and the reduction in the need for PPM implantation, it was not effective.

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