

Short Term Hospital Outcome of Atrioventricular (AV) Block in the Setting of Acute Inferior Wall Myocardial Infarction (M.I) Treated by Primary Percutaneous Coronary Intervention (PPCI)

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ABSTRACT

Objective: To assess impact of the Primary Percutaneous Coronary Intervention (PPCI) on the early resolution of AV block in patients presenting with acute inferior STEMI.

Study Design: Analytic study

Place and Duration of Study: This study was conducted at the National Institute of Cardiovascular Diseases (NICVD), Karachi from November 2020 to April 2021.

Materials and Methods: We enrolled 165 patients with acute inferior STEMI who presented with any degree of AV block. All patients received PPCI as an initial therapeutic strategy. Pre-and post-procedure clinical parameters were recorded for 5 days after invasive therapy.

Results: Out of 165 enrolled patients, AV block was more common in the older patients (mean age 60.08 ± 10.09 years), in males 118 (71.5%), and in 86 (52.1%) patients with multi vessel coronary artery disease. The predominant culprit artery was the right coronary artery in 152 (92.1%) patients. 139 (84.2%) patients had restoration of normal AV conduction at end of 5 days of hospitalization. The average time for reversal of AV block was 51.3 ± 30.2 hours. 23 (14%) patients had persistent AV block and underwent permanent pacemaker implantation. 3 (1.8%) patients had in-hospital mortality.

Conclusion: PPCI for acute inferior wall STEMI significantly enhances early resolution of AV block. Our study highlights that a significant number of patients had restoration of AV conduction at end of five days following PPCI. We suggest delaying waiting time to at least five days after PPCI, before final consideration of implanting permanent pacemaker in this patient group.

Key Words: A V block, Inferior wall, Infarction, coronary intervention

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INTRODUCTION

AV block (Atrioventricular block) is the commonest arrhythmic complications in the situation of acute ST-elevation myocardial infarction (STEMI).⁽¹⁾

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The incidence of high-grade atrioventricular block was reported to be 3-4% in the thrombolytic period, and was associated with increased in-hospital mortality.⁽²⁻⁴⁾

With advancements in mechanical reperfusion strategies and improved anti-thrombotic therapy, the incidence of high grade AV block has reduced remarkably over the last few decades and was reported to be 3.2% according to the results of one study.^(2,5) Acute myocardial infarction Patients (inferior wall) are considerably more vulnerable to developing AV block and have 2-4 fold increased risk of development of high grade atrioventricular block compared with those having anterior wall myocardial infarction (MI).⁽³⁾

Factors linked with the development of AV block in the setting of STEMI include: hypertension, diabetes mellitus, smoking, older age, female gender, prior myocardial infarction and presence of multi vessel coronary artery disease.⁽⁶⁾ Several mechanisms have been proposed for the development of AV block in acute coronary syndrome; parasympathetic system

activation in inferior wall MI may result in bradycardia and AV block, compromised blood supply may lead to ischemia of the AV node.⁽⁷⁻⁹⁾

AV block in the situation of acute inferior infarction has propensity for reversibility after revascularization and it seems reasonable to allow waiting time to affect this improvement in AV conduction.⁽¹⁰⁾ This, however, would translate into an extended monitoring period and lengthening of hospital stay. At present, for these patients there is no clear consensus on the ideal waiting time. With this background, we aimed to assess the impact of PPCI on early resolution of atrioventricular block in the setting of acute inferior STEMI and clarify the waiting timeline for implantation of permanent pacemaker in this patient group.

MATERIALS AND METHODS

A study was conducted at the National institute of cardiovascular diseases (NICVD), Karachi during time interval between November 2020 to April 2021.

Data was analyzed by using SPSS software through non-probability, consecutive sampling technique; the sample size was calculated to be 165.

Data Collection: Approval from ethical review committee of the institute was taken and verbal informed consent for enrolment in the study and for performance of PPCI procedure was sought from patients. Clinical parameters of patients who fulfilled the selection criteria were documented in data collection questionnaire form. Patients who presented with symptoms consistent with acute inferior STEMI and met electrocardiographic criteria i.e., ST-elevation of 1 mm or more in two or more contiguous ECG limb leads (leads II, III and VF) and with any degree of atrioventricular block at presentation were included. Patients who did not consent to undergo PPCI were excluded. Temporary trans-venous pacemaker was placed in patients who were hemodynamically unstable or had symptomatic bradycardia (heart rate less than 40 bpm). After interventional treatment, patients were monitored for 05 days at coronary care unit, Patients' who had restoration of AV conduction within 5 days after STEMI

were discharged home on medical treatment, while patients who had persistent complete heart block after 5 days post-STEMI were implanted a permanent pacemaker.

The acquired data was analyzed using SPSS version 20. For quantitative data, mean and standard deviation were determined, while frequency and percentage were computed for qualitative variables.

RESULTS

The study population comprised 165 patients presenting with acute inferior wall STEMI and any degree of atrioventricular block. Baseline characteristics, clinical

presentation, extent of coronary artery disease and PPCI procedural characteristics are shown in Table 1.

Atrioventricular block was seemed more frequent in the older population (mean age: 60.08 ± 10.09 years), predominantly in males 115 (69.7%), in those who had prior history of diabetes mellitus 78 (47.2%), hypertension 98 (59.4%) and tobacco use 72 (43.6%) patients. 18 (10.9%) patients presented in Killip class III or IV. Predominant culprit artery was right coronary artery in 152 (92.1%) subjects. Right ventricular infarction was present in 32 (19.4%). Patients with multi vessel coronary artery disease were observed high atrioventricular block as compared to those with single-vessel coronary artery disease (52.1% vs 47.9%). On angiography right artery dominance were seen in majority of patients 143 (86.6%). TIMI III flow was achieved in 150 (90.9%) of patients after revascularization. There was requirement for temporary trans-venous pace maker in 108 (65.4%) patients.

Degree of AV block at clinical presentation, restoration of AV conduction and in hospital mortality is shown in Table 2. Third degree AV block and first-degree AV block were seen in majority of patients at presentation (72.1% and 14.5% respectively). Restoration of normal AV nodal conduction was seen in 139 (84.2%) patients within 5 days. The average time for reversal of AV block was 51.3 ± 30.2 hours. Third degree AV block was the predominant bradyarrhythmia among patients who had persisted atrioventricular block beyond 5 days post- STEMI and majority (95.3%) of them had multi-vessel disease. In-hospital mortality was in 3 (1.8%) patients.

Table No.1: Baseline characteristics, clinical presentation, extent of coronary artery disease and PPCI procedural characteristics.

Age	60.08 ± 10.09
Gender:	
Male (%)	115 (69.7)
Female (%)	50 (30.3)
Risk Factors:	
Diabetes mellitus (%)	78 (47.2)
Hypertension (%)	98 (59.4)
Tobacco use (%)	72 (43.6)
Right ventricular involvement (%)	32 (19.4)
Killip class III or IV (%)	18 (10.9)
Culprit coronary artery:	
Left main coronary artery (%)	0 (0)
Left anterior descending coronary artery (%)	1 (0.6)
Right coronary artery (%)	152 (92.1)

Left circumflex coronary artery (%)	14 (8.5)
Coronary artery dominance:	
Right (%)	143 (86.6)
Left (%)	22 (13.4)
TIMI flow III achieved (%)	150 (90.9)
Number of diseased vessels:	
Single vessel disease (%)	79 (47.9)
Multi-vessel disease (%)	86 (52.1)

Table No.2: Degree of AV block at clinical presentation, restoration of AV conduction and in hospital mortality

Need for temporary pacemaker insertion (%)	108 (65.4)
Type of AV block at presentation:	
1 st degree block (%)	24 (14.5)
Mobitz type I, 2 nd degree AV block (%)	08 (4.8)
Mobitz type II, 2 nd degree AV block (%)	14 (8.5)
Complete heart block (3 rd degree AV block)(%)	119 (72.1)
Restoration of AV nodal conduction:	
Day 1 (%)	57 (34.5)
Day 2 (%)	40 (24.2)
Day 3 (%)	18 (10.9)
Day 4 (%)	14 (8.5)
Day 5 (%)	10 (6.1)
Total (%)	139 (84.2)
Average time to reversal of AV block (hours)	51.3 ± 30.2
Persistent AV Block:	
1 st degree block (%)	5 (21.7)
Mobitz type I, 2 nd degree AV block (%)	3 (13.4)
Mobitz type II, 2 nd degree AV block (%)	6 (26.1)
Complete heart block (3 rd degree AV block) (%)	9 (39.1)
Total (%)	23 (13.9)
Nature of lesion in persisted AV Block	
Single vessel disease	1 (4.3)
Multi-vessel disease	22 (95.7)
In-hospital mortality (%)	3 (1.8)

DISCUSSION

Like other complications of STEMI, incidence of atrioventricular block has reduced in the current era of improved reperfusion strategy with PPCI and adjuvant anti-thrombotic therapy. PPCI can ameliorate atrioventricular block in significant number of patients

presenting with acute inferior STEMI patients and associated AV block.

Early beginning AV block is caused by obstruction of the AV nodal branch of the right coronary artery (RCA), which is the AV node's major supply; second, RCA blockage enhances acetylcholine release from vagal efferent neurons in ischemic inferior wall myocardium. Late onset AV block is related to the metabolic changes due to coronary ischemia.⁽⁹⁾

The results of our study showed that older people were at higher risk of developing AV block in setting of acute inferior wall STEMI. These results are consistent with earlier research.^(6,10) Female gender has been shown to be an independent risk factor for developing AV block.^(6,11) In contrast, our results showed that males were more affected (69.7%). Studies by Auffret and Singh et al have also demonstrated a male dominancy distribution.^(10,12) Other independent risk factors like diabetes mellitus, hypertension, and tobacco use were noticeable in a significant number of our patients. This pattern is also consistent with results of other studies.^(6,10,13,14)

On admission, the AV block was primarily caused by an infarction in the right coronary artery. Patients with AV block and any type of acute coronary syndrome and found nearly two-thirds of the patients had infarction or ischemia of right coronary artery.⁶ This finding is in line with studies during and after the thrombolytic era.^(10,12,15)

Patients with multi vessel coronary artery disease are theoretically more prone to suffer from AV block, as there may be ischemia of AV node due to compromised blood flow from the primary as well as the collateral vessels. In our study, AV block was also more prevalent among patients with multi vessel disease. It was further noticed that there was either delayed or no improvement in AV conduction in such patients. Singh et al in their study noted similar observations.⁽¹²⁾

The most common AV block at presentation was complete AV block followed by first degree AV block. After PPCI, early reversal of AV block was seen in nearly 35% on day 1 and 24.2% on day 2. This early reversal signifies the immediate benefit provided by mechanical reperfusion therapy. This is consistent with results of studies by Gang and Yadav, et al.^(2,13) One of the known mechanisms of AV block in inferior wall MI is parasympathetic activation known as the Bezold-Jarisch reflex, this may also have contributed to the early restoration of AV nodal conduction.

During hospitalization, complete heart block increased the risk of heart failure, cardiac shock, electrical arrhythmias, mechanical problems, and mortality. Survival after discharge was comparable for individuals with and without heart block.⁽¹⁶⁾ Our study, 3(1.8%) patients mortality observed in five day in-hospital, among those patients have multi vessel coronary artery disease and presentation with Killip class >II. Malik et

al found mortality rate of 3.3% in a similar group of patients.⁽¹⁷⁾ Presence of right ventricular infarction was also a major contributory factor to mortality. Pirzada et al reported significant impact of right ventricular infarction on mortality among same group of patients.⁽¹⁸⁾

Insertion of temporary pacemaker was utilized in 65.4% of our patients; Hwang et al showed 22.2% of their patients were implanted a temporary pacemaker peri-procedure.⁽¹⁹⁾ At the end of 5 days following PPCI, about three-fourths (84.2%) of patients restored normal AV conduction with an average time to AV block reversal of 51.3 ± 30.2 hours. Yadav et al showed average time to reversal of AV block of 24.5 ± 35.5 hours in their study.⁽¹³⁾

Despite the reversible nature of AV block in inferior STEMI, permanent pacemakers are implanted relatively early in contemporary clinical practice. According to US data, the mean time from admission to permanent pacemaker implantation with inferior STEMI and high grade AV block was 3 days in mostly patient.⁽²⁰⁾

CONCLUSION

PPCI significantly improves clinical outcomes with early resolution of AV block in the setting of acute inferior STEMI. A significant number of patients regained normal AV conduction within 5 days following PPCI, which provides suggestion for a reasonable waiting timeline for clinicians before final consideration of implanting a permanent pacemaker in this patient group.

Limitations: To the best of our knowledge, this is the first study to examine the incidence of varying degrees of AV block at presentation with acute inferior STEMI and to assess the favorable impact of PPCI on early restoration of different degree of AV block. Study limitations were that this was a single institution experience and that there was limited number of patients. We utilized waiting time of 5 days after PPCI for our patients, however because of the reversibility potential of AV block post STEMI, a longer waiting time with continued monitoring may have yielded further chances of improvement in AV conduction.

Author's Contribution:

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

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