Short-term outcome of acute inferior wall myocardial infarction with emphasis on conduction blocks: a prospective observational study in Indian population

Varun Kumar, Santosh Sinha, Prakash Kumar, Mohammed Razi, Chandra Mohan Verma, Ramesh Thakur,
Umeshwar Pandey, Rajpal Singh Bhardwaj, Mohammed Ahmad, RK Bansal, Shalini Gupta[1]

Department of Cardiology, LPS Institute of Cardiology, GSVM Medical College; Rawatpur, Kanpur-*India*
[1]Institute of Medical Sciences, Banaras Hindu University; Varanasi-*India*

ABSTRACT

Objective: The primary aim of the present study was to evaluate the complications, particularly conduction blocks, subsequent morbidity and mortality, and effect of thrombolytic therapy in Indian patients with inferior wall myocardial infarction (IWMI).

Methods: This was a prospective, observational, single-center study conducted at LPS Institute of Cardiology, Kanpur, from December 2011 to May 2014. Patients who presented with typical chest pain and were subsequently diagnosed by standardized diagnostic criteria as having IWMI were enrolled. Patients were grouped on basis of conduction abnormalities, right ventricular (RV) infarction and thrombolytic treatment. Each group was analyzed for comparison of complication profile and mortality.

Results: Of 573 patients with IWMI enrolled in the study (mean age: 58.90±12.3 years), 81.2% were male, 225 (39.3%) had conduction blocks, and 189 (32.9%) had RV infarction. In patients with conduction blocks, mortality occurred in 27 patients (12.0%) in contrast to 3.4% of patients without conduction block (p<0.03). Also, there were 27 cases of in-hospital mortality in patients with RV infarction compared with 9 cases in patients without RV infarction (p<0.01). Thrombolytic therapy significantly reduced mortality in patients with IWMI (p<0.001). A significant reduction was observed in cardiogenic shock (p=0.002), severe mitral regurgitation (p=0.007), and left ventricular failure (p<0.001) in patients undergoing thrombolytic therapy.

Conclusion: In Indian patients with IWMI, incidence of conduction blocks was higher than previously reported studies. Major complications such as atrioventricular block and RV infarction are associated with increased mortality and poor clinical outcomes. Thrombolytic therapy has a beneficial role in reduction of mortality rate and other complications. *(Anatol J Cardiol 2017; 17: 229-34)*

Keywords: atrioventricular block, inferior wall myocardial infarction, thrombolytic therapy

Introduction

Inferior wall myocardial infarctions (IWMI) accounts for about 30% to 50% of all acute myocardial infarctions and are generally viewed as having more favorable prognosis than anterior wall myocardial infarctions (1, 2). Data from a number of recent trials on thrombolytic therapy in acute infarction appear to support this view, with mortality rates of 2% to 9% reported among patients with inferior infarctions assigned to "standard care" or control group in these studies (1–3). Thrombolytic therapy has been shown to reduce mortality in patients with acute MI by restoring antegrade coronary flow in infarct- related artery and by reducing myocardial injury (4). However, it is not known whether it has produced parallel reductions in incidence or severity of conduction defects.

It is important to note that nearly 50% of patients suffering from inferior infarctions will have complications or distinguishing features associated with increased mortality that will substantially alter an otherwise favorable prognosis (5). Many trials have failed to demonstrate reduced mortality after thrombolytic therapy in subset of patients with inferior infarction (1, 3, 6). Berger et al. (5) reviewed data published before 1989 and documented third-degree atrioventricular (AV) block in 12% of patients with IWMI, with an additional 7% having second-degree AV block. More recent reports with equivalent sample sizes have noted similar incidences of third-degree AV block (6, 7).

Right ventricular (RV) infarction complicates 30% to 50% of cases of IWMI (8). Patients with RV infarction have higher incidence of cardiogenic shock, complete heart block, RV free wall

230 Kumar et al.
Assessment of patients with inferior wall myocardial infarction

Anatol J Cardiol 2017; 17: 229-34

rupture, cardiac tamponade, pulmonary embolism, and atrial fibrillation, resulting in poor clinical outcomes in patients with IWMI (9, 10).

Further, there are limited data and studies on IWMI in Indian population. Thus, the primary aim of the present study was to evaluate complications, subsequent morbidity and mortality, and effect of thrombolytic therapy in Indian patients with IWMI.

Methods

Study design

Current study was a prospective, observational, single-center study conducted at LPS Institute of Cardiology, Kanpur, from December 2011 to May 2014. Study was conducted in accordance with Declaration of Helsinki and under guidelines of good clinical practice. Patients were enrolled after providing them with complete information about the study and obtaining their written, informed consent.

Study population

Patients of age >18 years of either gender who had been diagnosed with inferior MI were included in the study. Patients having infarction for second time, prior coronary revascularization (e.g., coronary artery bypass grafting or percutaneous coronary intervention), who were pregnant or had associated valvular heart disease, thyroid disease, or renal failure were excluded.

Patients presenting at the department with typical chest pain and subsequently diagnosed with inferior MI by standardized diagnostic criteria were taken as sample. IWMI was defined as ischemic cardiac pain lasting more than 30 minutes, characteristic ST-segment elevation of ≥0.1 mV in 2 or more inferior leads (II, III, aVF), and creatine kinase-MB (CK-MB) elevation more than twice the upper reference limit.

Patients were first analyzed on basis of presence (Group A) or absence (Group B) of high degree AV block, irrespective of RV infarction. Then they were divided into patients with RV infarction (Group I) and without RV infarction (Group II). All 573 participants were also grouped by patients who received thrombolytic therapy (Group a) and patients who did not receive thrombolytic therapy (Group b).

Second- and third-degree AV blocks are considered high-degree. Second-degree AV block was defined as 2:1 or Wenckebach block in the presence of narrow QRS complex. Third-degree AV block or complete heart block (CHB) was defined as complete dissociation of atrial and ventricular rates with atrial rate greater than ventricular rate. Junctional rhythm was defined as cardiac rhythms arising from AV junction as an escape mechanism during periods of significant bradycardia with rates slower than intrinsic junctional pacemaker.

RV infarction was diagnosed electrocardiographically as (a) ST segment elevation of 1 mm or more in right precordial leads, i.e., V3R to V6R, in particular in lead V4R, (b) when there was associated ST segment elevation in lead II, III, aVF (11). Patients

with ST segment elevation in inferior leads coming within window period (within 12 hours of onset of chest pain) were considered for thrombolysis according to the American College of Cardiology/American Heart Association (ACC/AHA) guidelines (12). Those with settled ST segment even within window period or with contraindications for thrombolysis were excluded. Settled ST segment was defined as development of new Q waves in inferior leads with isoelectric ST segment and associated T wave inversion at time of presentation after onset of chest pain. Thrombolytic therapy consisted of streptokinase 1.5 million units intravenously (IV), administered over 30 to 60 minute period, tenecteplase (TNK-tPA) single IV weight-based bolus or reteplase (rPA) 10 U + 10-U IV boluses given 30 minutes apart, per ACC/AHA guidelines (12).

Echocardiography was performed using Vivid-7 ultrasound machine (GE Healthcare, Wauwatosa, WI, USA). Regional wall motion abnormality, left ventricular (LV) ejection fraction, valvular heart disease, and other structural abnormalities were quantified and assessed. Valvular heart disease was diagnosed according to ACC/AHA and European Society of Cardiology echocardiographic guidelines, and only moderate and severe valvular heart diseases were kept in exclusion criteria.

Baseline clinical data, including date and time of onset of chest pain, clinical history, smoking habit, diabetes, hypertension, and details of treatment were collected prospectively and stored in a purpose- built electronic database. Data regarding complications including AV block, atrial and ventricular arrhythmia, cardiogenic shock, mitral regurgitation, ventricular septal rupture, and LV failure were also recorded prospectively.

Statistical evaluation

All data were analyzed using the Statistical Package for Social Sciences software (version 15; SPSS, Inc., Chicago, IL, USA). Continuous variables were expressed as mean±SD and differences between groups were tested by means of Student's t-test. For non-parametric variables, Mann-Whitney U test was used. Fisher's exact test was used for cases where expected cell size was less than 5. Difference was considered significant at p≤ 0.05; p values for two-tailed test were considered.

Results

A total of 573 patients were enrolled in the study. Mean age of patients was 58.90±12.3 years and 81.2% of patients were male. Baseline characteristics of participants are outlined in Table 1. Of 573 patients, 297 (51.8%) were given thrombolytic agent, primarily streptokinase (94.8%). High degree AV block or junctional rhythm was found in 39.3% of cases and there was significantly higher mortality in this group; many of these patients required temporary pacemaker implantation. Of all participants, 216 patients underwent coronary angiography (Table 2). There were 42 (19.4%) cases of triple-vessel disease, 81 (37.5%) cases of double-vessel disease, and 78 (36.1%) cases of single-vessel

Anatol J Cardiol 2017; 17: 229-34

Kumar et al.
Assessment of patients with inferior wall myocardial infarction 231

Table 1. Baseline characteristics of patients with inferior wall myocardial infarction

Characteristics	Total patients n=573
Risk factors	
Age, years, mean±SD	58.90±12.3
Male, n (%)	465 (81.2%)
Smoking, n (%)	231 (40.3%)
Diabetes, n (%)	186 (32.5%)
Hypertension, n (%)	177 (30.9%)
Dyslipidemia, n (%)	147 (25.7%)
Complications	
Second-degree AV block, n (%)	54 (9.4%)
Complete heart block, n (%)	120 (20.9%)
Junctional rhythm, n (%)	51 (8.9%)
Atrial fibrillation, n (%)	8 (1.4%)
Ventricular tachycardia/fibrillation, n (%)	12 (2.1%)
RVMI, n (%)	189 (32.9%)
Cardiogenic shock, n (%)	49 (8.5%)
Severe mitral regurgitation, n (%)	39 (6.8%)
Left ventricular failure, n (%)	36 (6.3%)
Ventricular septal rupture, n (%)	5 (0.8%)
Ejection fraction, (mean±SD)	50.74±4.9
Thrombolytic therapy, n (%)	297 (51.8%)
AV - atrioventricular; RVMI - right ventricular infarction	

Table 2. Angiographic outcomes of patients who underwent coronary angiography

Angiographic outcomes	Total patients n=216
Single-vessel disease, n (%)	78 (36.1%)
Double-vessel disease, n (%)	81 (37.5%)
Triple-vessel disease, n (%)	42 (19.4%)
Normal coronaries, n (%)	15 (6.9%)
Culprit vessel	
RCA, n (%)	156 (77.6%)
LCX, n (%)	45 (22.4%)
LCX - left circumflex artery; RCA - right coronary artery	

Table 3. Characteristics of patients with and without conduction block (high-degree atrioventricular block and junctional rhythm)

Baseline characteristics	Group A n=225 (39.3%)	Group B n=348 (60.7%)	P
Age, years (mean±SD)	62.32±10.3	56.69±13.1	0.02
Gender			
Male, n (%)	168 (74.7%)	297 (85.3%)	0.001
Female, n (%)	57 (25.3%)	51 (14.7%)	
Patients with			
Diabetes mellitus, n (%)	99 (44.0%)	87 (25.0%)	0.001
Hypertension, n (%)	84 (37.3%)	93 (26.7%)	0.007
Smoking, n (%)	96 (42.7%)	135 (38.8%)	NS
Dyslipidemia, n (%)	66 (29.3%)	81 (23.3%)	NS
Patients presenting with			
Second-degree block, n (%)	54 (24.0%)	–	–
Complete heart block, n (%)	120 (53.3%)	–	–
Junctional rhythm, n (%)	51 (22.7%)	–	–
Ejection fraction, n (%)	49.81±5.6	51.34±4.3	NS
Thrombolytic therapy, n (%)	102 (45.3%)	195 (65.0%)	0.01
Mortality, n (%)	27 (12.0%)	12 (3.4%)	0.03
NS - non-significant			

disease, while 15 (6.94%) patients had normal coronaries. Culprit vessel in majority of patients (156 cases) was right coronary artery, followed by left circumflex artery in 45 patients.

Conduction block (AV block and junctional rhythm) and IWMI

Out of total 573 patients with IWMI, 225 (39.3%) had either high-degree AV block or junctional rhythm (Group A). High-degree AV block was present in 174 (30.3%) cases and junctional rhythm was present in 51 (9.0%) cases. Detailed characteristics

of patients with and without high-degree AV block irrespective of RV infarction are provided in Table 3. Patients with conduction blocks were older in age, mean age being 62.32±10.32 years, compared with patients without conduction blocks, who had mean age of 56.69±13.05 years (p=0.02). Complete heart block, second-degree AV block, and junctional rhythm were found in 120 (53.3%), 54 (24%) and 51 (22.7%) patients, respectively. In patients with conduction blocks (high-degree AV block and junctional rhythm), mortality occurred in 27 patients (12.0%) and was statistically significant (p<0.03), when compared with patients without conduction blocks.

RV infarction and IWMI

A total of 573 patients with IWMI were further analyzed by taking into consideration RV infarction. Of those, 189 (32.9%) had RV infarction. Detailed characteristics of patients with and without RV infarction are described in Table 4. In patients with RV infarction, ejection fraction was significantly reduced compared to patients without RV infarction (p=0.002). Also, there were 27 cases of in-hospital mortality in patients with RV infarction in contrast to 9 cases in patients without RV infarction (p=0.01).

Thrombolytic therapy and IWMI

A total of 297 (51.8%) patients underwent thrombolytic therapy. Detailed clinical profile and complications of both groups are provided in Table 5. Thrombolytic therapy significantly reduced mortality in patients with IWMI (p<0.001). A significant reduction was observed in occurrence of complications like cardiogenic

232 Kumar et al.
Assessment of patients with inferior wall myocardial infarction

Anatol J Cardiol 2017; 17: 229-34

Table 4. Characteristics of patients with and without right ventricular infarction

Baseline characteristics	Group I n=189 (33%)	Group II n=384 (67%)	P
Age, years (mean±SD)	59.46±12.5	58.63±12.3	NS
Gender			
Male, n (%)	153 (81.0%)	312 (81.3%)	NS
Female, n (%)	36 (19.0%)	72 (18.8%)	
Patients with			
Diabetes mellitus, n (%)	69 (36.5%)	117 (30.5%)	NS
Hypertension, n (%)	54 (28.6%)	123 (32.0%)	NS
Smoking, n (%)	72 (38.1%)	159 (41.4%)	NS
Dyslipidemia, n (%)	63 (33.3%)	56 (21.9%)	0.01
Patients presenting with			
Second-degree block, n (%)	9 (4.8%)	45 (11.7%)	0.002
Complete heart block, n (%)	57 (30.2%)	63 (16.4%)	<0.001
Junctional rhythm, n (%)	27 (14.3%)	24 (6.3%)	0.001
Cardiogenic shock, n (%)	42 (22.2%)	7 (1.8%)	<0.001
SMR, n (%)	15 (7.9%)	24 (6.3%)	NS
Left ventricular failure, n (%)	0 (0.0%)	36 (9.4%)	0.01
Ejection fraction, n (%)	46.13±5.03	53.02±2.91	<0.001
Thrombolytic therapy, n (%)	102 (54.0%)	195 (50.8%)	NS
Mortality, n (%)	27 (14.3%)	9 (2.34%)	0.01
NS - non-significant; SMR - severe mitral regurgitation			

Table 5. Characteristics of patients in thrombolytic and non-thrombolytic groups

Baseline characteristics	Group a n=297 (51.8%)	Group b n=276 (48.2%)	P
Age, years (mean±SD)	56.49±12.9	61.49±12.3	NS
Gender			
Male, n (%)	216 (78.3%)	249 (83.8%)	NS
Female, n (%)	48 (16.2%)	60 (21.7%)	
Patients with			
Diabetes mellitus, n (%)	102 (34.3%)	84 (30.4%)	NS
Hypertension, n (%)	90 (30.3%)	87 (31.5%)	NS
Smoking, n (%)	102 (34.3%)	129 (46.7%)	0.002
Dyslipidemia, n (%)	75 (25.3%)	72 (26.1%)	NS
Patients presenting with			
Second-degree block, n (%)	27 (9.1%)	27 (9.8%)	NS
Complete heart block, n (%)	57 (19.2%)	63 (22.8%)	NS
Junctional rhythm, n (%)	18 (6.1%)	33 (12.0%)	0.013
Cardiogenic shock, n (%)	15 (5.0%)	34 (12.3%)	0.002
Severe mitral regurgitation, n (%)	12 (4.0%)	27 (9.9%)	0.007
Left ventricular failure, n (%)	6 (2.0%)	30 (10.8%)	<0.001
Ejection fraction, n (%)	51.09±5.0	50.37±4.8	NS
Mortality, n (%)	9 (3.0%)	30 (10.9%)	<0.001
NS - non-significant			

shock (p=0.002), severe mitral regurgitation (p=0.007), and LV failure (p<0.001) in patients undergoing thrombolytic therapy.

Discussion

Although IWMI is no more an oblivion term, there are several discrepancies in the setting of IWMI that demand clarity. Prevalence of complications like conduction blocks and RV infarction worsen prognosis, and even thrombolytic therapy failed to demonstrate reduced mortality. Thus, this study mainly focused on complications associated with IWMI leading to poor clinical outcomes and worsened prognosis in the Indian population. The effect of thrombolytic therapy amid various complications in Indian patients with IWMI was also analyzed.

In the present study, prevalence of CHB and second-degree AV block was found to be 20.9% and 9.4%, respectively, among patients with IWMI, which is much higher than seen in earlier studies. Berger et al. (5) reviewed data published before 1989 and documented CHB in 12% of patients with IWMI, with an additional 7% having second-degree AV block. More recent reports with equivalent sample sizes have noted similar incidence of CHB (6, 7). Although, significance of AV block in the setting of IWMI is not yet clear, it is believed to be associated with higher incidence of congestive heart failure, larger infarct size, and LV failure leading to increased in-hospital mortality. Interestingly, it

was found that IWMI patients with diabetes and hypertension were significantly more prone to develop conduction disturbances, worsening the prognosis.

An in-hospital mortality rate of 12% was found in IWMI patients with presence of conduction defects (high-degree AV block and junctional rhythm) in contrast to 3.44% in IWMI patients with absence of conduction defects. Present results are consistent with results demonstrated by Harpaz et al. (13), which indicated that mortality rate was 4 times higher in patients with CHB compared with counterparts who did not develop this complication. Previous studies have demonstrated that AV block is not an independent predictor of mortality, but rather it is a marker of larger infarct size, which ultimately causes poor prognosis (7, 11).

Etiologies behind occurrence of AV block are disturbances in blood flow to AV node and high vagal tone resulting from Bezold-Jarisch reaction (14, 15). Vagally mediated AV block, considered a sign of successful reperfusion, also indicates that patients undergoing thrombolytic therapy are more prone to develop AV block (16). In the current study, no such significant difference was observed between thrombolytic and non-thrombolytic group. However, this assumption needs further investigation.

Incidence of RV infarction was found to be 32.9%, which is well within the range (10–50%) reported in previous studies (8, 14). These patients with hemodynamically significant RV infarc-

Anatol J Cardiol 2017; 17: 229-34

Kumar et al.
Assessment of patients with inferior wall myocardial infarction   *233*

tions suffer from diminished preload and loss of AV synchrony, leading to decreased RV, and subsequently LV, output (11). Thus, patients with IWMI who have RV myocardial involvement are at substantially increased risk of complications such as hypotension, cardiogenic shock and ventricular arrhythmia.

In the present study, 42 patients in Group I presented with cardiogenic shock, compared with only 7 patients in Group II (p<0.001). This is consistent with results demonstrated by Malla et al. (8), which indicated prevalence of cardiogenic shock was significantly greater in IWMI patients with RV infarction. Also, incidence of CHB was found to be between 33% and 66% in IWMI patients with RV infarction in a study by Braat et al. (17). In our study, prevalence was found to be 30.2%, slightly less than reported prevalence. In concordance with previous studies, however, it was found to be significantly higher percentage in IWMI patients with RV infarction (p<0.01). Here, it should be taken into consideration that in presence of AV block, there is loss of atrial contribution to ventricular filling, and this may be of critical importance in presence of acute RV dysfunction.

Zehender et al. (18) reported in-hospital mortality in IWMI patients with RV infarction to be 31% compared with 6% for patients without RV infarction. Mortality observed in our study was 14.3% and 2.34% for the respective groups.

There was no incidence of LV failure in IWMI patients with RV infarction, however in patients without RV infarction it was found to be 9.4%. Meta-analysis conducted by Mehta et al. (19) demonstrated that RVMI was associated with an increased risk of death, cardiogenic shock, ventricular tachycardia or fibrillation, and high-grade AV block. This increased risk is related to presence of RV myocardial involvement itself, rather than extent of LV myocardial damage (20, 21). Low incidence of LV failure may be due to protective effects of RV infarction on pulmonary circulation (14, 22).

Clinical profile of patients who underwent thrombolytic therapy gives us some insight into longstanding controversies about beneficial role of thrombolytic therapy in treatment of inferior MI. Complications such as cardiogenic shock, LV failure, mitral regurgitation, and associated mortality significantly decreased in patients treated with thrombolytic therapy. Yet, in spite of beneficial role of thrombolytic therapy, no advantage in simultaneous reduction of conduction abnormalities has been evidenced. This needs further investigation.

Study limitations

This was single-center observational study with limited number of patients (n=573). Results might vary in multi-center randomized study with larger population. Moreover, only 216 (37.69%) cases underwent coronary angiography due to cost constraints, which may be a confounding factor. Additionally, cardiac enzyme CK-MB was selected as diagnostic tool instead of troponin, which is less sensitive and specific for myocardial infarction.

Conclusion

In Indian patients with IWMI, major complications such as conduction block and RV infarction are associated with increased mortality and poor clinical outcomes. Higher incidence of complications, particularly high conduction abnormalities (AV block), needs further evaluation. Thrombolytic therapy, although not efficient enough to reduce conduction abnormalities, reduces mortality rate and other complications like cardiogenic shock, left ventricular failure and severe mitral regurgitation.

Conflict of interest: None declared.

Peer-review: Externally peer-reviewed.

Authorship contributions: Concept – V.K.; Design – S.S., V.K., U.P.; Supervision – V.K., U.P.; Funding – M.R., R.S.B., R.K.B.; Materials – R.T.; Data collection &/or processing – C.M.V., V.K.; Analysis and/or interpretation – P.K., M. A.; Literature review – S.G.; Writing – S.G., P.K.; Critical review – V.K.

References

1. Effectiveness of intravenous thrombolytic treatment in acute myocardial infarction. Gruppo Italiano per lo Studio della Streptochinasi nell'Infarto Miocardico (GISSI). Lancet (London, England) 1986; 1: 397-402.
2. Randomized trial of intravenous streptokinase, oral aspirin, both, or neither among 17,187 cases of suspected acute myocardial infarction: ISIS-2.ISIS-2 (Second International Study of Infarct Survival) Collaborative Group. J Am Coll Cardiol 1988; 12: 3A-13A. **Crossref**
3. Kennedy JW, Martin GV, Davis KB, Maynard C, Stadius M, Sheehan FH, et al. The Western Washington Intravenous Streptokinase in Acute Myocardial Infarction Randomized Trial. Circulation 1988; 77: 345-52. **Crossref**
4. Archbold RA, Sayer JW, Ray S, Wilkinson P, Ranjadayalan K, Timmis AD. Frequency and prognostic implications of conduction defects in acute myocardial infarction since the introduction of thrombolytic therapy. Euro Heart J 1998; 19: 893-8. **Crossref**
5. Berger PB, Ryan TJ. Inferior myocardial infarction. High-risk subgroups. Circulation 1990; 81: 401-11. **Crossref**
6. Goldberg RJ, Zevallos JC, Yarzebski J, Alpert JS, Gore JM, Chen Z, et al. Prognosis of acute myocardial infarction complicated by complete heart block (the Worcester Heart Attack Study). Am J Cardiol 1992; 69: 1135-41. **Crossref**
7. Behar S, Zissman E, Zion M, Goldbourt U, Reicher-Reiss H, Shalev Y, et al. Complete atrioventricular block complicating inferior acute wall myocardial infarction: short- and long-term prognosis. Am Heart J 1993; 125: 1622-7. **Crossref**
8. Malla RR, Sayami A. In hospital complications and mortality of patients of inferior wall myocardial infarction with right ventricular infarction. JNMA J Nepal Med Assoc 2007; 46: 99-102.
9. Rechavia E, Strasberg B, Mager A, Zafrir N, Kusniec J, Sagie A, et al. The incidence of atrial arrhythmias during inferior wall myocardial infarction with and without right ventricular involvement. Am Heart J 1992; 124: 387-91. **Crossref**
10. Bueno H, Lopez-Palop R, Bermejo J, Lopez-Sendon JL, Delcan JL. In-hospital outcome of elderly patients with acute inferior myocar-

234 Kumar et al.
Assessment of patients with inferior wall myocardial infarction

Anatol J Cardiol 2017; 17: 229-34

dial infarction and right ventricular involvement. Circulation 1997; 96: 436-41. **Crossref**

11. Strasberg B, Pinchas A, Arditti A, Lewin RF, Sclarovsky S, Hellman C, et al. Left and right ventricular function in inferior acute myocardial infarction and significance of advanced atrioventricular block. Am J Cardiol 1984; 54: 985-7. **Crossref**

12. O'Gara PT, Kushner FG, Ascheim DD, Casey DE Jr, Chung MK, de Lemos JA, et al. 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation 2013; 127: e362-425.

13. Harpaz D, Behar S, Gottlieb S, Boyko V, Kishon Y, Eldar M. Complete atrioventricular block complicating acute myocardial infarction in the thrombolytic era. SPRINT Study Group and the Israeli Thrombolytic Survey Group. Secondary Prevention Reinfarction Israeli Nifedipine Trial. J Am Coll Cardiol 1999; 34: 1721-8. **Crossref**

14. Pirzada AM, Zaman KS, Mahmood K, Sagheer T, Mahar SA, Jafri MH. High degree Atrioventricular block in patients with acute inferior Myocardial Infarction with and without Right Ventricular involvement. J Coll Physicians Surg Pak 2009; 19: 269-74.

15. Nicod P, Gilpin E, Dittrich H, Polikar R, Henning H, Ross J Jr. Long-term outcome in patients with inferior myocardial infarction and complete atrioventricular block. J Am Coll Cardiol 1988; 12: 589-94.

16. Verstraete M, Bernard R, Bory M, Brower RW, Collen D, de Bono DP, et al. Randomised trial of intravenous recombinant tissue-type plasminogen activator versus intravenous streptokinase in acute myocardial infarction. Report from the European Cooperative Study Group for Recombinant Tissue-type Plasminogen Activator. Lancet 1985; 1: 842-7. **Crossref**

17. Braat SH, de Zwaan C, Brugada P, Coenegracht JM, Wellens HJ. Right ventricular involvement with acute inferior wall myocardial infarction identifies high risk of developing atrioventricular nodal conduction disturbances. Am Heart J 1984; 107: 1183-7. **Crossref**

18. Zehender M, Kasper W, Kauder E, Schonthaler M, Geibel A, Olschewski M, et al. Right ventricular infarction as an independent predictor of prognosis after acute inferior myocardial infarction. N Engl J Med 1993; 328: 981-8. **Crossref**

19. Mehta SR, Eikelboom JW, Natarajan MK, Diaz R, Yi C, Gibbons RJ, et al. Impact of right ventricular involvement on mortality and morbidity in patients with inferior myocardial infarction. J Am Coll Cardiol 2001; 37: 37-43. **Crossref**

20. O'Rourke RA, Dell'Italia LJ. Diagnosis and management of right ventricular myocardial infarction. Curr Prob Cardiol 2004; 29: 6-47.

21. Haddad F, Doyle R, Murphy DJ, Hunt SA. Right ventricular function in cardiovascular disease, Part II pathophysiology, clinical importance, and management of right ventricular failure. Circulation 2008; 117: 1717-31. **Crossref**

22. Pfisterer M. Right ventricular involvement in myocardial infarction and cardiogenic shock. Lancet (London, England) 2003; 362: 392-4. **Crossref**

From Prof. Dr. Arif Akşit's collections