Prognostic Significance of Atrial Fibrillation after the First Acute Myocardial Infarction

Jahanbakhsh Samadikhah, MD; Farzin Boroomandan, MD; Azin Alizadeh Asl, MD; Mehdi Peyqambari, MD; S. Hadi Hakim, MD; Rasoul Azarfarin, MD; A. Hossein Mohammad Alian, MD

Abstract

- *Background* Several studies have been performed to analyze the significance of atrial fibrillation (AF) following acute myocardial infarction (AMI). In this study, we evaluated the prognostic significance of AF considering timing of its occurrence after the first AMI.
- *Methods-* This investigation is a prospective multivariate study (cohort type); among 500 consecutive first infarct survivors who were admitted to our heart center over a 2-year period (1998-2000).
- **Results-** Among 500 consecutive patients (pts), 66 pts (13.2%) had AF. These pts were divided into two groups A (n=36) and B (n=30), who developed AF within and after 24 hours of onset of AMI, respectively. The infarct occurred mainly (62.8%) in the proximal right coronary artery in A group (p<0.05), left ventricular ejection fraction was more decreased in B group (p<0.05); and also mitral regurgitation was more frequent in this group (p<0.05). According to multivariate analyses; older age, female sex, hypertension, ventricular hypertrophy, ventricular tachycardia, ventricular fibrillation, pericarditis, atrioventricular block (AVB) especially complete AVB, intraventricular conduction disturbance, high admission Killip class, pulmonary congestion, heart failure in hospital and 1 year follow-up mortality were higher in both groups compared to the sinus rhythm group. AF was an independent predictor of cardiac death (in-hospital and 1 year follow-up) in A group (odds ratio 2.29, 95% confidence interval 1.1 to 4.1, p<0.05), and B group (odds ratio 2.29, 95% confidence interval 2.1 to 7.9, p<0.05), respectively.
- *Conclusion-* The appearance of AF within or after 24 hours of first AMI is a useful parameter for evaluation of the cardiac status and prognosis of patients with AMI. We also found that emergence of AF is more common in right coronary artery lesions. (*Iranian Heart Journal.* 2002, 2003; 3(2&3): 44-48)

Keywords: atrial fibrillation < acute myocardial infarction < prognosis

A trial fibrillation (AF) is the most common supraventricular arrhythmia in patients (pts) with acute myocardial infarction (AMI). The atrium loses its pump function, contributing to the deterioration of cardiac hemodynamics.^{1,2} The incidence of congestive heart failure and in-hospital mortality rates are higher in AMI pts with AF than in AMI pts without AF.¹⁻⁵ Furthermore, the long-term

survival rate is lower in AMI pts with AF.^{1,2,6}

Sinus node ischemia, atrial ischemia, congestive heart failure, pericarditis, right ventricular infarction, and other factors may be involved in the pathogenesis of AF in AMI.⁷⁻⁹ However, no information is available regarding the relation between the time of onset of AF during the acute phase of AMI and cardiac function and/or

From the Department of Cardiology Shaheed Madani Heart Hospital, University of Medical Seiences, Tabriz , Iran Correspondence to J. Samadikhah, MD, Shaheed Madani Heart Hospital, Tabriz, Iran Fax: (+98411) 3344021

prognosis.² In the present study, we classified AMI pts with AF into 2 groups according to the time of onset, to investigate the possible relation between the onset of AF and clinical background, cardiac function, and in-hospital and long-term prognosis.

Methods

The subjects consisted of 500 pts who were admitted consecutively to our center with a diagnosis of first AMI from 1998 to 2000. None of the pts had a history of thyroid disease, rheumatic valvular disease, or mitral valve prolapse syndrome. Patients who presented with Killip class II or more were diagnosed as having a complication of congestive heart failure. A diagnosis of cardiogenic shock was based on 2 specific findings: (1) systolic blood pressure ≤80mmHg with no response to a volume load, (2) signs of circulatory insufficiency acute and congestive heart failure.

All pts underwent electrocardiography and echocardiography; pts who were found to have ≥ 1 mm ST segment elevation in leads V₄R and/or V₃R on the electrocardiogram (ECG) taken on admission were diagnosed as having right ventricular AMI (RV MI). Of the 500 pts with AMI, 66 (13.2%) developed AF and they were classified into the AF total group. These pts were subdivided into AF group A (36 pts who developed AF within 24 hours of onset of AMI) and AF group B (30 pts who developed AF 24 hours after onset of AMI; the remaining 436 pts were classified as the sinus group.

A diagnosis of mitral regurgitation (MR) at echocardiography was made when the ratio of the jet area to the left atrial area ratio was > 20%.¹¹

Coronary angiography was performed on 211 pts (sinus group: 168, AF group A: 23, AF group B: 20). The angiographic findings were graded according to American Heart Association (AHA) classification,¹² with significant coronary stenosis defined as $\geq 75\%$ narrowing of the artery. Pts were further classified as having 1, 2 or 3 vessel disease.

Statistical analysis

Values are expressed as mean \pm SD. Significant differences between 2 groups were assessed by student's t test. Significant difference among \geq 3 groups was tested by analysis of variance. Differences were considered statistically significant at *p*<0.05.

The relative likelihood for some parameters was calculated as odds ratio with 95% confidence intervals.

Results

The incidence of AF was 13.2%; the age of the sinus group was significantly younger than that of AF group A (p < 0.05) or of AF group B (p < 0.05). Also AF groups were associated with female sex (p < 0.05), hypertension (P < 0.05), diabetes mellitus type 1 (p < 0.05) and high systolic blood pressure at entry (p < 0.05). The incidence of inferior wall AMI was significantly higher in AF group A than in the sinus group (p < 0.05) or AF group B (p < 0.05). The incidence of anterior AMI was significantly higher in AF group B than in AF group A (Table I). The incidence of MR was also significantly higher in AF total group (p < 0.05); especially in AF group 2 (p < 0.05) than in the sinus group (Table II). The left ventricular ejection fraction was clearly lower in AF group B (p < 0.05) than the sinus group or AF group A (Table II).

Also left ventricular hypertrophy was significantly higher in AF groups than sinus group. Occlusion of the right proximal coronary artery was responsible for AMI in a significantly higher number of pts in AF group A than in the sinus group (p<0.05) or AF group B (p<0.05). Occlusion of proximal left anterior descending branch was responsible for AMI at a significantly higher rate in AF

group B than in the sinus group (p<0.05) or AF group A (p<0.05, Table II).

Table I. Clinical Characteristics

	Sinus Group	AF Total Group	AF Group A	AF Group B
Number	436	66	36	30
Age	64 ± 9	71 ± 12*	70 ± 10*	70 ± 11*
Female	21%	32%*	30%*	34%
Hypertension	42%	56%*	59%*	54%
Diabetes mellitus	20%	25%	24%	22%
Type I	4%	8%*	8%*	7%
Type II	16%	18%	16%	15%
High systolic BP at entry \geq (160/90)	61%	74%*	74%*	75%*
Hyperlipemia	32%	26%	24%	29%
Smoking	43%	42%	43%	42%
Anterior AMI	49%	45%	25%	67% [•]
Inferior AMI	41%	47%	$66\%^{*^{\Delta}}$	29%
Non-Q AMI	13%	11%	12%	13%

* p<0.05 versus sinus group

• P<0.05 versus AF group A

^ΔP<0.05 versus AF group B

 Table II. Echocardiographic and Angiographic Data

	Sinus Group	AF Total Group	AF Group A	AF Group B
Mitral regurgitation	39%	59%*	38%	69%*
Left ventricular ejection fraction	50 ± 11	44 ± 10*	49 ± 10	40 ± 12•∗
Left ventricular hypertrophy	12%	22%*	24%*	22.5%*
Right coronary artery lision	35%	42%	$63\%^{*\Delta}$	20%
Left anterior descending artery lision	50%	46%	19%* ^Δ	79%* •
Left circumflex coronary artery lision	14%	11%	12%	8%
Multivessel disease	54%	55%	41%	78* •

* p<0.05 versus sinus group

• P<0.05 versus AF group A ^ΔP<0.05 versus AF group B

F<0.05 versus AF group B

The occurrence of congestive heart failure was significantly higher in AF group A (p<0.05) and AF group B (p<0.05) than in the sinus group.^{*} The incidence of

pulmonary edema and cardiogenic shock were significantly higher in AF group A (p < 0.05) and AF group B (p < 0.05) than in the sinus group. The incidence of right ventricular AMI and atrioventricular block (AVB), especially complete AVB were significantly higher in AF group A than sinus group and AF group B. The frequency of pericardial effusion and pericarditis were significantly higher in AF group B than in the sinus group (Table III). Also, as shown in Table III, sustained tachycardia, ventricular ventricular fibrillation and intraventricular conduction disturbance all occurred more often in pts with AF than in sinus group; but no significant difference was observed in reinfarction rate. The in-hospital mortality rate was significantly higher in AF group A and B than in the sinus group; also according to 1 year follow-up mortality rate, this parameter was significantly lower in AF group A and especially in AF group B than in the sinus group. Multivariate logistic regression analysis for cardiac death (in-hospital mortality + 1 year follow-up mortality) revealed that in AF group A, AF [odds ratio (OR) 2.99, 95% confidence interval (CI) 1.1 to 4.1, p < 0.05] and age (OR 1.17, 95% CI 1.03 to 1.31, p < 0.05) were significant independent predictors of cardiac death, and in AF group B, AF (OR 4.21, 95% CI 2.1 to 7.9. *p*<0.05) and age (OR 1.15, 95% CI 1.08 to 1.28, p < 0.05) were significant independent predictors of cardiac death.

Table	III.	Com	plica	tions

	Sinus	AF	AF -A	AF - B
	Group	Total	Group	Group
Heart failure	35%	64%*	51%*	74%*•
Pulm. Edema	17%	31%*	29%*	33%*
Cardiogenic shock	12%	29%*	30%*	28%*
RV MI	12%	25%*	32 [∆] *	21%
Reinfarction	7%	7%	5.5%	7%
AV block	12%	31%*	$40\%^{\Delta_{*}}$	21%*
CompleteAVB	5%	19%*	$30\%^{\Delta_{*}}$	14%*
Pericardial effusion	5%	14%*	9%	24%*
Pericarditis	3%	8%*	5%	13%*
V-tachycardia	16%	33%*	35%*	31%*
V-fibrillation	11%	26%*	29%*	22%*
Intra ventricular	19%	36%*	39%*	33%*

^{*} also the incidence of congestive heart failure was significantly higher in AF group B than in the AF group A (Table III).

13%	33%*	35%*	30%*
18%	40%*	37%*	45%*
	13% 18%	13% 33%* 18% 40%*	13% 33%* 35%* 18% 40%* 37%*

Discussion

AF occurs in 6% to 26% of pts with AMI.^{1,3,6,13} Various pathologic conditions, including ischemia of the sinus node,¹⁴ atrial ischemia and atrial AMI,^{15,16} congestive heart failure,⁷ pericarditis,⁷ and right ventricular AMI⁹ may be involved in the development of AF in AMI. In the present study, AF occurred in 13.2% of pts with AMI. Patients in whom AF occurred within 24 hours of the onset of AMI tended to have inferior AMI accompanied by right ventricular AMI. The incidence of occlusion of the right proximal coronary artery causing the infarct was significantly higher in AF group A than in AF group B. possible causes of AF in group A include:

(1) atrial and sinus node ischemia due to impairment of blood flow in the sinus node artery or atrioventricular node artery, (2) atrial ischemia and atrial AMI, or (3) right atrial overload due to right ventricular AMI. The in-hospital mortality rate was the highest in AF group A. The poor prognosis of pts in AF group A during the acute phase of AMI may be due to acute worsening of cardiac hemodynamics with the development of AF and the presence of right ventricular dysfunction.

Patients in whom AF occurred ≥ 24 hours after the onset of AMI tended to have anterior AMI; the incidence of congestive heart failure was high in this group. Hemodynamically, pulmonary capillary wedge pressure was increased with a marked decrease in the left ventricular ejection fraction. In addition, the incidence of mitral regurgitation and multivessel disease were high in this group. In AF group B, advanced left ventricular dysfunction appeared to play an important role in the development of AF. The frequency of pericardial effusion was significantly high in AF group B, and the pts with pericardial effusion in AF group B

carried a still poorer prognosis. This seemed attributable to a hemodynamic change due to extensive myocardial infarction.⁷

Patients with AF more often developed serious arrhythmias, particularly ventricular tachycardia and ventricular fibrillation. The in-hospital mortality rate was significantly higher in all AF pts than in the sinus group. The incidence of right ventricular AMI and shock was highest in AF group A, whereas the incidence of multivessel disease and heart failure was highest in AF group B. The incidence of MR also was highest in AF group B. Consequently, it appears that these complications might worsen prognosis.

The long-term prognosis of pts in AF groups A and B was likely affected adversely by persistent impairment of cardiac function and coronary artery pathology, which lead to the development of AF. The location of the infarct-related coronary artery lesions and cardiac function are related to the onset time of AF in AMI. When the pts were classified according to the AF onset time of 24 groups hours. the were clearly characterized.

Patients with inferior myocardial infarction who developed AF more than 24 hours after the onset of AMI presented with elevation in the left atrial pressure accompanying multivessel disease. extensive AMI, and traits of AF group B rather than the traits of inferior wall AMI complicated by AF. Briefly a comparison of AF between sites of myocardial infarction may be important, but the onset time of AF seems to be of no less importance.

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