

## Interatrial conduction disorders in patients with ST-elevation myocardial infarction

### *ST-segment elevasyonlu akut miyokard infarktüsü ile başvuran hastalarda interatrial ileti bozuklukları*

Gökhan Altunbaş<sup>1</sup> Ertan Vuruşkan<sup>1</sup> Fatma Yılmaz Coşkun<sup>1</sup> Murat Sucu<sup>1</sup>

Gaziantep University Medical Faculty Hospital, Department of Cardiology, Gaziantep, Turkey

#### Abstract

**Aim:** The most significant clinical association of interatrial block (IAB) was found with increased risk of atrial fibrillation and ischemic stroke. In this study, we sought to evaluate P wave duration and interatrial block in patients presented with acute ST-segment-elevation myocardial infarction (STEMI) who underwent primary percutaneous coronary intervention (PCI).

**Materials and Methods:** We performed a retrospective analysis of patients presented with acute STEMI who underwent emergent PCI. Follow-up electrocardiograms were obtained from electronic database system. Echocardiographic data were also obtained from electronic patient records. Electrocardiographic measurements were performed using SEMA Workstation 3.8.1 (Schiller AG).

**Results:** Primary analysis included 200 consecutive patients with STEMI. However, there were 20 in-hospital deaths and 83 patients were lost to follow-up. Remaining 97 patients (80 male, 17 female) were included in the final analysis. Mean age was 57.02±12.18 years. There were 48 patients with anterior STEMI and 49 patients with inferior STEMI. Mean duration of follow-up was 11 months and ECGs at the end of the follow up revealed that the frequency of partial and advanced IAB were 13.2% and 7.7% respectively. Statistical analysis showed that neither P wave duration nor IAB showed significant association with the infarct related artery lesion localization. Also, the degree of systolic dysfunction was not associated with IAB. Only male gender and left atrial diameter had significant positive correlation with P wave duration.

**Conclusion:** IAB was not rare in patients with a history of acute coronary syndrome. The infarct related artery does not seem to have a significant correlation with interatrial conduction.

**Keywords:** Interatrial block, acute coronary syndrome, electrocardiography.

#### Öz

**Amaç:** İnteratrial bloğun klinikte en önemli ilişkisi bu hastalarda atrial fibrilasyon ve iskemik strok riskinin arttığına gösterilmiş olmasındır. Bu çalışmamızda ST-segment elevasyonlu akut miyokard infarktüsü (STEMI) ile başvurup primer perkütan koroner girişim (PCI) yapılan hastaların takibinde EKG'de P dalga süresi ve interatrial bloğu incelemeyi amaçladık.

**Gereç ve Yöntem:** STEMI ile başvuran ve acil PCI uygulanan hastalar retrospektif olarak incelendi. Takip EKG'leri ve ekokardiyografileri sistemden tarandı. EKG ölçümleri SEMA Workstation 3.8.1 (Schiller AG) yardımıyla yapıldı.

**Bulgular:** Primer analize 200 hasta dahil edildi. Ancak 20 hastanın hastane içi ölüm nedeniyle kaybedildiği ve 83 hastanın ise indeks olaydan sonra tekrar takibe gelmediği saptandı. Bu nedenle son analize 97 hasta (80 erkek, 17 kadın) dahil edildi. Ortalama yaş 57,02±12,18 yıl idi. 48 hasta ön duvar STEMI ve 49 hasta ise alt duvar STEMI ile başvurdu. İndeks olay sonrası ortalama takip süresi 11 ay olarak hesaplandı.

Corresponding author: Gökhan Altunbaş  
Gaziantep University Medical Faculty Hospital, Department of  
Cardiology, Gaziantep, Turkey  
E-mail: drgokhanaltun@gmail.com  
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*Takip süresi sonunda kısmi İAB %13,2, ileri İAB ise 7,7% olarak izlendi. İstatistiksel analiz sonucuna göre P dalga süresi ve İAB infarkt arter lokalizasyonu ile ilişkili bulunamadı. Aynı zamanda enfarktüs sonrası gelişen sol ventrikül sistolik disfonksiyonu ile de İAB arasında ilişkili bulunamadı. P dalga süresi ile sadece erkek cinsiyet ve sol atrial çap arasında anlamlı pozitif korelasyon izlendi.*

**Sonuç:** İAB'nin koroner arter hastalarında nadir olmadığı görüldü. Aynı zamanda enfarkt arterinin interatrial ileti ile ilişkisi olmadığı gözlemlendi.

**Anahtar Sözcükler:** İnteratrial blok, akut koroner sendrom, elektrokardiyografi.

## Introduction

Interatrial conduction is evaluated on surface electrocardiography (ECG) by the morphology and duration of P wave. Dilated left atrium will result in prolonged P wave duration and/or biphasic/notched P wave morphologies. Recently published scientific data indicate the clinical significance of interatrial block (IAB), the most important of which is increased risk of stroke. In the ARIC trial, the incidence of ischemic stroke was more than twice in patients with advanced IAB compared to patients with no IAB (1). Most of the studies evaluating interatrial block has been performed in non-selected populations or patients with heart failure. Here, we evaluated patients presenting with ST-elevation acute myocardial infarction who underwent emergent primary percutaneous coronary intervention (PCI). Follow-up ECGs are observed in order to clarify the incidence and risk factors for development of interatrial block in this patient population. We also evaluated risk factors and clinical variables associated with IAB in patients with acute myocardial infarction.

## Materials and Methods

Retrospective evaluation of patient charts was performed. We evaluated 200 consecutive patients with acute ST elevation myocardial infarction who underwent primary percutaneous coronary intervention (PCI) with implantation of at least one stent. Approval of local ethics committee was obtained. ECGs of the patients were evaluated using SEMA Workstation 3.8.1 (Schiller AG). Clinical variables of the patients and angiographic results were also obtained from electronic patient data system. Based on ECG, IAB was defined as absent (P wave < 120 ms), mild (P wave  $\geq$  120 ms with normal morphology) and advanced (P wave  $\geq$  120 ms with biphasic P waves in inferior leads).

## Statistical Analysis

Shapiro Wilk test was used to test the normal distribution of the data. Since all of the numerical variables across groups were normally distributed ( $p < 0.05$ ), nonparametric statistical methods were

used. The Mann-Whitney U test is used to compare differences between two independent groups. The Kruskal-Wallis test is used to compare mean difference among three or more groups. Spearman rank correlation analysis was used to detect the association between numerical variables that do not have normal distribution and Ki square test was used to evaluate the association between categorical variables. Mean  $\pm$  standard deviation was used for descriptive statistics and number and percentage (%) was used for categorical variables. SPSS for Windows version 22.0 (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. A two-sided  $p < 0.05$  was considered significant.

## Results

We evaluated 200 patients with ST-elevation acute myocardial infarction (STEMI). There were 20 in-hospital deaths due to myocardial infarction (10%). Also, 83 patients were lost to follow-up and no control visits were recorded after the index event. For the remaining 97 patients, the mean duration of follow-up was 11 months (min. 1 month and max. 28 months). Mean age of the remaining 97 patients was  $57.02 \pm 12.18$  years. Clinical, ECG and echocardiographic variables of the patients are demonstrated in Table 1. Among 97 patients, 49 were presented with acute inferior STEMI of which 19 had circumflex coronary artery (Cx) occlusion and 30 had right coronary artery (RCA) occlusion. 48 patients were admitted with anterior STEMI and all had left anterior descending coronary artery (LAD) occlusion. (Figure-1) is a sample ECG obtained from a patient who experienced anterior STEMI seven months before. ECG shows prolonged P waves. (Figure-2) is zoomed view of the same ECG which clearly shows prolonged and biphasic P waves in inferior leads, especially lead III. When gender was evaluated as regards to the lesion localization, LAD was the most frequently associated infarct related artery in men, whereas Cx was the least frequent infarct related artery in both genders. At the final visit, only one patient was on atrial fibrillation. The frequency of partial IAB was 13.2% and advanced IAB was 7.7%. P

wave duration had a significant positive correlation with male gender (p: 0.03). Also, there was a significant correlation between P wave duration and left atrial diameter (r: 0.239 p: 0.02). There was no significant association between electrocardiographic P wave duration and infarct related artery-lesion localization (Table-2). In

addition, the presence and degree of IAB was not associated with lesion localization. The mean ejection fraction (EF) of the patients was 50.63±10 % (min. 25%, max. 60%). The degree of systolic dysfunction, as assessed by EF was also not associated with P wave duration (p: 0.93).

**Table-1.** Baseline characteristics of the patients.

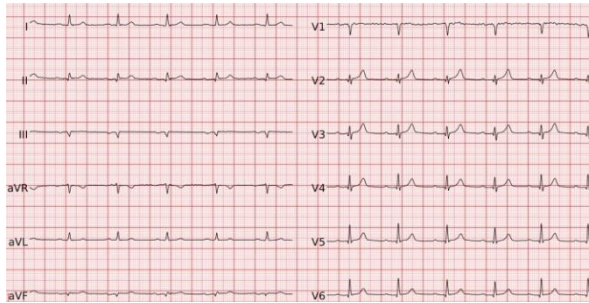
|                             |                              |
|-----------------------------|------------------------------|
| <b>Mean age (years)</b>     | 57.02±12.18                  |
| <b>Gender</b>               | Male: 80<br>Female: 17       |
| <b>EF (%)</b>               | 50.63±10                     |
| <b>P wave duration (ms)</b> | 112.81±16.92                 |
| <b>LA diameter (mm)</b>     | 36.98±5.83                   |
| <b>Lesion localization</b>  | LAD: 48<br>Cx: 19<br>RCA: 30 |

EF: ejection fraction, LA: left atrium, LAD: left anterior descending, Cx: circumflex, RCA: right coronary artery

**Table-2.** The mean±standard deviation values of electrocardiographic P wave duration of the patients based on culprit lesion localization.

|                             | <b>Cx (n:19)</b> | <b>LAD (n:45)</b> | <b>RCA (n:30)</b> | <b>p</b> |
|-----------------------------|------------------|-------------------|-------------------|----------|
| <b>P wave duration (ms)</b> | 112.26±15.26     | 114.71±19.18      | 110.93±14.32      | 0.92     |

Cx: circumflex, LAD: left anterior descending, RCA: right coronary artery



**Figure-1.** 12-lead ECG showing sinus rhythm and prolonged P waves in a patient with prior inferior wall myocardial infarction.



**Figure-2.** Zoomed view of figure-1 showing prolonged and biphasic P waves are clearly visible on III.

## Discussion

In this study, we evaluated interatrial conduction properties in patients with STEMI and found that the presence and degree of IAB was not associated with either infarct related artery or the degree of systolic dysfunction developed after infarction.

Inter atrial block is gaining more and more interest in recent research publications. The majority of findings indicate increased risk of ischemic stroke in patients with interatrial block (2, 3). In addition to the elderly, IAB was found to be significantly more frequent in younger patients (≤55 years of age) with cryptogenic stroke (4). Also, IAB has a strong correlation with the development of atrial fibrillation and recurrence of atrial fibrillation after cardioversion or ablation (5-8).

Alexander et al. (9) retrospectively evaluated patients with non-ST-segment elevation myocardial infarction (NSTEMI) and found that the frequency of partial and advanced IAB was 31.9% and 6.5% respectively. The frequency of advanced IAB is quite similar to our findings.

They also found that no specific coronary artery lesion localization was associated with IAB. This is also consistent with our findings. They also found that patients with IAB had higher prevalence of multivessel coronary artery disease. At the end of the 12-month follow-up after NSTEMI, patients developing atrial fibrillation had higher prevalence of IAB.

We also did not find any significant association between culprit artery and presence and degree of IAB. However, Ariyarajah et al. (10) studied patients with evidence of ischemia on exercise stress test. After coronary angiography, they found that patients with baseline IAB, the predominant lesion was proximal and mid right coronary artery stenosis and for patients without IAB there was no such difference. The opposite findings between our study and Ariyarajah et al.'s study can be explained in part by different patient cohorts. They studied patients with stable ischemic heart disease but we included only patients with acute ST-segment-elevation myocardial infarction.

Çinier et al. (11) evaluated patients with STEMI, a cohort similar to our patients. They found that, like our findings, the patients with IAB were significantly older. However, their findings indicate that patients with IAB had more frequently right coronary artery lesions as the culprit artery for acute coronary syndrome. They also performed a 12-month follow-up and showed that new-onset atrial fibrillation was more frequent in patients with baseline IAB.

IAB is also a frequent accompanying abnormality in patients with heart failure. Abdellah et al. (12) evaluated the frequency and clinical associates of IAB in patients with systolic heart failure. They found that patients with IAB had significantly

higher functional classes and increased mortality during 12-month follow up period. Sadiq Ali et al (13) evaluated patients with severe heart failure and cardiac resynchronization therapy (CRT). At baseline there were 37 patients with advanced IAB and during follow-up period, atrial fibrillation occurrence was significantly more frequent among patients with advanced IAB compared to patients without IAB.

We found a significant positive correlation between IAB and male gender. Male patients had significantly more IAB and prolonged P wave durations compared to female counterparts. Also, left atrial dilatation was significantly associated with prolonged P wave duration and IAB. IAB reflects prolonged activation of the atria through Bachmann bundle and thus this prolonged P wave duration in patients with left atrial dilatation is an expected finding. However, IAB is not the same phenomenon with left atrial dilatation. Advanced IAB can be seen in patients with acute pericarditis, acute myocardial infarction without left atrial dilatation (14). Also, in these cases, IAB can be reversible. After the index event has been cured, interatrial conduction returns to normal and P wave duration can also return to baseline.

### **Conclusion**

Interatrial block frequently accompanies coronary artery disease. However, there does not seem a relationship between interatrial conduction delay and coronary lesion localization in patients who experienced a ST-segment-elevation myocardial infarction.

### **Conflict of interests**

There is no conflict of interests regarding the publication of this paper for the authors.

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