Association of the QRS duration on the resting electrocardiogram with the severity of coronary artery disease in 2,196 patients undergoing coronary angiography for suspected coronary artery disease

Hari Kannam, Wilbert S. Aronow, Karin Chilappa, Srikala Devabhakturi, Tarunjit Singh, Kumar Kalapatapu, Melvin B. Weiss, Anthony L. Pucillo, Craig E. Monsen

Department of Medicine, Division of Cardiology, New York Medical College, Valhalla, NY, USA

Submitted: 29 June 2008
Accepted: 11 August 2008

Arch Med Sci 2009; 5, 2: 163-165

Corresponding author:
Wilbert S. Aronow, MD
Cardiology Division
New York Medical College
Macy Pavilion, Room 138
Valhalla, NY 10595, USA
Phone: (914) 493-5311
Fax: (914) 235-6274
E-mail: wsaronow@aol.com

Abstract

Introduction: To investigate the association between QRS duration on the resting electrocardiogram (ECG) with severity of coronary artery disease (CAD) in patients undergoing coronary angiography for suspected CAD.

Material and methods: We investigated the prevalence of a QRS duration ≥ 120 ms on the resting ECG in patients with no CAD, nonobstructive CAD, 1-vessel obstructive CAD, 2-vessel obstructive CAD, and 3-vessel obstructive CAD undergoing coronary angiography for suspected CAD. The 2,196 patients included 1,291 men and 905 women, mean age 69 ±10 years, with suspected CAD. Nonobstructive CAD was diagnosed if there was < 50% obstruction of 1 major coronary artery. Obstructive CAD was diagnosed if there was > 50% obstruction of at least 1 major coronary artery.

Results: A QRS duration of ≥ 120 ms on the resting ECG was present in 30 of 220 patients (14%) with no CAD, in 44 of 276 patients (16%) with nonobstructive CAD, in 76 of 441 patients (17%) with 1-vessel CAD, in 99 of 464 patients (21%) with 2-vessel CAD, and in 217 of 795 patients (27%) with 3-vessel CAD ($p < 0.001$ comparing 5 with 1, 5 with 2, and 5 with 3; $p < 0.02$ comparing 5 with 4 and 4 with 1).

Conclusions: The prevalence of a QRS duration ≥ 120 ms on the resting ECG increased with increasing severity of obstructive CAD.

Key words: coronary artery disease, QRS duration, electrocardiogram, coronary angiography.

Introduction

A QRS duration of ≥ 120 ms on the resting ECG was associated with increased mortality in 1,4555 postinfarction patients [1], in 669 patients with heart failure [2], in 995 patients undergoing risk stratification for ventricular arrhythmias [3], and in 1,040 patients with coronary heart disease or hypertensive heart disease with left ventricular hypertrophy [4]. To the best of our knowledge, the prevalence of a QRS duration of ≥ 120 ms on the resting ECG correlated with the severity of coronary artery disease (CAD) diagnosed by coronary angiography has not been previously reported.

The present study reports a clinical study the prevalence of a QRS duration of ≥ 120 ms on the resting ECG in patients with no CAD,

nonobstructive CAD, 1-vessel obstructive CAD, 2-vessel obstructive CAD, and 3-vessel obstructive CAD in 2,196 patients undergoing coronary angiography for suspected CAD.

Material and methods

The 2,196 patients included 1,291 men and 905 women, mean age 69 ±10 years, with suspected CAD. Nonobstructive CAD was diagnosed if there was < 50% obstruction of 1 major coronary artery. Obstructive CAD was diagnosed if there was > 50% obstruction of at least 1 major coronary artery. No CAD was diagnosed if there was no angiographic evidence of CAD.

The 12-lead ECGs were recorded in the resting supine position with a paper speed of 25 mm/s and with 1 mv/cm standardization. The QRS duration on the resting ECG was measured by 4 of the authors without knowledge of the coronary angiographic findings.

The coronary angiograms were interpreted by 4 of the authors without knowledge of the QRS findings.

Chi-square tests were used to analyze dichotomous variables.

Results

Table I shows the prevalence of a QRS duration of ≥ 120 ms on the resting ECG in 220 patients with no CAD, in 276 patients with nonobstructive CAD, in 441 patients with 1-vessel obstructive CAD, in 464 patients with 2-vessel obstructive CAD, and in 795 patients with 3-vessel obstructive CAD. Table I also lists levels of statistical significance.

An abnormal QRS duration of ≥ 120 ms on the resting ECG was present in 284 of 1,291 men (22%) and in 182 of 905 women (20%) (p not significant). The prevalence of major coronary risk factors was not significantly different between patients with a QRS duration ≥ 120 ms vs. less than 120 ms (14 vs. 13% for current cigarette smoking, 74 vs. 72% for hypertension, 32 vs. 30% for diabetes mellitus, and 77 vs. 75% for hypercholesterolemia).

The prevalence of prior myocardial infarction was not significantly different between patients with a QRS duration ≥ 120 ms vs. less than 120 ms (20 vs. 18%). The prevalence of an abnormal left ventricular ejection fraction (less than 50%) was not significantly different between patients with a QRS duration ≥ 120 ms vs. less than 120 ms (30 vs. 27%).

A QRS duration ≥ 120 ms was present in 36 of 119 patients (30%) with left main CAD, in 366 of 1,369 patients (27%) with left anterior descending CAD, in 253 of 1,071 patients (24%) with left circumflex CAD, and in 270 of 1,195 patients with right coronary CAD (p not significant).

Table I. Prevalence of a QRS duration ≥ 120 ms associated with severity of coronary artery disease in 2,196 patients undergoing coronary angiography for suspected coronary artery disease

Extent of coronary artery disease	QRS duration ≥ 120 ms
No coronary artery disease (n = 220)[1]	30 (14%)
Nonobstructive coronary artery disease (n = 276)[2]	44 (16%)
1-vessel obstructive coronary artery disease (n = 441)[3]	76 (17%)
2-vessel obstructive coronary artery disease (n = 464)[4]	99 (21%)
3-vessel obstructive coronary artery disease (n = 795)[5]	217 (27%)

p < 0.001 comparing 5 with 1, 5 with 2, and 5 with 3
p <0.02 comparing 5 with 4 and 4 with 1

Discussion

A QRS duration of ≥ 120 ms on the resting ECG was associated with increased mortality in 1,455 postinfarction patients (hazard ratio = 4.0) [1], in 669 patients with heart failure (risk ratio = 1.46) [2], and in 915 patients undergoing risk stratification for ventricular arrhythmias (hazard ratio = 2.1) [3]. At 17-month follow-up of 1,040 patients with coronary heart disease or hypertensive heart disease with left ventricular hypertrophy, all-cause mortality was 11% in 598 patients with a normal left ventricular ejection fraction (LVEF) and a normal QRS duration, 19% in 100 patients with a normal LVEF and a QRS duration of ≥ 120 ms, 22% in 242 patients with an abnormal LVEF and a normal QRS duration, and 36% in 100 patients with an abnormal LVEF and an QRS duration of ≥ 120 ms [4].

Nelson *et al*. [5] reported a strong correlation between the QRS durations and coronary artery calcium scores in patients in the Diabetes Heart Study. Yosefy *et al*. [6] reported that computer-measured QRS duration changes during exercise testing were more sensitive and specific than ST-T wave changes for the detection of ischemia in 234 women. Michaelides *et al*. [7] reported that exercise-induced QRS prolongation in patients with CAD is a marker of myocardial ischemia.

To the best of our knowledge, the prevalence of a QRS duration of ≥ 120 ms on the resting ECG correlated with the severity of CAD diagnosed by coronary angiography has not been previously reported. The present study reports in 2,196 patients undergoing coronary angiography for suspected CAD that the prevalence of a QRS duration of ≥ 120 ms on the resting ECG was 14% in patients with no CAD, 16% in patients with nonobstructive CAD, 17% in patients with 1-vessel obstructive CAD, 21% in patients with 2-vessel obstructive CAD, and 27% in patients with 3-vessel obstructive CAD. The greater the severity of obstructive CAD,

the higher the prevalence of a QRS duration of ≥ 120 ms on the resting ECG. These data were observed with the persons interpreting the ECGs blinded to the coronary angiographic findings and the persons interpreting the coronary angiograms blinded to the ECG findings. The mechanism linking the wide QRS duration with increasing severity of CAD has not been investigated and needs to be investigated.

Acknowledgments

None of the authors have any conflict of interest pertaining to this paper.

References

1. Bauer A, Watanabe MA, Barthel P, et al. QRS duration and late mortality in unselected post-infarction patients of the revascularization era. Eur Heart J 2006; 27: 427-33.
2. Iuliano S, Fisher SG, Karasik PE, et al. QRS duration and mortality in patients with congestive heart failure. Am Heart J 2002; 143: 1085-91.
3. Kalahasti V, Nambi V, Martin DO, et al. QRS duration and prediction of mortality in patients undergoing risk stratification for ventricular arrhythmias. Am J Cardiol 2003; 92: 798-803.
4. Lai HM, Aronow WS, Rachdev A, et al. Incidence of mortality in 1,040 patients with coronary heart disease or hypertensive heart disease with normal and abnormal left ventricular ejection fraction and with normal and abnormal QRS duration. Arch Med Sci 2008; 4: 140-2.
5. Nelson MR, Daniel KR, Carr JJ, et al. Associations between electrocardiographic interval durations and coronary artery calcium scores: the Diabetes Heart Study. Pacing Clin Electrophysiol 2008; 31: 314-21.
6. Yosefy C, Cantor A, Reisin L, et al. The diagnostic value of QRS changes for prediction of coronary artery disease during exercise testing in women: false-positive rates. Coron Artery Dis 2004; 15: 147-54.
7. Michaelides A, Ryan JM, VanFossen D, et al. Exercise-induced QRS prolongation in patients with coronary artery disease: a marker of myocardial ischemia. Am Heart J 1993; 126: 1320-5.