Comparison of the Prevalence of First-Degree Atrioventricular Block in African-American and in Caucasian Patients: An Electrocardiographic Study III

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Background: Electrocardiographic (ECG) differences occur between African-American and Caucasian patients.

Methods: The study includes ECGs of 2,123 patients, ages 20–99 years attending an urban hospital.

Results: First-degree atrioventricular (AV) block was more prevalent in African-American patients compared with Caucasian patients in all age groups of the study except for those patients in the eighth decade of life. The prevalence of first-degree AV block began to increase at age 50 years in both ethnic groups and gradually increased with advancing age, peaking in African-American patients in the 10th decade of life, and in Caucasian patients in the ninth decade of life. The continuing increase in first-degree AV block in African-American patients in the 10th decade of life suggests increasing impairment but greater durability of the AV conduction system in African-American compared with Caucasian patients. The dramatic decline of the prevalence of first-degree AV block in Caucasian patients in the 10th decade of life suggests more frequent failure of the AV conduction system in this group of patients at ages 90–99 years, compared with African-American patients in the same age group. In population-based surveys, first-degree AV block was more prevalent in African-American subjects compared with Caucasian subjects.

Key words: AV block ■ AV conduction ■ pacemakers ■ electrocardiograms

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It is the purpose of this study to present data on the prevalence of first-degree atrioventricular (AV) conduction block in African-American and Caucasian patients attending an urban hospital. In earlier studies of racial differences of the electrocardiogram (ECG), African-American patients attending an urban hospital had atrial fibrillation and intraventricular block significantly less frequently than Caucasian patients.[1,2] Piedmont Hospital in Atlanta, GA is a 500-bed tertiary care facility offering a wide variety of medical, surgical, and diagnostic services (including invasive cardiovascular studies and treatment, and cardiovascular surgery). The hospital serves a metropolitan area with 4.1 million people.

METHODS AND DEFINITIONS

The study group consisted of 2,123 patients—1,201 Caucasian patients and 922 African-American patients—attending the hospital as both inpatients, outpatients, and the emergency department. These patients had an ECG recorded as part of their examination, and they were divided according to patient age into 10-year groups beginning at the third decade of life and extending through the 10th decade of life. ECGs recorded between October 28, 1996 and June 30, 1998 were retrieved from the files of the Carter Smith, Sr. ECG Laboratory of the hospital in groups of 95 to 250 ECGs for each age group of both African-American and Caucasian patients. The number of patients in each age group varied because of differing numbers of patients in the study groups attending the hospital but averaged 115 for African-American patients (range: 43–167) and 150 for Caucasian patients (range: 104–181). Each group of ECGs was studied in a consecutive manner. When a series of ECGs were recorded on a patient, the earliest ECG was chosen as the one of study. All ECGs were recorded with the patient supine using the computer programs of the Marquette Electronic MAC8 Resting ECG Analysis system at a paper speed of 25 mm/s, and the author reviewed all ECG interpretations. Correlation of the patient's ECG and hospital diagnosis

was not within the scope of this study. All calculations of the prevalence of first-degree AV block were rounded off to the nearest 10th of a percent.

Standard definitions of first-degree AV block were used throughout the study,[3,4] and the lead with the longest PR interval, usually lead II, was employed for the study. First-degree AV block is defined as occurring in a patient with sinus rhythm and a PR interval of 210 ms or greater. Seven patients were excluded from the study: three with complete AV block, two with second-degree AV block, and two with second-degree sino-atrial block. The results of the present study are compared with data from population-based surveys.[5-9]

STATISTICAL ANALYSIS

Pearson's χ^2 (Chi-squared) test was used to compare differences in the prevalence of AV block in various groups. A p value of <0.05 is considered statistically significant.

RESULTS

Figure and Table 1 demonstrate the gradual rising prevalence of first-degree AV block with advancing age in both ethnic groups. In the study group (Table 1), 6.9% (n=64 of 922) African-American patients had first-degree AV block, compared with 7.0% (n=84 of 1,201) Caucasian patients. For African-American patients, there is a gradual rise in the prevalence of first-degree AV block beginning at age 50 years and peaking in the 10th decade of life at 23.3% (n=10 of 43) patients. For Caucasian patients there is a gradual rise in the prevalence of first-degree AV block beginning at age 50 years with peaking in the ninth decade of life at 14.6% (n=26 of 178) patients, followed by a decline in the 10th decade of life to 12.2% (n=22 of 181) patients. First-degree AV block is more prevalent in African-American patients compared with Caucasian patients in all age groups of the study except for those patients in the eighth decade of life.

Gender and Racial Prevalences of First-Degree AV Block

First-degree AV block occurred in 7.6% (n=72 of 950) male patients in the study, in 7.1% (n=27 of 380) African-American male patients, and in 7.9% (n=45 of 570) Caucasian male patients. First-degree AV block occurred in 6.5% (n=76 of 1,173) female patients in the study group, in 6.8% (n=37 of 542) African-American female patients; and in 6.2% (n=39 of 631) Caucasian female patients.

The Placement of Electronic Pacemakers

In the study group, 47 patients received electronic pacemakers. For African Americans 1.3% (n=12 of 922) patients received electronic pacemakers. Placement of the pacemakers occurred primarily between ages 80–89 years when six of the 12 pacemakers were placed. For Caucasians, 2.9% (n=35 of 1,201) patients received electronic pacemakers. Placement occurred primarily between ages 80–99 years when 27 of the 35 pacemakers were placed.

DISCUSSION

In an urban hospital setting, the prevalence of first-degree AV block is slightly less in African-American patients compared with Caucasian patients. The greatest contrast of the prevalence of first-degree AV block between the two ethnic groups occurs in the 10th decade of life when the prevalence of first-degree AV block rises to a level of 23.3% (n=10 of 43) in African-American patients compared with only 12.2% (n=22 of 181) in Caucasian patients in the same age group; p=0.06. The cause of the reduced prevalence of first-degree AV block in Caucasian patients in the 10th decade of life is not known. Although the sample size is relatively small for analysis, and the statistical relationship approaches—but does not achieve—traditional criteria of significance, one can speculate that the presence of various disease states involving the AV node could lead to complete AV block, death, or the implan-

Table 1. Prevalence of First-Degree Atrioventricular Block by Age and Race in an Urban Hospital

Age Groups (Years)	20–29	30–39	40–49	50–59	60–69	70–79	80–89	90–99	Totals
Number of patients in age group	223	217	296	296	284	295	288	224	2123
Race: Caucasian/ African-American	117/106	104/113	129/167	153/143	167/117	172/123	178/110	181/43	1,201/922
Number of patients with first-degree atrioventricular block	1/3	1/4	1/4	7/10	12/10	14/6	26/17	22/10	84/64
Percent	0.9/2.8	1.0/3.5	0.8/2.4	4.6/7.0	7.2/8.5	8.1/4.9	14.6/15.5	12.2/23.3	7.0/6.9

tation of an electronic pacemaker. Such a series of events would result in a decreased prevalence of first-degree AV block in Caucasian patients in the 10th decade of life. A similar observation was reported in an earlier study of intraventricular block in which there was a dramatic reduction in the prevalence of left ventricular conduction block in both ethnic groups in the 10th decade of life.[2] This suggested failure of left ventricular conduction with advancing age due to increasing sclerosis of the left ventricular conduction system.

By way of contrast, the greater prevalence of first-degree AV block in African-American patients in the 10th decade of life suggests increasing impairment but greater durability of the AV conduction system in African-American patients compared with Caucasian patients.

First-degree AV block was more common in males at 7.6%, compared with females at 6.5%, in both ethnic groups. Although the relationship was not statistically significant, first-degree AV block was most common in Caucasian males at 7.9% (n=45 of 570) and was least common in Caucasian females at 6.2% (n=39 of 631); p=0.25; and in African-American females at 6.8% (n=37 of 542); p=0.50. In an earlier study, intraventricular block was most prevalent in Caucasian males at 16.8% and was least prevalent in African-American females at 6.5%.[2] Thus, by combining the findings of both studies, Caucasian males have the greatest prevalence of conduction system disease and African-American females have the least prevalence of conduction system disease.

In studies of pooled data of population-based surveys, the prevalence of first-degree AV block is statistically significantly higher in African-American subjects compared with Caucasian subjects.[5-8] In Table 2, the prevalence of first-degree AV block in African Americans is 4% (n=60 of 1494) subjects compared with 2% (n=79 of 3976) Caucasian subjects; p= 0.00002. In a large select group of healthy U.S. Air Force male flying personnel, 0.6% of whom were African-American subjects,[9] the prevalence of first-degree AV block is low compared with both hospital patients and with subjects of other population-based surveys. In these largely Caucasian subjects, ages 17–54 years, first-degree AV block occurred in 0.52% (n=350 of 67,375) subjects. In contrast the prevalence of first-degree AV block in African-American subjects in this study, ages 21–26 years, was 1.7% (n=7 of 409) subjects. The prevalence of first-degree AV block in both ethnic groups is greater in the present study of urban hospital patients at 7.0% (n=148 of 2,123) compared with the prevalence of first-degree AV block in pooled data of population-based surveys at 2.5% (n=139 of 5,470). This difference is expected because most patients attending an urban hospital are ill, whereas the majority of subjects in population-based surveys are not ill. In summary, the prevalence of first-degree AV block varies in different groups:

1. Urban hospital group 7.0%;
2. Population-based surveys..... 2.5%;
3. Healthy U.S. Air Force African-American subjects..... 1.7%;
4. Healthy U.S. Air Force Caucasian subjects. . 0.52%.

The cause of a prolonged PR interval in patients is often obscure. It may be due to various drugs or disease

Table 2. Population Surveys of First-Degree Atrioventricular Block by Age and Race

Age Groups (Years)	40–64	45–64	35–74	50–69	Totals
Number of subjects in age group	287*	2,686#	993*	1,504+	5,470
Race: Caucasian/African-American	143/144	2,193/493	584/409	1,056/448	3,976/1,494
Number of Caucasian subjects with first-degree atrioventricular block	4	34	1	40	79
Percent					2.0
Number of African-American subjects with first-degree atrioventricular block	13	20	4	23	60
Percent					4.0
Source:	Strogatz[5]	Vitelli[6]	Sutherland[7]	Riley[8]	

* all males; #698 Caucasian males, 1,495 Caucasian females, 116 African-American males, 377 African-American females; + 423 Caucasian males, 633 Caucasian females, 180 African-American males, 268 African-American females

states which slow AV conduction, but in population-based surveys of mostly healthy subjects the cause of first-degree AV block in both ethnic groups presumably is due to increased vagal tone. In a study of subjects with first-degree AV block, the PR interval was reduced to 0.20 s or less in 88% (n=83 of 94) subjects who had been given intravenous atropine.[9] The combined effects of standing and of exercise in the same group demonstrated that the PR interval was shortened to 0.20 s or less in 89% (n=84 of 94) subjects. These findings suggested that first-degree AV block in these subjects was the result of increased vagal tone. In a study of 289 healthy male professional football players, ages 21–35 years, weight lifting one- to three hours per day was an integral part of training for each player.[10] African-American athletes comprised 34% (n=97) players of the group. Sinus bradycardia at 60 bpm or less was present in 77% (n=223) players of the group, and first-degree AV block was present in 9% (n=26) players. With exercise, the PR interval shortened to less that 0.20 s in every instance. This suggested that increased vagal tone in this group was responsible for the sinus bradycardia and for the associated AV conduction delay.

The frequency of pacemaker placement was more than twice as great in Caucasian patients compared with African-American patients, presumably because of better intraventricular conduction and more-durable AV conduction demonstrated in an earlier study[2] and in the present study, respectively, in African-American patients compared with Caucasian patients.

SUMMARY

1. In an urban hospital setting, beginning at age 50 years in both ethnic groups, the prevalence of first-degree AV block gradually increases with advancing age, peaking at 23.3% in African-American patients in the 10th decade of life and at 14.6% in Caucasian patients in the ninth decade of life;

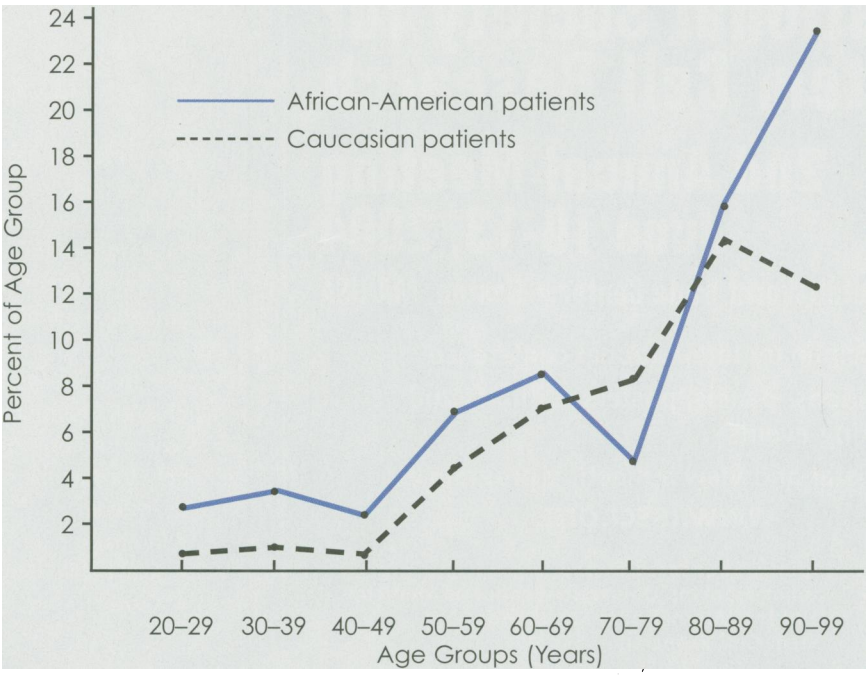
2. In Caucasian patients, there is a dramatic decline in the prevalence of first-degree AV block in the 10th decade of life, suggesting increased failure of the AV conduction system in this age group;

3. The higher prevalence of first-degree AV block in African-American patients in the 10th decade of life suggests increasing impairment but greater durability of the AV conduction system compared with Caucasian patients;

4. The prevalence of first-degree AV block is greater in African-American patients compared with

Figure 1. Prevalence of Atrioventricular Block by Age and Race

The prevalence of first-degree AV block at various ages in African-American and Caucasian patients. The prevalence of first-degree AV block in African-American patients gradually increases from age 50 through 99 years to a level of 23.3% in the 10th decade of life. For Caucasian patients, the prevalence of first-degree AV block gradually increases from age 50 through 89 years to a level of 14.6% in the ninth decade of life, followed by a decline to 12.2% in the 10th decade of life. First-degree AV block is more prevalent in African-American compared with Caucasian patients at all age groups except in the eighth decade of life.



Caucasian patients in all age groups in the study except for those patients in the eighth decade of life;

5. First-degree AV block is most prevalent in Caucasian males at 7.9% and least prevalent in Caucasian females at 6.2% and in African-American females at 6.8%.

6. In population-based surveys, first-degree AV block is more prevalent in African-American subjects compared with Caucasian subjects.

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REFERENCES

1. Upshaw Jr CB. Reduced prevalence of atrial fibrillation in black patients compared with white patients attending an urban hospital: an electrocardiographic study. *J Natl Med Assoc.* 2002;94:204-208.

2. Upshaw Jr CB. Lower prevalence of intraventricular block in African-American patients compared with Caucasian patients: an electrocardiographic study II. *J Natl Med Assoc.* 2003;95:818-824.

3. 12SL ECG Analysis Program; Physician's Guide, Revision B; General Electric Marquette Medical Systems Company, Inc., Milwaukee, WI; 1999:6-12.

4. Silverman ME, Myerburg RJ, Hurst JW. Electrocardiography; Basic Concepts and Clinical Application. New York, NY: McGraw-Hill Book Company, 1983;299,300,320.

5. Strogatz DS, Tyroler HA, Watkins LO, et al. Electrocardiographic abnormalities and mortality among middle-aged black men and white men of Evans County, GA. *J Chronic Dis.* 1987;40:149-155.

6. Vitelli LL, Crow RS, Shahar E, et al. Electrocardiographic findings in a healthy biracial population. *Am J Cardiol.* 1998;81:453-459.

7. Sutherland SE, Gazes PC, Keil JE, et al. Electrocardiographic abnormalities and 30-year mortality among white and black men of the Charleston Heart Study. *Circulation.* 1993;88:2685-2692.

8. Riley CP, Oberman A, Hurst DC, et al. Electrocardiographic findings in a biracial, urban population; the Birmingham Stroke Study. *Ala J Med Sci.* 1973;10:160-170.

9. Johnson RL, Averill KH, Lamb LE. Electrocardiographic findings in 67,375 asymptomatic subjects; VII. atrioventricular block. *Am J Cardiol.* 1960;6:153-177.

10. Balady GJ, Cadigan JB, Ryan TJ. Electrocardiogram of the athlete: an analysis of 289 professional football players. *Am J Cardiol.* 1984;53: 1339-1343. ■