Table 1 Baseline Demographics and Characteristics

Variables	NFL (n = 257)	NHANES (n = 1,539)	p Value
Age (yrs)	53.9 ± 1.0	52.9 ± 0.4	0.35
BMI (kg/m^2)	32.3 ± 0.3	30.0 ± 0.1	<0.001
Race (%)			
White	52	53	0.67
Black	47	22	<0.001
Other	1	24	<0.001
Systolic blood pressure (mm Hg)	133.5 ± 1.1	126.5 ± 0.5	<0.001
Diastolic blood pressure (mm Hg)	80.0 ± 0.7	72.7 ± 0.3	<0.001
Hypertension (%)	37.8	21.4	<0.001
Overweight (%)*	33.9	53.1	<0.001
Obese (%)†	63.7	40.5	<0.001
Total cholesterol (mg/dl)	183.4 ± 4.1	195.3 ± 1.5	0.02
Triglycerides (mg/dl)	149.8 ± 12.7	168.0 ± 4.7	<0.001
HDL concentration (mg/dl)	44.0 ± 0.8	47.0 ± 0.3	<0.001
LDL concentration (mg/dl)	121.4 ± 2.3	117 ± 1.3	0.16
Fasting glucose (mg/dl)	101.1 ± 1.8	109.6 ± 1.0	<0.001
History of diabetes (%)	7.0	12.4	0.03
History of smoking (%)	4.3	57.6	<0.001
Apnea-hypopnea index (events/h)	16.6 ± 1.0	‡	
SDB (%)	52.3	‡	

Data are presented as mean ± SD for continuous variable and as percentages for categorical variables. *Defined as a BMI of ≥ 30 kg/m^2. †Defined as a BMI of 25 to 29.9 kg/m^2. ‡The NHANES group did not undergo sleep evaluation to diagnose SDB.

BMI = body mass index; HDL = high-density lipoprotein; LDL = low-density lipoprotein; NFL = National Football League; NHANES = National Health and Nutrition Examination Survey; SDB = sleep-disordered breathing.

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REFERENCES

1. Baron SRR. Health Hazard Evaluation Report, National Football League Players Mortality Study. Atlanta, GA: Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, 1994. Report No. HETA 88-085.
2. Somers VK, White DP, Amin R, et al. Sleep apnea and cardiovascular disease: an American Heart Association/American College of Cardiology Foundation Scientific Statement from the American Heart Association Council for High Blood Pressure Research Professional Education Committee, Council on Clinical Cardiology, Stroke Council, and Council on Cardiovascular Nursing. J Am Coll Cardiol 2008;52:686–717.
3. George CF, Kab V, Levy AM. Increased prevalence of sleep-disordered breathing among professional football players. N Engl J Med 2003;348:367–8.
4. Tucker AM, Vogel RA, Lincoln AE, et al. Prevalence of cardiovascular disease risk factors among National Football League players. JAMA 2009;301:2111–9.

Letters to the Editor

Electrocardiographic Criteria in Takotsubo Cardiomyopathy and Race Differences

Asians Versus Caucasians

Recently, Kosuge et al. (1) reported an interesting set of electrocardiographic criteria in order to differentiate Takotsubo cardiomyopathy (TC) from anterior myocardial infarction (AMI), with its consequent prognostic implications. ST-segment depression in aVR together with the absence of ST-segment elevation in V_1 clearly helped to differentiate TC from anterior AMI in their Asian population and was superior to any other electrocardiographic finding (1). However, we feel it is worthy to point out that in TC there are some race electrocardiographic differences that could make the widespread use of this criteria in Caucasians challenging (2). Thus, Caucasians more frequently have T-wave inversion, whereas Asians more frequently have ST-segment elevation (2,3). In our experience, including only patients within 6 h of symptom onset as well (1) and taking account only the first admission electrocardiogram, we found 51 TC patients and compared them with 135 anterior AMI patients randomly selected (age 65.25 ± 13 years vs. 63.84 years, $p = 0.5$; women 78.8% vs. 25.9%, $p < 0.001$, respectively). In our TC series, onset persistent ST-segment elevation was barely displayed in 50%, and negative T waves were shown in 26.9%. When we tested the Kosuge score (1), we only found 3 TC patients fulfilling together both lead criteria (vs. 1 in the AMI group, $p = 0.007$). Therefore, the area under the curve was small (0.529). We conclude that race and epidemiologic differences should be strongly considered when a TC suspicion is made. In our opinion, until further studies report more evidence, invasive regular AMI management is warranted, at least in all Caucasian patients.

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REFERENCES

1. Kosuge M, Ebina T, Hibi K, et al. Simple and accurate electrocardiographic criteria to differentiate Takotsubo cardiomyopathy from anterior acute myocardial infarction. J Am Coll Cardiol 2010;55:2514–6.
2. Donohue D, Movahed MR. Clinical characteristics, demographics and prognosis of transient left ventricular apical ballooning syndrome. Heart Fail Rev 2005;10:311–6.
3. Nunez-Gil IJ, Fernandez-Ortiz A, Perez-Isla L, et al. Clinical and prognostic comparison between left ventricular transient dyskinesia and a first non-ST-segment elevation acute coronary syndrome. Coron Artery Dis 2008;19:449–53.

Reply

We thank Dr. Núñez-Gil and colleagues for their interest in our paper (1). They have concerns regarding racial differences in electrocardiographic (ECG) findings between Asians and Caucasians with Takotsubo cardiomyopathy (TC). To our knowledge, only 1 study by Donohue et al. (2) showed such a difference in TC: Caucasians more frequently had T-wave inversion, whereas Asians more frequently had ST-segment elevation, as Dr. Núñez-Gil and colleagues suggested. However, time from symptom onset to recording ECG was not specified in that study (2). ECG findings are time-dependent in TC. Mitsuma et al. (3) examined detailed ECG changes in TC and showed that TC was characterized by 4 ECG phases: phase 1, initial ST-segment elevation immediately after the onset; phase 2, initial T-wave inversion after ST-segment elevation from days 1 to 3; phase 3, transient improvement in T-wave inversion in the subacute period; and phase 4, second deeper T-wave inversion persisting for several months. Perhaps ST-segment elevation is present in patients early in the course of TC, and T-wave inversion without ST-segment elevation occurs subsequently. Moreover, the perception of symptoms is subjective, and the timing of symptom onset is unclear in some patients or difficult to decide in others whose symptoms wax and wane. This is compounded by the fact that most patients with TC are elderly women, in whom the evaluation of symptoms is often challenging. Therefore, our study included only patients who were admitted within 6 h after symptom onset and had acute ST-segment elevation in pre-cordial leads on admission ECG. In 33 patients with TC in our study, T waves became inverted at 16 ± 7 h, after which the inversion deepened progressively to its first negative peak, occurring at 2 ± 2 days, consistent with the findings of Mitsuma et al. (3). We believe that our strict entry criteria enabled us to differentiate TC from anterior acute myocardial infarction on admission ECG. Our findings may not be able to be extrapolated to a general group of patients with TC. However, in patients with TC and anterior acute myocardial infarction who are admitted within 6 h after symptom onset with acute ST-segment elevation, differential diagnosis is essential for deciding whether reperfusion therapy is indicated. Further studies in larger numbers of patients are needed to verify our results and the presence or absence of racial differences in ECG findings between Asians and Caucasians with TC, as Dr. Núñez-Gil and colleagues suggested.

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REFERENCES

1. Kosuge M, Ebina T, Hibi K, et al. Simple and accurate electrocardiographic criteria to differentiate Takotsubo cardiomyopathy from anterior acute myocardial infarction. J Am Coll Cardiol 2010;55:2514–6.
2. Donohue D, Movahed MR. Clinical characteristics, demographics and prognosis of transient left ventricular apical ballooning syndrome. Heart Fail Rev 2005;10:311–6.
3. Mitsuma W, Kodama M, Ito M, et al. Serial electrocardiographic findings in women with Takotsubo cardiomyopathy. Am J Cardiol 2007;100:106–9.