



Racial Variation in the Complexity of Coronary Artery Disease in Patients with Acute ST-Segment Elevation Myocardial Infarction☆

Ayman Elbadawi^{a,*}, Erfan Alotaki^b, Carlos Vazquez^c, Kirolos Barssoum^b, Sumon Roy^b, Hend I. Shahin^d, Islam Y. Elgendy^e, Jeremiah P. Depta^f

^a Division of Cardiovascular Medicine, University of Texas Medical Branch, Galveston, TX, United States of America

^b Department of Internal Medicine, Rochester General Hospital, Rochester, NY, United States of America

^c Division of Cardiovascular Medicine, University of New Mexico, Albuquerque, NM, United States of America

^d Department of Pharmaceutical Sciences, Future University, Cairo, Egypt

^e Division of Cardiovascular Medicine, University of Florida, Gainesville, FL, United States of America

^f Sands-Constellation Heart Institute, Rochester General Hospital, Rochester, NY, United States of America

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ABSTRACT

Background: Racial variations in presentation of patients with ST-segment elevation myocardial infarction (STEMI) have been suggested.

Methods: This was a retrospective analysis of a tertiary center from 2012 to 2016. We included patients presenting with acute STEMI who received primary percutaneous coronary intervention (PCI). The main outcome was racial variation in the complexity of coronary artery disease assessed by SYNTAX score. We also reported predictors of higher SYNTAX scores in the study population.

Results: Our final analysis included 260 patients: 201 Whites (77.3%), 24 African Americans-AA (9.2%), 19 Hispanics (7.3%) and 15 were of other ethnicities (5.8%). The mean SYNTAX score was 13.8 ± 7.7 . There was no significant difference between Whites, AA, Hispanics and other races in the SYNTAX score (13.8 ± 7.7 , 13.4 ± 7.9 , 14.5 ± 9 and 13.5 ± 6.6 , $p = 0.965$). Logistic regression analysis identified chronic kidney disease as the only significant predictor of higher SYNTAX score (Coefficient = 3.5, 95%CI:0.41–6.60, $p = 0.026$), while no significant association was identified between different races and higher SYNTAX score.

Conclusion: The current study did not identify racial variations in the complexity of coronary artery disease for STEMI patients. Further studies are needed at a larger scale to identify racial variations in STEMI patients.

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1. Background

Atherosclerosis is the primary cause of morbidity and mortality worldwide [1,2]. Identification of persons at high risk for cardiovascular events is the major focus of primary prevention efforts. This includes lifestyle changes and pharmacological interventions that have been shown to increase the life expectancy of high-risk persons [3]. The World Health Organization has projected a major shift in racial representativeness for the population of coronary artery disease (CAD) in coming decades, resulting in less Caucasians and more other races like Asians and African Americans (AA). Hence, statements from the American Heart Association have called for further research to explore the racial variations in presentation and outcomes of CAD [4]. Cardiovascular disease exhibits variations across

different races as regards pathophysiology, presentation, and clinical outcomes. [5] The background for these differences is multifactorial including genetic, environmental and lifestyle variations. [6,7] Some studies have found a lower prevalence of coronary artery calcification (CAC) estimated by Computed Tomography (CT) of coronary arteries in African Americans (AA) compared with Whites [8,9], while others found no differences [10,11]. Other studies demonstrated less progression of coronary artery disease in AA compared with Whites [12]. Racial variations in ST-segment elevation myocardial infarction (STEMI) have been also demonstrated [13]. In this study, we sought to evaluate racial variations in the complexity of coronary artery disease in patients presenting with STEMI assessed by the SYNTAX score.

2. Methods

This was an observational retrospective single center study. A comprehensive chart review was conducted of the electronic medical records for patients who were admitted to our tertiary referral center between January 2012 to January 2016 with acute STEMI and received primary

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* Corresponding author at: Department of Cardiovascular Medicine, University of Texas Medical Branch, 301 University Blvd, Galveston, TX 77555, United States of America.

E-mail address: amelbada@utmb.edu (A. Elbadawi).

PCI. Patients with missing data regarding ethnicity, demographics, missing images of their coronary angiograms, history of coronary artery bypass grafting or transferred from another facility were excluded.

The following data were gathered from the medical records for eligible patients: demographic data, past medical history, past surgical history, family history, medications history as well as relevant cardiac imaging and laboratory data. Images from coronary angiograms were reviewed and SYNTAX score was calculated for each patient using a validated SYNTAX-I score calculator.

Our main study outcome was the racial variation in the complexity of coronary artery disease assessed by the SYNTAX score. We also reported clinical predictors of higher SYNTAX score. The study was approved by the institutional review board and follows the ethics of the declaration of Helsinki.

3. Statistical analysis

Categorical variables were reported as counts and percentage while continuous variables were reported as mean \pm standard deviation or median and interquartile range depending on their distribution (normally distributed or not). Categorical variables were compared using chi-square test. Continuous variables were compared using independent sample *t*-test. A univariate linear regression analysis was used to evaluate predictors of higher SYNTAX score; those included: different races, age, gender, smoking, dyslipidemia, diabetes, hypertension, paroxysmal atrial fibrillation, chronic atrial fibrillation, chronic kidney disease (CKD), cerebrovascular disease, peripheral artery disease, obesity and prior CAD. A univariate binary regression analysis was conducted to evaluate the predictors of higher mortality; including same variables in the prior model in addition to door-to-balloon time and the SYNTAX score. A multivariable model was conducted if the results of the univariable analysis showed more than one significant association. Effect sizes were expressed using regression coefficient or odds ratio (OR). Associations were considered significant if the *p*-value was <0.05 . All statistical analyses were performed using SPSS® Statistics 25.

4. Results

During the study period, we identified 391 patients who were admitted for acute STEMI and received primary PCI. After excluding those with a history of CABG ($n = 51$), missing images of the full coronary angiograms ($n = 42$), missing data on ethnicity ($n = 31$) or transferred from other facilities ($n = 7$) we ended with 260 patients as our main study cohort. Among those, 201 (77.3%) were Whites, 24 (9.2%) were African Americans, 19 (7.3%) were Hispanics and 15 (5.8%) were of other races. Fig. 1 outlines the study flow sheet.

Baseline characteristics are presented in Table 1. African Americans had a higher prevalence of history of cerebrovascular accident (CVA) ($p = 0.047$) and hypertension (HTN) ($p = 0.016$) as well as younger age ($p = 0.010$) compared with other ethnicities. Location of infarction displayed some variation across ethnicities, with more inferior STEMI in Hispanics and Whites, more posterior STEMI in AA and Hispanics more commonly to have anterolateral STEMI.

Analysis of the main study outcome showed no significant racial variation in the SYNTAX score. The mean SYNTAX score in the whole population was 13.8 ± 7.7 . SYNTAX score in Whites was $13.8 (\pm 7.7)$ versus $13.4 (\pm 7.9)$ in AA, $14.5 (\pm 9)$ in Hispanics and $13.5 (\pm 6.6)$ in other races ($p = 0.965$). (Fig. 2).

A linear regression analysis was conducted to estimate predictors of higher SYNTAX score. When developing the model, we excluded 9 cases with missing variables; dyslipidemia ($n = 3$), atrial fibrillation ($n = 2$), cerebrovascular disease ($n = 3$), peripheral vascular disease ($n = 1$). Different ethnicities had no significant correlation with higher SYNTAX score. A history of CKD showed a significant association with higher SYNTAX scores (Coefficient = 3.5, 95%CI:0.41–6.6, $p = 0.026$). While other factors in the model including age, gender, and different baseline characteristics had no association with higher SYNTAX scores. (Fig. 3) (Supplemental Table 1) A multivariable regression analysis was also conducted to evaluate factors associated with higher 6-months mortality in our dataset. Results showed an increased 6-months mortality associating a higher SYNTAX score (OR = 1.1, 95%CI:1.01–1.14, $p = 0.050$) and increased door-to-balloon time (OR = 1.02, 95%CI:1.01–1.03, $p = 0.001$).

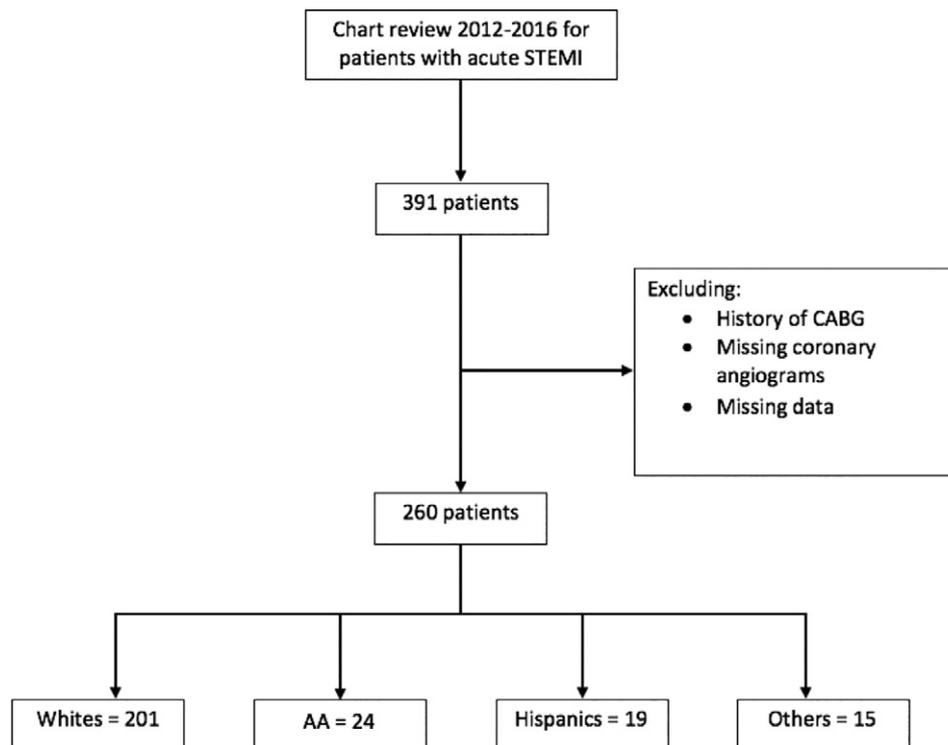


Fig. 1. Study flow sheet.

Table 1
Baseline characters of study population.

	White (n = 201)		African American (n = 24)		Hispanic (n = 19)		Others (n = 15)		P-value
Age mean (SD) ^a	65.3	±12	57	±10	66	±14.3	61.1	±11.4	0.010
Male	142	70.6%	20	83.3%	12	60.0%	13	86.7%	0.192
HTN	130	64.7%	18	75.0%	13	65.0%	4	26.7%	0.016
DM	48	24.0%	24	100.0%	6	30.0%	6	40.0%	0.302
Known CAD	54	26.9%	4	16.7%	4	20.0%	3	20.0%	0.631
PAD	10	5.0%	1	4.2%	1	5.3%	0	0%	0.848
CVA	17	8.5%	5	20.8%	0	0%	0	0%	0.047
CKD	17	8.5%	6	25.0%	3	15.0%	1	6.7%	0.076
Chronic AF	6	3.0%	1	4.2%	1	5.0%	0	0%	0.845
Paroxysmal AF	20	10.0%	2	8.3%	2	10.0%	0	0%	0.637
Previous PCI	31	15.5%	1	4.2%	4	20.0%	0	0%	0.147
Dyslipidemia	138	68.7%	12	50.0%	13	65.0%	6	40.0%	0.053
Smoking	143	71.1%	22	91.7%	14	70.0%	10	66.7%	0.176
DBT mean (SD)	56.9	±38.5	72.3	±48	60.4	±33	67.0	±32.5	0.266
≥2 diseased vessels	45	22.5%	3	13.0%	4	20.0%	2	13.3%	0.638
Anterior STEMI	72	35.8%	11	45.8%	6	30.0%	10	66.7%	0.079
Inferior STEMI	109	54.2%	7	29.2%	11	55.0%	4	26.7%	0.029
Lateral STEMI	3	1.5%	2	8.3%	0	0%	1	6.7%	0.103
Inferolateral STEMI	7	3.5%	1	4.2%	0	0%	0	0%	0.725
Anterolateral STEMI	6	3.0%	0	0%	3	15%	0	0%	0.023
Posterior STEMI	1	0.5%	2	8.3%	0%	0%	0	0%	0.007
LVEF mean (SD) ^a	47.3	±11.6	45.2	±13.8	51.4	±6.6	42.0	±18.8	0.138

SD = standard deviation; CAD = coronary artery disease; PAD = peripheral artery disease; CVA = cerebrovascular accident; CKD = chronic kidney disease; AF = atrial fibrillation; PCI = percutaneous coronary intervention; DBT = door to balloon time.

^a Independent student *t*-test.

5. Discussion

In this observational study of 260 patients, we sought to evaluate the racial variations in the complexity of coronary artery disease among STEMI patients. Our results showed no significant difference between Whites, AA, Hispanics and other races in their SYNTAX score. Similarly, a regression analysis showed no association between different races and SYNTAX score. History of CKD was the only identified predictor of higher SYNTAX score in our analysis. A multivariable regression analysis identified higher SYNTAX score and increased door-to-balloon time as predictors of higher 6-months mortality.

The burden and complexity of coronary atherosclerotic disease have several implications on different management strategies for patients with STEMI. The SYNTAX score is a well-validated score to quantify the severity of angiographic CAD, which has been used as a tool to help deciding optimal revascularization strategies (PCI versus CABG)

for patients with complex coronary artery disease. [14] Identification of racial variations in presentations and outcomes of coronary artery disease is crucial to implement race-specific preventive and treatment strategies. Racial variation in the complexity of coronary disease has been seldom addressed in the literature.

Our study results confirmed prior evidence establishing SYNTAX score as a predictor of adverse cardiovascular mortality and morbidity [14]. However, we found no racial variations in SYNTAX score between Whites, AA, Hispanics and other ethnicities. A multi-centered study was conducted by Gijbets et al. to evaluate racial variations in coronary artery disease severity, including 1000 patients of Caucasians, Chinese, Malays, and Indians [15]. Among patients with STEMI, Gijbets et al. found higher SYNTAX score among Chinese and Malays. Also, all-cause mortality was higher in Indians and Malays compared with Caucasians [15]. Another retrospective study compared coronary artery lesions between Australians and Mainland Chinese populations [16]. The study

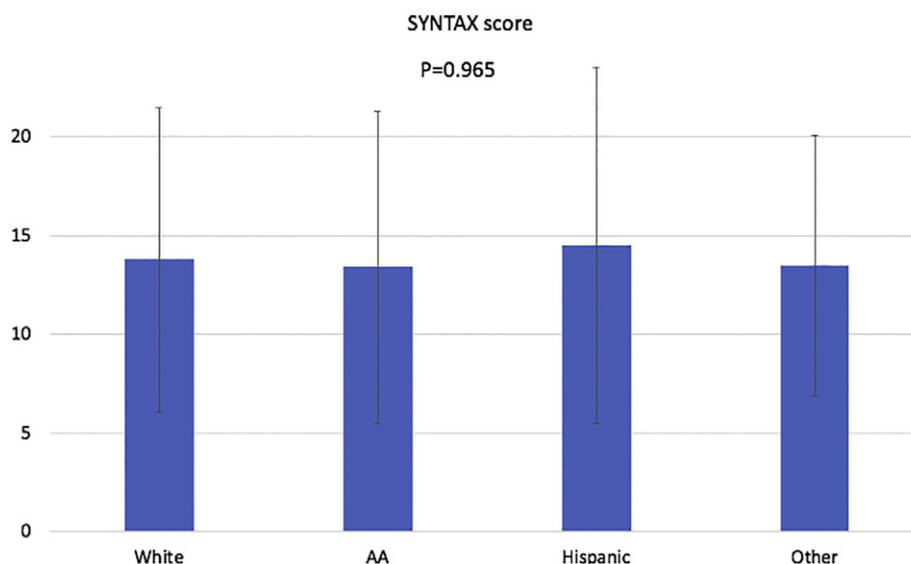


Fig. 2. Racial variation in SYNTAX score.

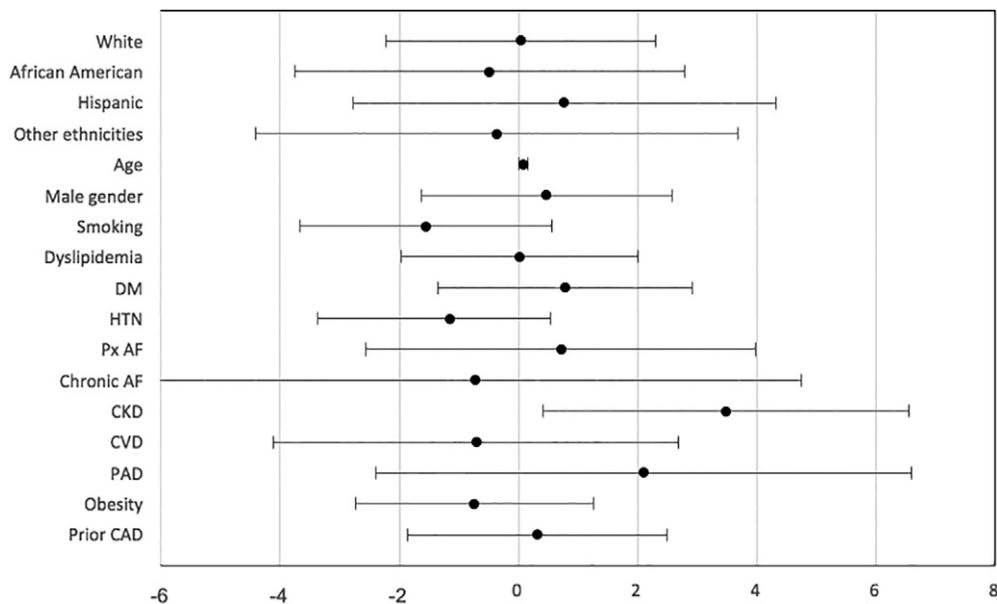


Fig. 3. Forrest plot demonstrating the predictors of higher SYNTAX score.

found more severe coronary artery lesions assessed by Gensini score in Australians compared with Mainland Chinese, with the biggest differences seen among ages >80 [16].

The mechanisms for possible inter-racial differences in CAD are probably of multifactorial origin. Socio-economic differences exist among different races, including cultural lifestyle differences that could directly impact atherosclerotic disease development and progression. Genetic differences across different races have been demonstrated as well [6]. Recently a study showed that Hispanics were more commonly associated with the development of collaterals of their coronary circulation compared to AA and White [7]. The same study group identified chromosomal regions, to which the racial variations were attributed [7].

The current analysis is the first study to identify CKD as an independent predictor of higher SYNTAX scores. Other studies have shown that CKD correlates with early and more severe coronary artery calcification in pre-dialysis as well as post-dialysis CKD patients [17]. The underlying pathophysiology has been attributed to disturbances in calcium and phosphorus homeostasis in CKD patients [18]. Moreover, uremia is associated with an enhanced inflammatory state and possible contributing to increased atherosclerotic disease [18].

Our study has some limitations. This study is a single center experience and the sample size might not have provided adequate representation of different races; hence, our results might not be generalizable. Some useful clinical data were not available for our analysis, such as the socioeconomic status of the patients. Being an observational analysis, the possibility of unmeasured confounders exists. However, we conducted multiple regression analysis to account for different factors.

6. Conclusion

The current study did not identify racial variation in the complexity of coronary artery disease among patients with STEMI. CKD was identified as an independent predictor of higher SYNTAX score. Future studies are still needed at a larger scale to further explore the racial variations in the complexity of coronary artery disease and its implications on clinical outcomes.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.carrev.2018.12.012>.

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