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ORIGINAL ARTICLE

Race/Ethnicity-Specific Disparities in the Severity of Disease at Presentation in Adults with Ulcerative Colitis: A Cross-Sectional Study

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Abstract

Background While ulcerative colitis (UC) is well studied in Caucasian populations, less data are available on UC patients of racial/ethnic minorities, including variations in disease severity at presentation.

Aim To evaluate race/ethnicity-specific disparities in UC disease presentation among an ethnically diverse underserved population.

Methods We performed a cross-sectional study of all consecutive UC adults among a large ethnically diverse safety-net hospital from July 2014 to May 2016 to compare race/ethnicity-specific disparities in severity of disease at presentation. Severity was evaluated using the clinician-based simple clinical colitis activity index (SCCAI) and the Mayo score at time of presentation. Multivariate ordered logistic regression models were used to evaluate associations with SCCAI and Mayo scores.

Results Among 98 UC patients (56.1% male, mean age 40.1 (SD 14.2), 32.0% were African-American, 26.7% Hispanic, 16.0% Asian, and 20.0% Caucasian. Mean Mayo score was 6.6 and mean SCCAI score was 6.5. When stratified by race/ethnicity, SCCAI scores were significantly higher in non-Caucasians compared to Caucasians (7.0 vs 4.6, $p = 0.03$) and in Asians compared to Caucasians (8.0 vs 4.6, $p = 0.02$). There was a trend toward higher mean SCCAI in Hispanics compared to Caucasians (6.9 vs 4.6, $p = 0.07$). Mayo scores at presentation demonstrated similar trends. On multivariate logistic regression, Asians (OR 5.26, 95% CI 1.24–22.42) and Hispanics (OR 3.74; 95% CI 1.02–13.66) had more severe disease at presentation than Caucasians based on SCCAI.

Conclusions Among a diverse underserved cohort of UC patients, racial/ethnic minority patients with UC, specifically Asians and Hispanics, had more severe disease at presentation compared to Caucasians. The differences may reflect disparities in timely access to specialty care and treatment and deserves greater attention and research.

Keywords Disparities · Inflammatory bowel disease · Safety-net · Mayo score

Abbreviations

SCCAI	Simple clinical colitis activity index
UC	Ulcerative colitis

Introduction

Ulcerative colitis (UC) contributes to significant disease burden in the USA, with a prevalence of 248 to 388 per 100,000 adults. This corresponds to roughly one million affected American adults [1–3].The complex management

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of UC patients contributes billions of dollars per year in direct medical costs alone to the health care system [4]. While many of these costs result from unavoidable progression of the disease, any delays in diagnosis or proper treatment can only exacerbate the prices we pay. Understanding disparities in disease presentation may create opportunities for improving timely diagnosis and management of UC patients.

Recent research in UC has focused heavily on development of new therapeutics to achieve acute disease control and long-term clinical remission [5–7]. Since therapeutic success is heavily influenced by timely receipt of and response to immunosuppressive agents, disparities in timeliness of appropriate therapies based on race/ethnicity have also been evaluated [8–10]. Less attention has been paid to severity of disease at time of presentation. This information can have important impact on the choice of therapy, therapeutic response, and the potential for complications [5]. Racial/ethnic disparities in severity of disease at presentation are particularly relevant, because despite UC primarily affecting Caucasians, the incidence has recently been increasing in ethnic minorities [11–14].

Understanding race/ethnicity-specific variations in UC epidemiology, including disease presentation and outcomes, is important given how ethnic minorities are traditionally underrepresented in large UC trials. Studies have clearly shown that the development and progression of UC has a strong genetic component [15–17]. As with all illnesses that are influenced by heritability, race/ethnicity is likely an important factor affecting UC epidemiology. While there is a clear genetic component in UC [18], the degree to which race and ethnicity influence disease presentation and long-term outcomes remains unknown. With these knowledge gaps in mind, our current study uses data from an ethnically diverse population to evaluate race/ethnicity-specific variations in the severity of UC at presentation.

Methods

Study Design and Data Source

A cross-sectional study was performed to retrospectively analyze all consecutive patients (age $\geq$18) with UC who were seen in the gastroenterology clinics of Highland Hospital in Oakland, California, from July 2014 to May 2016. All adult patients with IBD seen during this time period in the gastroenterology clinics were included in the sample cohort. Once potential patients were identified, a detailed review of the electronic health record was performed by a trained clinician researcher. The diagnosis of UC was determined through a detailed review of the medical records including supporting data from laboratory values, radiographic data, endoscopic and histopathology findings, as well as review of historical medical history. Confirmation of UC diagnosis was further assessed by evaluation of the gastroenterology clinic notes and supported by the clinical assessment and interpretation of the gastroenterology provider's notes. Highland Hospital is an urban safety-net healthcare system that is richly diverse and thus allowed us to include a large fraction of UC patients from ethnic minorities.

Outcome Measures

Disease severity of UC patients was determined based on the initial encounter in the gastroenterology clinics. An in depth review of electronic health records, clinic notes, laboratory values, radiographic data, endoscopic findings, and histopathology data from biopsies was conducted for each patient. These data were then further assessed using the simple clinical colitis activity index (SCCAI) and the Mayo score.

The SSCAI [19] is a 15-point index that assigns points based on bowel frequency during the day (0–3 points) and night (0–2), urgency of defecation (0–3), blood in stool (0–3), and general well-being (0–4) with extra points added for extracolonic manifestations of disease (1 point each). The Mayo score [20] is a 12-point scale that assigns 0–3 points across 4 categories: bowel frequency, rectal bleeding, physician global assessment, and severity of disease upon endoscopy. Endoscopic severity is broken down to normal, mild (erythema, decreased vascularity, and mild friability), moderate (marked erythema, absent vascularity pattern, friability, and erosion), and severe (spontaneous bleeding and ulceration). Given the retrospective nature of our study, when missing data were encountered, which prevented complete assessment and calculation of SCCAI and/or composite Mayo scores, the patient's disease severity data that could not be calculated were excluded. In addition to disease severity, we also evaluated baseline demographic and clinical data including sex, age at time of diagnosis, prevalence of *Clostridium difficile* infection, Hepatitis B serology results, ESR, and CRP.

Statistical Analysis

Clinical data were presented as proportions and frequencies or mean and standard deviation as appropriate. Comparison of SCCAI and Mayo scores between racial/ethnic groups relied on the unpaired Student's *t* test with Caucasians as the reference group. Scores were also analyzed on the basis of sex, age, presence of *Clostridium difficile* infection, and Hepatitis B status to assess for potential confounding variables. Categorical variables were compared using Chi-

squared testing. To perform an adjusted evaluation of predictors of disease severity at presentation, multivariate ordered logistic regression models were used to evaluate associations with SCCAI and Mayo disease severity scores at presentation. Our method for determination of variables to be included in the final model was based on a priori clinical assessment of factors that we hypothesized to be associated with disease severity. As such, all the variables selected for inclusion in the final model were selected a priori, and the final model adjusted for age, sex, and race/ethnicity.

Ethical Considerations

This study was approved by the Institutional Review Board at Alameda Health System.

Results

Among our cohort of 98 patients, the plurality of UC patients was African-American (32.0%) followed by Hispanic (26.7%), Caucasian (20.0%), and Asian (16.0%) (Table 1). The mean age of the cohort was 40.1 years (SD 14.2), and there were no significant differences in age at presentation among racial/ethnic groups. Overall, 56.1% of patients were male which was similar across all groups. Inflammatory markers at presentation grossly reflected the clinical scoring data when broken down by race/ethnicity.

The mean scores for the entire cohort were 6.5 for the SCCAI (Table 2) and 6.6 for the Mayo score (Table 3). When stratified by race/ethnicity, significant differences were observed in severity of disease at presentation. Compared to Caucasians with UC, non-Caucasian ethnic minorities had significantly more severe disease at presentation as reflected by a higher mean SCCAI score (7.0 vs 4.6, $p = 0.03$). The most significant disparities in disease severity at presentation were observed between Asians and Caucasians. Asians had significantly higher SCCAI disease severity score compared to Caucasians (8.0 vs 4.6, $p = 0.02$), whereas the differences seen in Hispanics (6.9 vs 4.6, $p = 0.07$) and African-Americans (6.3 vs 4.6 $p = 0.20$) were less pronounced.

While the evaluation of disease severity using the Mayo score revealed similar trends, the race/ethnicity-specific differences did not reach statistical significance (Table 3). For example, when compared to Caucasians with UC, Asians demonstrated a nonsignificant trends toward higher Mayo disease severity score at presentation (7.8 vs 5.4, $p = 0.11$) followed by Hispanics (7.4 vs 5.4, $p = 0.08$) and African-Americans (6.1 vs 5.4, $p = 0.54$).

On multivariate logistic regression mode, race/ethnicity-specific differences in disease severity persisted. Compared to Caucasians with UC, Hispanics (OR 3.74, 95% CI 1.02–13.66, $p < 0.05$) and Asians (OR 5.26, 95% CI 1.24–22.42, $p < 0.03$) were significantly more likely to have more severe disease at presentation when measured by SCCAI (Table 4). When measured by Mayo score, a nonsignificant trend toward more severe disease at presentation was observed in Hispanics when compared to Caucasians (OR 2.90, 95% CI 0.81–10.47, $p = 0.10$). No significant sex-specific or age-specific associations were observed.

Discussion

In an ethnically diverse safety-net population, our study of UC patients was composed of primarily ethnic minorities with over 80% being non-Caucasian. This diverse cohort displayed significant differences in severity of UC at presentation when using the SCCAI system. Asians in particular had significantly more severe disease at presentation when compared to Caucasians.

Table 1 Baseline characteristics of UC cohort

	Entire cohort	African-American	Hispanic	Asian	Caucasian
% of Cohort	–	30.1	29.8	17.9	19.1
% Male	56.1	57.1	57.7	56.3	61.1
Mean age	40.1	40.5	39.5	49.9	39.5
% C difficile positive	6.1	7.1	3.8	12.5	0
% HBV positive	3.1	7.1	0	6.3	0
Mean ESR	31.8	35.6	32.6	37.5	26.9
Median ESR	26.5	32.0	29.0	23.0	21.0
Mean CRP	7.6	14.2	4.4	9.6	1.8
Median CRP	1.5	3.8	2.9	1.6	0.4
Mean weight (lbs)	168.3	190	166	128	174

ESR erythrocyte sedimentation rate; *CRP* C-reactive protein

Table 2 SCCAI scores by race/ethnicity

Race/ethnicity	Caucasian	African-American	Hispanic	Asian	All non-Caucasian
SCCAI score	4.6	6.3	6.9	8.0	7.0
SD*	3.9	4.1	3.8	3.4	3.9
p value**	Reference	0.20	0.08	0.02	0.03

*Standard deviation **p value of the t test compared to Caucasians

Table 3 Mayo scores by race/ethnicity

Race/ethnicity	Caucasian	African-American	Hispanic	Asian	All non-Caucasian
Mayo score	5.4	6.1	7.3	7.4	6.9
SD*	3.6	3.2	2.7	2.5	2.9
p value**	Reference	0.54	0.08	0.11	0.10

* Standard deviation ** p value of the t test compared to Caucasians

Table 4 Multivariate ordered logistic regression models

Variable	Odd ratio	95% CI	*p* value
Outcome: Mayo score			
Age	1.00	0.98–1.04	0.76
Female	1.00	Reference	–
Male	1.83	0.77–4.34	0.17
Caucasian	1.00	Reference	–
African-American	1.16	0.34–3.91	0.81
Hispanic	2.90	0.81–10.47	0.10
Asian	2.51	0.60–10.52	0.21
Outcome: SCCAI score			
Age	1.01	0.98–1.04	0.46
Female	1.00	Reference	–
Male	1.78	0.75–4.19	0.19
Caucasian	1.00	Reference	–
African-American	1.93	0.57–6.54	0.29
Hispanic	3.74	1.02–13.66	<0.05
Asian	5.26	1.24–22.42	<0.03

The discrepancy between the significant differences seen in the SCCAI scores but not in the Mayo scores may reflect the incorporation of endoscopy results in the latter but not the former. Given the safety-net population, it is possible that patients may have experienced significant delays between diagnosis and colonoscopy. During this time, empiric immunosuppressive treatments were often initiated, thus contributing to a lower Mayo score at time of endoscopic evaluation. Early disease assessment using scoring systems such as the SCCAI system may provide a more accurate assessment of disease severity, especially among underserved populations where a delay in access to endoscopic evaluation exists. While no significant race/ethnicity-specific differences in UC disease severity were observed in our study when using the Mayo scoring system, it is interesting to note that prior studies relying on endoscopy-dependent scoring systems such as the Montreal classification or simply the extent of disease seen on endoscopy have also failed to demonstrate significant differences in disease severity by race/ethnicity [21–23].

Our results differ from a similar San Francisco-based study from 2010 that looked at a diverse cohort of inflammatory bowel disease patients with an UC cohort roughly the same size as our own [21]. The investigators demonstrated no significant race/ethnicity-specific differences in disease severity between their patients using the Montreal classification system, which, as discussed above, relies heavily on endoscopic assessments. However, the authors did observe that Asians with UC were significantly older at time of disease diagnosis, which reflected a strong trend observed in our UC cohort.

While the exact etiology of the race/ethnicity-specific differences in disease presentation is likely complex, underlying differences in disease genetics may partially explain differences in disease progression and complications. For example, in Asians but not Caucasians, certain mutations in the tumor necrosis factor protein and cytotoxic T lymphocyte antigen predispose patients to UC [24]. More generally, human leukocyte antigen and interleukin genotypes may be predictive of disease extent/severity, and differences by race/ethnicity may occur [25, 26].

Despite these findings, it is far from certain that ethnicity alone is the cause of the difference in presentation severity. Another possible explanation for more severe disease at presentation in Asian and Hispanic patients may reflect delays in access to care in these immigrant-heavy populations. It is reasonable to suspect that patients who are non-native English speakers may experience significant barriers in access to medical sub-specialty care and access to endoscopy. Furthermore, the low socioeconomic status that is typical of our safety-net population may also reflect poor understanding of UC and the need for seeking prompt medical attention for timely diagnosis and treatment. Even

when immigrant safety-net populations have insurance, they often face significant barriers to medical care access.[27] While length of time from symptoms onset to clinic presentation would provide valuable information about patient-specific factors affecting delays in seeking medical care, our current data do not allow a accurate assessment of these factors.

While our study incorporates a unique and under-studied population of UC patients, namely ethnic minorities and underserved safety-net populations, we acknowledge several limitations of our analyses. While the overall sample size of our cohort is relatively small, the number of non-Caucasian UC patients included is similar to the minority representation in previous studies that included many more Caucasian participants. In addition, as previously mentioned, specific factors that may have contributed to delays in patients seeking medical care could not be clearly evaluated. While the main focus of our analyses was to compare differences in disease severity between race/ethnic groups, we acknowledge that the two scoring systems we utilized in our study may be affected by the chronology of diagnostic workup, such that delays in access to colonoscopy may have affected the severity of disease as assessed by Mayo score. As such, direct comparisons between SCCAI and the composite Mayo score may be biased by timing of colonoscopy following initial presentation. It should also be acknowledged that our relatively small sample size and our safety-net population cohort limit the generalizability of our findings to populations with dissimilar demographics. Given our focus on race/ethnicity-specific differences, it is also possible that differences observed with respect to the clinical SCCAI scores may have been affected by discordance between the patient and provider spoken languages. While use of translation services is standard of care, there are inherent unmeasured cultural factors that result from patient-provider language discordance that may have affected the accuracy of assessing clinical symptoms.

In conclusion, this underserved safety-net population of UC patients with a large proportion of non-Caucasian minorities demonstrated a significant race/ethnicity-specific difference in severity of disease at presentation based on the SCCAI severity score. More research is needed to understand whether these observed differences are secondary to modifiable factors such as disease awareness and system-based barriers to access so that quality improvement interventions can be developed to improve outcomes among UC patients.

Compliance with ethical standards

Conflict of interest The authors of this manuscript have no conflicts of interest to disclose as described by *Digestive Diseases and Sciences.*

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