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Disparities in use of computed tomography for patients presenting with headache☆

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Abstract

Objective—Headache is a common presenting complaint in the emergency department (ED). Physicians may choose to screen for causes of headache using computed tomography (CT). It is not known whether patient characteristics influence this decision. This study sought to identify patient demographic factors associated with CT evaluation for adult patients with headache.

Methods—This study used a retrospective cohort review at an academic, urban ED. Study eligibility was based on chief complaint of headache and final diagnosis of the same. Detailed demographic (age, sex, race/ethnicity, insurance) and clinical (Emergency Severity Index [ESI], Charlson comorbidity score, pain score) data were abstracted from the ED medical record. The main outcome studied was whether a head CT was part of clinical evaluation.

Results—One hundred fifty-five patients were reviewed. Mean age was 42 years (SD, ±18 years); 75% female, 17% white, 41% black, and 33% Hispanic; 73% were insured; mean ESI was 3.06 (SD, ±0.64); and Charlson score was 0.60 (SD, ±1.55). Thirty-seven percent of patients underwent head CT. In multivariable analyses, patients were more likely to undergo head CT if they had greater acuity (ESI ≤ 3; odds ratio [OR], 5.11; P <.01) but were less likely to undergo head CT if they were black (OR, 0.21; P <.01) when adjusting for each other as well as older age, sex, comorbidity, insurance status, and history of migraine.

Conclusion—In this study, patients who were black were significantly less likely to undergo head CT during their ED evaluation for headache, independent of clinical and demographic factors.

1. Introduction

1.1. Background

Headache is a common presenting complaint in the emergency department (ED) and accounts for 1.7% of all visits [1]. An acutely life-threatening cause of headache is subarachnoid hemorrhage (SAH) that usually results from a ruptured saccular aneurysm. This condition affects an estimated 30,000 Americans every year [2]. Prospective analysis indicates that SAH accounts for 4% of ED visits for headache [3]. Evaluation with head CT (followed by lumbar

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puncture [LP], if the head CT is negative) is the gold standard diagnostic approach for the early detection of this life-threatening condition [4]. Given the time and expense involved in using CT and possible LP as part of a patient's diagnostic evaluation, physicians often reserve these tests for patients with compelling histories or focal neurologic examinations indicative of SAH.

1.2. Importance

Racial and ethnic disparities have been documented to exist in a wide range of health care settings. Specifically in the ED setting, disparities secondary to race and ethnicity have been found in use of analgesia [5,6], use of thrombolytics for suspected myocardial infarction [7] and stroke [8], diagnostic testing for cardiac conditions [9,10], and treatment of traumatic injuries [11,12]. We hypothesized that patient race and ethnicity may be a factor influencing physicians' decisions to use head CT in the diagnostic evaluation of headache.

1.3. Goals of this investigation

The goal of this study was to identify patient demographic factors associated with use of head CT evaluation for adult patients with headache.

2. Methods

2.1. Study design

This was a retrospective cohort review of a subset of patients with complaints of headache or head injury from a previous study evaluating pain care in the ED. The original study looked at patient-related and environment-related factors (specifically, patient demographics and ED census) influencing the quality of pain management for a variety of painful conditions.

2.2. Setting

The setting was an urban, academic, level II trauma, tertiary care ED (annual visits of approximately 76,000) during the months of July and December 2005.

2.3. Selection of participants

Adult patients (≥18 years) from the original study were enrolled based on presenting complaint and final ED diagnosis consistent with a painful condition involving abdomen, extremity, head, back, flank, or a fall. A waiver of consent was approved by the institutional review board.

2.4. Data collection and processing

For the purpose of this study, the ED medical record was reviewed for presenting complaint, final diagnoses, as well as mode of arrival, demographic (age, sex, race/ethnicity, insurance) and clinical data (Emergency Severity Index [ESI] [13], Charlson comorbidity score [this is a widely used weighted-prognostic score that classifies comorbid conditions associated with risk of mortality; the higher the score, the greater the risk] [14], history of trauma either in the chief complaint or final ED diagnosis, and report of pain severity [0–10; 0 = none, 10 = severe pain]). Race/ethnicity data were abstracted from registration files. Although there were multiple abstractors for the larger study, all of the charts reviewed in this study were abstracted by a single investigator, (WL), who was blinded to the hypothesis of the study. Ten percent of the charts abstracted were reviewed by the primary investigator and had 100% agreement for the variables of interest.

2.5. Outcome measures

The primary outcome measure for this study was the use of head CT during diagnostic evaluation of the enrolled patient.

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2.6. Primary data analysis

To ensure a clinically homogeneous study sample, we excluded patients with a recent history of trauma from the analyses. These patients represented 8% of all enrolled patients. Descriptive univariate and bivariate analyses using χ^2 and *t* test were completed. Adjusted multivariable logistic regression models were created for use of head CT using covariates that were significant ($P < .10$) or of construct validity. All analyses were performed using SAS 9.0 (SAS Institute Inc, Cary, NC).

3. Results

3.1. Characteristics of study subjects

A total of 9148 unique patient visits were recorded during the study period; 1068 were enrolled in the original study of pain management. Of these patients, 155 had complaints and diagnoses involving headache and/or head injury. A comparison table of the original cohort excluding the headache subset vs the headache subset can be found in Table 1. Of note, 19 (12%) of the headache patients also reported history of migraine headaches, and 13 (8%) had a recent history of trauma related to their presenting complaint of headache (eg, headache with laceration). These trauma patients were excluded from our subsequent analyses. Head CT was ordered for 57 (37%) of the 155 subjects; of these, 6 (11%) had abnormal findings (eg, hematoma, brain mass, sinusitis, infarct) reported in the radiologist final report (Table 1), none of which were acutely life-threatening.

3.2. Main results

Use of head CT was not associated with pain severity or mode of arrival; thus, these variables were excluded from the regression. Patients were more likely to undergo head CT if they had greater acuity (ESI ≤ 3; odds ratio, 5.11; 95% confidence interval, 1.53–17.12; $P < .01$) but were less likely to undergo head CT if they were black (odds ratio, 0.21; 95% confidence interval, 0.09–0.52; $P < .01$), when adjusted for patient age (≥65 years), sex, comorbidity, insurance status, and history of migraine (Table 2).

4. Discussion

In this study, racial disparity in care was found for patients evaluated for headache. After controlling for other known risk factors, black patients were significantly less likely than white, Hispanic, or other patients to undergo head CT during their ED evaluation.

The results of our findings are concerning, however not surprising, based on a review of the literature for racial and ethnic disparities in health care [5–12]. Despite growing public and professional awareness, disparities in care are persistent, widespread, and in some cases, increasing [15]. Research detecting these differences continues to be a first step toward identifying solutions and ultimately eradicating racial disparities in health care [16]. Although studies of racial disparities in patient care can be unflattering to institutions and may provoke controversy regarding confounding differences between populations, information provided by such studies are needed to inform and guide clinical decision-making and offer the possibility of providing better care to all patients [17].

Use of head CT for patients with complaints of headache and head injury is an appropriate condition to study racial/ethnic disparities in patient care. The American College of Emergency Physicians' clinical policy on imaging for headaches emphasizes the importance of identifying lesions amenable to lifesaving emergency surgery, as well as those lesions that will affect disposition or follow-up of patients [4]. Given that the age-adjusted and sex-adjusted incidence of SAH in African Americans has been found to be twice that of whites living in the same

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community [18], clinicians should have a greater index of suspicion for this condition in these patients. The higher pretest probability in African Americans might be expected to result in more frequent CT scans than white patients with similar clinical presentations, making our findings even more striking (of note, none of the patients in this study had hemorrhage noted on the radiologic findings for head CT).

One explanation for the lower use of head CT in black patients in this study may be the decision to obtain a CT scan depends in large part on the physician's perception of the severity of the patient's pain that, in turn, relies upon the quality of the physician-patient communication. Patient-provider communication is influenced by the attitudes, knowledge, beliefs, and roles during the interaction of both the patient and the provider; communication with minority patients may result in negative outcomes because of uncertainty, lack of information, stereotypes, or racial prejudice [17,19]. One need not be aware of these attitudes or consciously endorse stereotypes for these factors to influence behaviors; in turn, clinician behavior that reveals implicit or explicit stereotypes may evoke responses in minority patients who further compromise effective communication [19].

As a subgroup analysis of a larger study, the findings presented here may be limited and should be interpreted in that context [20]. As with all single institution studies, it is not known if the differences seen in this study would be found at other institutions. Because the study site does not see a large population of trauma patients, we excluded those individuals with recent histories of traumatic head injury from our analyses and cannot comment on the use of head CT for such individuals. In addition, the retrospective nature and small sample size of this study may limit the generalizability of the conclusions to other ED settings. Nonetheless, the findings of this study present information to the general medical community highlighting patient care disparities that merit further investigation. Future multicenter studies with larger sample sizes evaluating the relationship between patient race and ethnicity and the use of head CT are needed to validate these findings. Specifically, this study did not assess the appropriateness of the indication for CT scan; we therefore do not know whether the identified disparities in care may represent underuse of CT for some patients or overuse for others.

In conclusion, racial and ethnic disparities in diagnostic care existed for black patients who presented to the ED with complaints of headache. Future studies should include a prospective multicenter validation of these findings and evaluation of national databases to determine if these results are generalizable. Further research is also needed to develop and evaluate strategies to eliminate disparities in care. Such strategies should include both provider-focused and institutional interventions. Elimination of health care disparities will require that individuals at all levels—clinicians, health care administrators, and policymakers—examine the care they deliver and develop effective approaches to eliminate identified disparities.

References

1. Barton CW. Evaluation and treatment of headache patients in the emergency department: a survey. Headache 1994;34(2):91–4. [PubMed: 8163373]
2. Mayberg MR, Batjer HH, Dacey R, et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage. A statement for healthcare professionals from a special writing group of the Stroke Council, American Heart Association. Stroke 1994;25(11):2315–28. [PubMed: 7974568]
3. Morgenstern LB, Luna-Gonzales H, Huber JC Jr, et al. Worst headache and subarachnoid hemorrhage: prospective, modern computed tomography and spinal fluid analysis. Ann Emerg Med 1998;32(3 Pt 1):297–304. [PubMed: 9737490]
4. Clinical policy: critical issues in the evaluation and management of patients presenting to the emergency department with acute headache. Ann Emerg Med 2002;39(1):108–22. [PubMed: 11782746]
5. Todd KH, Samaroo N, Hoffman JR. Ethnicity as a risk factor for inadequate emergency department analgesia. JAMA 1993;269(12):1537–9. [PubMed: 8445817]

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6. Todd KH, Lee T, Hoffman JR. The effect of ethnicity on physician estimates of pain severity in patients with isolated extremity trauma. JAMA 1994;271(12):925–8. [PubMed: 8120961]
7. Green AR, Carney DR, Pallin DJ, et al. Implicit bias among physicians and its prediction of thrombolysis decisions for black and white patients. J Gen Intern Med 2007;22(9):1231–8. [PubMed: 17594129]
8. Johnston SC, Fung LH, Gillum LA, et al. Utilization of intravenous tissue-type plasminogen activator for ischemic stroke at academic medical centers: the influence of ethnicity. Stroke 2001;32(5):1061–8. [PubMed: 11340210]
9. Pezzin LE, Keyl PM, Green GB. Disparities in the emergency department evaluation of chest pain patients. Acad Emerg Med 2007;14(2):149–56. [PubMed: 17267531]
10. Takakuwa KM, Shofer FS, Hollander JE. The influence of race and gender on time to initial electrocardiogram for patients with chest pain. Acad Emerg Med 2006;13(8):867–72. [PubMed: 16801632]
11. Selassie AW, McCarthy ML, Pickelsimer EE. The influence of insurance, race, and gender on emergency department disposition. Acad Emerg Med 2003;10(11):1260–70. [PubMed: 14597503]
12. O'Connor RE, Haley L. Disparities in emergency department health care: systems and administration. Acad Emerg Med 2003;10(11):1193–8. [PubMed: 14597495]
13. Wuerz RC, Milne LW, Eitel DR, Travers D, Gilboy N. Reliability and validity of a new five-level triage instrument. Acad Emerg Med 2000;7:236–42. [PubMed: 10730830]
14. Charlson ME, Pompei P, Ales KL, McKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. J Chron Dis 1987;40(5):373–83. [PubMed: 3558716]
15. Agency for Healthcare Research and Quality. National Healthcare Disparities Report [AHRQ Pub. No. 07–0012]. Rockville (Md): U.S. Department of Health and Human Services, Agency for Healthcare Research and Quality ; 2006.
16. Heron SL, Stettner E, Haley LL Jr. Racial and ethnic disparities in the emergency department: a public health perspective. Emerg Med Clin North Am 2006;24(4):905–23. [PubMed: 16982346]
17. Richardson LD, Irvin CB, Tamayo-Sarver JH. Racial and Ethnic Disparities in the Clinical Practice of Emergency Medicine. Acad Emerg Med 2003;10:1184–8. [PubMed: 14597493]
18. Broderick J, Brott T, Kothari R, et al. The Greater Cincinnati/Northern Kentucky Stroke Study: preliminary first-ever and total incidence rates of stroke among blacks. Stroke 1998;29(2):415–21. [PubMed: 9472883]
19. Smedley, BD.; Stith, AY.; Nelson, AR., editors. Unequal treatment: confronting racial and ethnic disparities in health care. Washington (DC): Institute of Medicine of the National Academies; 2003.
20. Lagakos SW. The challenge of subgroup analyses—reporting without distorting. N Engl J Med 2006;354(16):1667–9. [PubMed: 16625007]

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Table 1

Patient characteristics

Characteristics	All other patients with pain * (n = 913)	Headache subset (n = 155)	*P*
Age (y), mean [SD]	48 (19)	42 (18)	<.0001
Female	64%	75%	<.01
Race/ethnicity			.12
White	25%	17%	
Black	31%	41%	
Hispanic	35%	33%	
Other/unknown	9%	9%	
ESI (1 = acute; 5 = nonacute), mean (SD)	3.2 (0.63)	3.06 (0.64)	<.01
Having insurance	79%	73%	.09
Charlson comorbidity score, mean (SD)	0.87 (1.71)	0.60 (1.55)	.07
No. of prior medications, mean (SD)	2.39 (3.14)	1.93 (2.47)	.04
Pain score reported at triage (0, none; 10, severe), mean (SD)	5 (3)	5 (3)	.96
Arrived by ambulance	23%	16%	<.0001
Patient self-report of having “migraine” headache	-	12%	-
Underwent head CT	-	37%	-
Had abnormal head CT		11%	

* Original study included patients with painful conditions involving the head, abdomen, extremities, back, flank, and falls.

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Table 2

Factors associated with having head CT

Nontrauma related headaches (n = 142)	* **Adjusted point estimate, odds ratio (95% confidence interval)**
Older (≥65 y)	1.75 (0.51–6.00)
Female	0.54 (0.21–1.37)
Black	0.21 (0.09–0.52)
Greater acuity (ESI ≤3)	5.11 (1.53–17.12)
Greater comorbidity (Charlson score ≥3)	4.60 (0.74–28.54)
Has insurance	1.36 (0.87–2.12)
History of migraine	1.03 (0.33–3.23)

* Adjusted for each other in multivariable logistic regressions.