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Socioeconomic Disparities in the Utilization of Mechanical Thrombectomy for Acute Ischemic Stroke in US Hospitals

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ABSTRACT

BACKGROUND AND PURPOSE: Previous studies have demonstrated that socioeconomic disparities in the treatment of cerebrovascular diseases exist. We studied a large administrative data base to study disparities in the utilization of mechanical thrombectomy for acute ischemic stroke.

MATERIALS AND METHODS: With the utilization of the Perspective data base, we studied disparities in mechanical thrombectomy utilization between patient race and insurance status in 1) all patients presenting with acute ischemic stroke and 2) patients presenting with acute ischemic stroke at centers that performed mechanical thrombectomy. We examined utilization rates of mechanical thrombectomy by race/ethnicity (white, black, and Hispanic) and insurance status (Medicare, Medicaid, self-pay, and private). Multivariate logistic regression analysis adjusting for potential confounding variables was performed to study the association between race/insurance status and mechanical thrombectomy utilization.

RESULTS: The overall mechanical thrombectomy utilization rate was 0.15% (371/249,336); utilization rate at centers that performed mechanical thrombectomy was 1.0% (371/35,376). In the sample of all patients with acute ischemic stroke, multivariate logistic regression analysis demonstrated that uninsured patients had significantly lower odds of mechanical thrombectomy utilization compared with privately insured patients (OR = 0.52, 95% CI = 0.25–0.95, $P = .03$), as did Medicare patients (OR = 0.53, 95% CI = 0.41–0.70, $P < .0001$). Blacks had significantly lower odds of mechanical thrombectomy utilization compared with whites (OR = 0.35, 95% CI = 0.23–0.51, $P < .0001$). When considering only patients treated at centers performing mechanical thrombectomy, multivariate logistic regression analysis demonstrated that insurance was not associated with significant disparities in mechanical thrombectomy utilization; however, black patients had significantly lower odds of mechanical thrombectomy utilization compared with whites (OR = 0.41, 95% CI = 0.27–0.60, $P < .0001$).

CONCLUSIONS: Significant socioeconomic disparities exist in the utilization of mechanical thrombectomy in the United States.

Endovascular clot retrieval has become an increasingly utilized treatment for a select group of patients with acute ischemic stroke.¹ Previous studies have demonstrated that significant socioeconomic disparities exist in the utilization of treatments such as tPA for acute ischemic stroke.^{2,3} With the use of the Perspective data base, we sought to determine if any socioeconomic disparities exist in the utilization of mechanical thrombectomy for the treatment of acute ischemic stroke.

MATERIALS AND METHODS

Patient Population

The Perspective data base is a voluntary, fee-supported collection of data developed by Premier, Inc (Charlotte, North Carolina), to

assess quality and resource utilization. As of 2011, the Perspective data base consisted of approximately 15% of hospitalizations nationwide and represented more than 600 US hospitals. Detailed information of a patient's hospitalization, including patient demographics, hospital information, diagnoses, procedures, discharge status, payer, and all billed items, are recorded.

Patients who presented with acute ischemic stroke (ICD-9-CM diagnostic codes 433.x1 and 434.x1) from November 2005 through December 2011 were identified from the Perspective data base. Patients were only included if the stroke code was listed as the primary hospitalization diagnosis to avoid including patients with a history of stroke. Patients were stratified into 4 groups on the basis of insurance status: 1) uninsured, 2) Medicaid, 3) Medicare, and 4) private insurance, and 3 groups on the basis of race: 1) white, 2) black, and 3) Hispanic. Patients who received mechanical thrombectomy were identified by utilization of ICD-9 procedural code 39.74. We compared utilization rates of mechanical thrombectomy between insurance groups and racial groups. Other demographic variables and hospital characteristics

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Table 1: Demographic characteristics

	All Patients n (%)	Thrombectomy Patients n (%)	Non-Thrombectomy Patients n (%)	P
Total No. of patients	249,336	371 (0.2)	248,965 (99.8)	–
Mean age, y (SD)	71.6 (14.0)	66.6 (16.3)	71.6 (14.0)	<.0001
Sex				
Male	114,199 (45.8)	185 (49.9)	114,014 (45.8)	.29
Female	135,137 (54.2)	186 (50.1)	134,951 (54.2)	
Race				
White	159,673 (76.5)	270 (86.5)	159,403 (76.5)	<.0001
Black	38,342 (18.4)	27 (8.7)	38,315 (18.4)	
Hispanic	10,738 (5.1)	15 (4.8)	10,723 (5.1)	
Insurance status				
Private	38,741 (15.5)	95 (25.6)	38,646 (15.5)	<.0001
Medicare	181,995 (73.0)	224 (60.4)	181,771 (73.0)	
Medicaid	16,540 (6.6)	39 (10.5)	16,501 (6.6)	
Uninsured	12,060 (4.8)	13 (3.5)	12,047 (4.8)	
Hospital location				
Urban	222,497 (89.2)	361 (97.3)	222,136 (89.2)	<.0001
Rural	26,839 (10.8)	10 (2.7)	26,829 (10.8)	
Hospital teaching status				
Teaching	96,739 (38.8)	210 (56.6)	96,529 (38.8)	<.0001
Non-teaching	152,597 (61.2)	161 (43.4)	152,436 (61.2)	

included in this study were sex, age, hospital location, and hospital teaching status.

Separate analyses were performed to determine disparities in the utilization rate of mechanical thrombectomy among 1) all patients with a primary diagnosis of acute ischemic stroke and 2) patients with acute ischemic stroke treated at centers that performed mechanical thrombectomy in a given year.

Statistical Analysis

χ^2 tests were used to compare utilization rates of mechanical thrombectomy between insurance groups and race groups. For comparisons on the basis of insurance groups, the private insurance group was the reference group. For comparisons on the basis of race, white race was the reference. A multivariate logistic regression analysis was performed to study the association between insurance status and mechanical thrombectomy adjusting for patient age, race, sex, and hospital location and teaching status. A multivariate logistic regression analysis was performed to study the association between race and mechanical thrombectomy utilization, adjusting for patient age, insurance status, sex, hospital location, and teaching status. Multivariate logistic regression analyses were performed for the 2 separate samples 1) all patients with a primary diagnosis of acute ischemic stroke and 2) all patients with a primary diagnosis of acute ischemic stroke treated at centers offering thrombectomy. Multivariate outcomes are presented as odds ratios and 95% CIs. All statistical analysis was performed by use of the SAS-based software package JMP 9.0 (www.jmp.com).

RESULTS

Patient Population

A total of 249,336 patients were included in this study; 38,741 patients (15.5%) had private insurance, 181,995 patients (73.0%) had Medicare, 16,540 patients (6.6%) had Medicaid, and 12,060 patients (4.8%) were uninsured. Race data were available for

208,753 patients. Of these, 159,673 patients (76.5%) were white, 38,342 patients (18.4%) were black, and 10,738 patients (5.1%) were Hispanic. Mechanical thrombectomy utilization rate was 0.15% (371/249,336) in this sample. A total of 35,747 patients were treated at centers that performed mechanical thrombectomy. The utilization rate of mechanical thrombectomy at these centers was 1.0% (371/35,747). Demographic characteristics of the patients in this sample are summarized in Table 1.

Insurance Status and Utilization

When considering patients treated at all centers, mechanical thrombectomy utilization rates among private insurance patients was 0.24% (95/38,741). Mechanical thrombectomy utilization rate among Medicare patients was 0.12% (224/181,995), significantly lower than that of private insurance patients ($P < .0001$). Medicaid patients had a similar utilization rate of mechanical thrombectomy compared with private insurance patients (39/16,540, 0.24%, $P = .92$). Uninsured patients had significantly lower utilization rates of mechanical thrombectomy than private insurance patients (13/12,060, 0.11%, $P = .005$).

When we considered only patients treated at centers offering mechanical thrombectomy, mechanical thrombectomy utilization rates among private insurance patients was 1.4% (95/6947). Mechanical thrombectomy utilization rates among Medicare patients was 0.9% (224/24,756), significantly lower than that of private insurance patients ($P = .0008$). Medicaid patients had a similar utilization rate of mechanical thrombectomy compared with private insurance patients (39/2545, 1.5%, $P = .92$). Uninsured patients had similar rates of mechanical thrombectomy compared with private insurance patients (13/1499, 0.9%, $P = .13$). These data are summarized in Table 2.

Race and Utilization

When considering patients treated at all centers, mechanical thrombectomy utilization rate among white patients was 0.17% (293/159,673). Black patients had a significantly lower rate of mechanical thrombectomy utilization compared with white patients (30/38,342, 0.07%, $P < .0001$). Hispanic patients had a similar utilization rate of mechanical thrombectomy compared with whites (15/10,738, 0.13%, $P = .29$).

When we considered only patients treated at centers offering mechanical thrombectomy, mechanical thrombectomy utilization rates among white patients was 1.2% (293/24,988). Black patients had a significantly lower rate of mechanical thrombectomy utilization compared with white patients (30/4950, 0.6%, $P = .0006$). Hispanic patients had a similar utilization rate of mechanical thrombectomy compared with whites (15/1395, 1.1%, $P = .84$). These data are summarized in Table 2.

Table 2: Insurance status and race and mechanical thrombectomy utilization

	All Patients		Patients Treated at Thrombectomy Centers	
	n (%)	P	n (%)	P
Race				
White	293 (0.17)	Reference	293 (1.2)	Reference
Black	30 (0.07)	<.0001	30 (0.6)	.0006
Hispanic	15 (0.13)	.29	15 (1.1)	.84
Insurance				
Private	95 (0.24)	Reference	95 (1.4)	Reference
Medicare	224 (0.12)	<.0001	224 (0.9)	.0008
Medicaid	39 (0.24)	.92	39 (1.5)	.61
None	13 (0.11)	.005	13 (0.9)	.13

Table 3: Multivariate logistic regression analysis

	All Patients		Patients Treated at Thrombectomy Centers	
	OR (95% CI)	P	OR (95% CI)	P
Race ^a				
Black versus Hispanic	0.42 (0.23–0.81)	<.0001	0.50 (0.26–0.97)	.04
Black versus white	0.35 (0.23–0.51)	<.0001	0.41 (0.27–0.60)	<.0001
Hispanic versus white	0.78 (0.44–1.27)	.33	0.83 (0.46–1.36)	.47
Insurance ^b				
Medicare versus private	0.53 (0.41–0.70)	<.0001	1.12 (0.80–1.57)	.52
Medicaid versus private	1.09 (0.70–1.65)	.71	1.19 (0.76–1.82)	.43
None versus private	0.52 (0.25–0.95)	.03	0.63 (0.31–1.18)	.16
Medicaid versus Medicare	1.16 (0.73–1.82)	.52	1.07 (0.66–1.68)	.78
None versus Medicare	0.56 (0.27–1.05)	.07	0.57 (0.27–1.08)	.08
None versus Medicaid	0.48 (0.22–0.95)	.03	0.94 (0.60–1.51)	.78

^a Adjusted for insurance status, sex, age, hospital teaching status, and hospital location.

^b Adjusted for race, sex, age, hospital teaching status, and hospital location.

Multivariate Analysis: All Patients

After multivariate logistic regression analysis was performed, uninsured patients had a significantly lower odds of mechanical thrombectomy when compared with patients with private insurance (OR = 0.52, 95% CI = 0.25–0.95, $P = .03$). Medicare patients also had lower odds of mechanical thrombectomy utilization when compared with private insurance patients (OR = 0.53, 95% CI = 0.41–0.70, $P < .0001$). Medicaid patients had a similar odds of mechanical thrombectomy utilization when compared with private insurance patients (OR = 1.05, 95% CI = 0.67–1.59, $P = .83$).

After multivariate logistic regression analysis examining race and outcomes was performed, black patients had a significantly lower odds of mechanical thrombectomy utilization compared with white patients (OR = 0.35, 95% CI = 0.23–0.51, $P < .0001$). Hispanic patients had a similar utilization rate of mechanical thrombectomy compared with whites (OR = 0.78, 95% CI = 0.44–1.27, $P = .33$). These data are summarized in Table 3.

Multivariate Analysis: Patients Treated at Thrombectomy Centers

When examining patients treated at thrombectomy centers, there was no significant difference in thrombectomy utilization rates by insurance status. When examining odds of utilization by race, black patients had a significantly lower odds of mechanical thrombectomy utilization when compared with Hispanic patients (OR = 0.50, 95% CI = 0.26–0.97, $P = .04$). Blacks also had a significantly lower odds of receiving mechanical thrombectomy when compared with white patients (OR =

0.41, 95% CI = 0.27–0.60, $P < .0001$). There was no significant difference in mechanical thrombectomy utilization when comparing white and Hispanic patients. These data are summarized in Table 3.

DISCUSSION

Our study demonstrated that significant race- and insurance-based disparities exist in the utilization of mechanical thrombectomy for treatment of acute ischemic stroke. On our adjusted analyses, uninsured and Medicare patients had significantly lower odds of mechanical thrombectomy utilization when compared with their privately insured counterparts. Similarly, black patients had significantly lower odds of mechanical thrombectomy utilization when compared with white and Hispanic patients. When we performed our adjusted analysis only examining thrombectomy utilization of patients treated at hospitals offering thrombectomy, some of these disparities remained present. Although insurance status was no longer associated with thrombectomy utilization, black patients were significantly

less likely to receive mechanical thrombectomy than were their white and Hispanic counterparts. These findings suggest that disparities in mechanical thrombectomy utilization in the United States can be explained, in part, by lack of access to centers offering this treatment.

Studies examining racial and economic disparities in utilization of mechanical thrombectomy for acute ischemic stroke are scarce. One prior study of 602 patients found that blacks were significantly less likely to undergo endovascular interventions at stroke centers; however, when adjusted for the fact that African Americans had more delayed arrivals to the emergency department, they found no racial disparity.⁴ In general, socioeconomic status has been associated with significant disparities in the resource utilization for acute ischemic stroke. Patients of lower socioeconomic status have been shown to receive less emergent imaging, lower rates of hospital admission, and lower rates of poststroke care.^{3,5–7} Several prior studies have demonstrated significant socioeconomic disparities in the utilization of intravenous rtPA for the treatment of acute ischemic stroke.^{2,8–10} Nasr et al¹⁰ found that whites had significantly higher intravenous tPA treatment rates for acute ischemic stroke when compared with blacks and Hispanics in the United States. Johnston et al⁹ found that blacks were significantly less likely to receive intravenous tPA for acute ischemic stroke and demonstrated that contraindications to treatment did not account for the differences in tPA utilization rates. Prior studies in both the United States and Canada have demonstrated that neighborhood income is not associated with any significant differences in initial stroke care, but these

studies did not evaluate differences in mechanical thrombectomy utilization rates.^{11,12}

There are many potential factors that could account for these disparities. Prior studies have demonstrated that disparities in the treatment of acute ischemic stroke in general could be related to delays in treatment, education level, or differences in stroke etiology.^{2,13-15} Minority patients are more likely to present with higher severity of stroke symptoms than whites and also present with more small-vessel lacunar strokes, thus making them less amenable to mechanical thrombectomy.¹⁶⁻¹⁹ Lower rates of mechanical thrombectomy among Medicare recipients could be related to a less aggressive therapeutic approach in older patients rather than to any economic considerations.²⁰

Limitations

There are a number of limitations to our study. To maintain consistency with the Perspective data base, we used the same racial/ethnic terms defined in the data base (white, black, Hispanic); however, we acknowledge that the broad racial designations provided present a potential limitation. Other weaknesses of this study include the fact that we are unable to determine important variables such as stroke severity at presentation, time to presentation, patient eligibility for mechanical thrombectomy, and the presence of large-vessel occlusions. Because of our inability to differentiate between various stroke subtypes, and, given the fact that stroke subtypes vary significantly by race, the observed racial disparities in our study must be interpreted cautiously. We cannot exclude that a racial difference in the likelihood of consenting for endovascular therapy could have played a contributing role. Coding errors are also a potential limitation of this study, as they are with any study of a large administrative data base.^{21,22}

CONCLUSIONS

Our study demonstrated that significant socioeconomic disparities exist in the utilization of mechanical thrombectomy for the treatment of acute ischemic stroke. To ensure that all segments of the population have equal access to optimal stroke care, further studies are needed to study the underlying causes of these disparities.

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