Fear in Arthroplasty Surgery

The Role of Race

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Abstract Understanding the difference in perceived functional outcomes between whites and blacks and the influence of anxiety and pain on functional outcomes after joint arthroplasty may help surgeons develop ways to eliminate the racial and ethnic disparities in outcome. We determined the difference in functional outcomes between whites and blacks and assessed the influence of fear and anxiety in total joint arthroplasty outcomes in 331 patients undergoing primary hip and knee arthroplasty. WOMAC, Quality of Well Being, SF-36, and Pain and Anxiety Symptoms Scale (PASS) were administered pre- and postoperatively (average 5-year followup). For the SF-36 General Health Score, blacks reported having worse perceived general health than whites before surgery. Regardless of time, blacks scored worse than whites for all measures except for the SF-36 physical function and general health scores. Blacks had a greater fear score (ie, that

associated with the procedure) and total PASS score. For both races, there was a low association between the fear dimensions and dependent measures before and after surgery. Black patients undergoing hip and knee arthroplasty had lower scores than whites in most outcome measures regardless of time of assessment. We found higher fear levels before joint arthroplasty in blacks compared with whites. After surgery, blacks had much higher associations of the fear subscale, cognitive subscale, and total PASS score with the WOMAC physical function, pain, and total scores.

Level of Evidence: Level II, prospective controlled cohort study. See Guidelines for Authors for a complete description of levels of evidence.

Introduction

Approximately 808,000 primary hip and knee arthroplasties are performed annually in the United States [17]. By 2030, it is estimated that there will be a 174% increase in the number of primary THAs to 572,000 from 208,600 in 2005 and a 673% increase in the number of TKAs to 3.48 million from 425,000 in 2005 [22]. From 2000 to 2006, the rate of knee arthroplasties in the United States increased 58%. Compared with whites, the rate for knee arthroplasties for blacks was 39% lower in 2006 [32]. This extremely effective surgical intervention is underused in the black population.

Investigations that describe differences in functional outcomes between races after joint arthroplasty are limited. However, several studies have compared health-related issues between racial/ethnic groups and have documented significant disparities, especially related to the experience and management of pain [11, 37]. Chronic pain adversely

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affects the quality of life and health status of blacks at initial presentation to a greater extent than it does in white Americans [15]. The time it takes an individual to recover from surgery can also influence outcomes. Montin and colleagues [29] reported that despite successful surgery, recovery takes time and the increased time may also cause anxiety, thus potentially deteriorating a patient's quality of life.

There is limited literature describing differences in perceived functional outcomes between whites and blacks and the influence of anxiety and pain on functional outcomes after joint arthroplasty. Riley et al. reported a stronger association between emotions and pain behavior in blacks when compared with whites [34]. A model by Norton and Asmundson [30] identified anxiety sensitivity as having a direct relationship to fear of pain in patients with recurrent headaches and that pain severity had an influence on the "fear of having pain." The concept of fear and/or anxiety related to surgery as it relates to preoperative or postoperative pain could play an important role in the development and maintenance of avoidance behavior and could thus be an important factor influencing early access to surgery and outcomes.

Our objectives were to (1) determine and compare function and quality of life between blacks and whites at clinical presentation and at an average followup of 5 years after surgery; (2) determine if differences in fear and anxiety of pain exist between races before surgery; and (3) explore the relationship of anxiety and fear of pain before surgery with function and quality of life before and after surgery as a function of race.

Patients and Methods

From October 2000 to March 2002, 331 patients with a diagnosis of end-stage osteoarthritis who were scheduled for either primary or revision hip or knee arthroplasty were solicited and agreed to participate in this Institutional Review Board-approved study. We diagnosed end-stage arthritis based on patient symptoms and radiographic

findings. We obtained sociodemographic information from questionnaires administered to patients at their first office visit and at their preoperative evaluation. The mean age of the cohort was 65 years (standard deviation ± 14). Of the total number of patients, 220 (66.46%) were females. Two hundred eighty-two patients (85.2%) self-classified themselves as white and 49 (14.8%) as black. Blacks were younger ($p = 0.047$) than whites at presentation (61 ± 2 [SEM] years versus 66 ± 0.8 years, respectively). The minimum followup was 3 years (average, 5 years; range, 3–8 years; Table 1). The most common complication was deep infection (two) for blacks and superficial infection (four) for whites (Table 2).

The 40-item Pain Anxiety Symptom Scale (PASS) is a self-reported instrument measuring four distinct components (cognitive, fear, escape/avoidance, physiological anxiety) of pain-related anxiety [5]. The cognitive subscale assesses cognitive anxiety symptoms such as racing thoughts and impaired concentration resulting from pain. The fear subscale assesses fearful thoughts and ruminations about the consequences of their pain. The escape/avoidance subscale assesses behavioral responses, which are believed to increase pain. The physiological anxiety subscale assesses physiological symptoms of fear associated with the experience of pain [27]. Each item is rated on a 6-point Likert scale ranging from 0 (never) to 5 (always). Summing each subscale (ie, cognitive, fear, escape/avoidance, physiological) provides a score that can be considered a general measure of pain-related anxiety [1]. We used the pain anxiety symptom scale to assess pain-related anxiety before surgery.

The Quality of Well Being (QWB) Index was developed by Kaplan et al. to assess general quality of life [20]. This index has been validated for use in a variety of populations, including blacks and Hispanics, with over 100,000 evaluations being completed with this instrument [19]. We administered the QWB preoperatively and at followup. The WOMAC has become another current standard for evaluating results of THA and TKA. It is designed to provide information on three dimensions: perception of pain, stiffness, and physical function [3]. The WOMAC consists

Table 1. Demographics by procedure for both races

Race	Gender	Hip						Knee					
		Primary			Revision			Primary			Revision		
		Number	Age	Mean followup (years)	Number	Age	Mean followup (years)	Number	Age	Mean followup (years)	Number	Age	Mean followup (years)
Blacks	Male	9	58.1	4.67	3	64.3	3.52	5	70.8	3.75	0	—	—
	Female	10	63.1	4.78	4	61	5.67	15	75.1	4.61	3	73	3.67
Whites	Male	37	67.9	4.97	20	72.4	4.72	31	73.2	5.24	6	75.1	4.33
	Female	72	70.5	5.46	28	78.8	4.62	74	73.8	4.97	14	80.3	5.17

Table 2. Type and frequency of complications by procedure for both races

Race	Gender	Hip				Knee			
		Primary		Revision		Primary		Revision	
		Frequency	Complication	Frequency	Complication	Frequency	Complication	Frequency	Complication
Black	Male	0	None	0	None	1	Patellar fracture	0	None
	Female	0	None	1	Deep infection	1	Superficial infection	0	None
White	Male	1	Dislocation	2	Dislocation (1) Superficial infection (1)	0	None	0	None
	Female	3	Superficial infection (2)	3	Stroke (1) Dislocation (1)	5	Deep infection (3) Pulmonary embolism (1)	4	Deep infection (1) Dislocation (1)
			Deep vein thrombosis (1)		Deep infection (1)		Patellar fracture (1)		Periprosthetic fracture (1) Superficial infection (1)

of 24 items (five for pain, two for stiffness, and 17 for function). Point values from 0 to 5 are assigned to each response, and scores are totaled for each category. The pain, physical function, and total WOMAC scores were used as outcome measures before and at the followup period after surgery.

The SF-36 is a validated measure of general physical and mental health status that has been assessed for content and construct in various populations such as blacks, Hispanics, and non-Hispanic whites [2, 26]. The SF-36 contains eight different subscales. For this study, we used the physical function, bodily pain, social function, and general health scores as outcome measures before and at followup. All domains are scored separately on a 0- to 100-point scale with higher numbers representing better health status. The pain and function subscales are the most sensitive to change in patients with osteoarthritis after surgery [26].

All surgeries were performed by three surgeons (CJL, AC, RP). For the knee, a cemented technique was used on all three components. A cruciate-retaining prosthesis with a cobalt chromium bearing surface on an ultrahigh-molecular-weight polyethylene insert surface was placed in all cases. The surgical technique in all patients was a midline approach with a median parapatellar arthrotomy. For hip patients, a press-fit technique was used for both components. Supplemental screws were used to fix the cup. Cobalt chromium on ultrahigh-molecular-weight polyethylene was the bearing surface in all cases. The surgical technique varied according to the surgeon's preferences (CL, anterolateral; AC and RP, posterior).

A standard preoperative questionnaire was filled out by the patient during the first office visit. In addition, QWB, WOMAC, and SF-36 assessments were used to assess outcome before surgery and at yearly intervals.

The Patient Analysis and Tracking System (Version 5.0; Portland, OR) was used to maintain the joint registry of all data. Microsoft Excel (Redmond, WA) was used to create initial statistical spreadsheets and SPSS (Version 13.0; Chicago, IL) was used for all statistical analysis. To assess for differences between races before and after surgery, we used a 2×2 analysis of variance. Before the analysis, we used an independent t-test to determine if there was a difference in age between groups. The interaction was evaluated first followed by the main effects if and when appropriate. Independent t-tests were used to assess for differences between groups for each of the five dependent measures of fear. For both groups, a correlation matrix was created using the Spearman-Rho correlation coefficient to determine the relationship of all fear dimensions with the dependent measures before and after surgery.

Results

All measures were influenced by the time of collection; regardless of group, all dependent measures improved postoperatively ($p < 0.0001$), except for the SF-36 social function score. Regardless of time, blacks scored worse than whites for all measures except for the SF-36 physical function and general health scores (Table 3). Blacks reported worse perceived general health than whites before surgery (Fig. 1).

Blacks presented with a higher fear score ($p = 0.002$; Fig. 2) and total PASS score ($p = 0.04$; Fig. 3) compared with whites.

For both races, there was a low association of the fear dimensions with results of the QWB, WOMAC dimensions, and SF-36 scores before surgery (Tables 4, 5) and a

Table 3. Dependent measures between races regardless of time

Outcome measures	Race	Mean	Standard error	p Value
QWB	Black	0.54	± 0.11	0.024
	White	0.56	± 0.05	
WOMAC function	Black	32.21	± 1.58	≤ 0.0001
	White	25.90	± 0.66	
WOMAC pain	Black	8.47	± 0.45	≤ 0.0001
	White	6.47	± 0.19	
WOMAC total	Black	44.31	± 2.06	≤ 0.0001
	White	34.51	± 0.87	
SF-36 physical function	Black	29.51	± 2.91	0.067
	White	25.29	± 1.22	
SF-36 bodily pain	Black	42.02	± 2.86	0.028
	White	48.88	± 1.21	
SF-36 general health	Black	54.81	± 3.75	0.021
	White	62.78	± 1.58	
SF-36 social function	Black	64.25	± 2.68	0.051
	White	71.02	± 1.13	

QWB = quality of well being index; standard error = standard error of mean.

Fig. 1 The graph shows the SF-36 general health score between races before and after surgery. Blacks report worse perceived general health than whites before surgery. Before = before surgery; after = after surgery; error bars = standard error of mean.

low association between the fear dimensions and results of the QWB, WOMAC dimensions, and SF-36 scores after surgery (Tables 6, 7).

Discussion

Among important factors that could potentially influence outcomes after knee or hip arthroplasty are race and fear of

Fig. 2 The graph shows the fear score between races before surgery. Blacks report more fear of pain with associated surgery than whites.

Fig. 3 The graph shows the Pain and Anxiety Symptoms Scale (PASS) score between races before surgery. The overall PASS score for blacks was worse than whites before surgery.

having pain with the associated surgery. We therefore (1) determined and compared perceived levels of function and quality of life between whites and blacks before and after surgery; (2) examined the differences in fear and anxiety of pain between races preoperatively; and (3) evaluated the relationship of anxiety and fear of pain before surgery with perceived levels of function and quality of life at initial presentation (before surgery) and at followup for whites and blacks.

Our study is first limited by the small sample size of black participants, thus making generalizations to the overall population tenuous. Furthermore, our sample consisted of a small percentage of revisions, which potentially could confound results. Second, we did not analyze the effect of ethnicity on our two cohorts. Although we had a small sample size, the strength of our study was that only four black and 29 white patients were lost at the average 5-year followup. Further strengthening our study was the fact that data were collected prospectively. However, future studies should look at larger cohorts and incorporate much larger samples using cluster sampling techniques to include

Table 4. Preoperative correlations of fear of pain with outcome measures for blacks

Outcome measures	Fear subscale	Cognitive subscale	Escape avoidance	Physiological anxiety	Total score
QWB	-0.099	-0.09	-0.08	-0.113	-0.118
WOMAC function	0.336*	0.508 [†]	0.139	0.287	0.392 [†]
WOMAC pain	0.187	0.238	0.153	0.165	0.222
WOMAC total	0.301*	0.481 [†]	0.222	0.269	0.397 [†]
SF-36 physical function	-0.346*	-0.25	-0.192	-0.241	-0.301*
SF-36 bodily pain	-0.253	-0.421 [†]	-0.096	-0.267	-0.302*
SF-36 general health	-0.311*	-0.218	-0.207	-0.261	-0.314*
SF-36 social function	-0.491 [†]	-0.581 [†]	-0.063	-0.443 [†]	-0.454 [†]

* $p \leq 0.05$; [†] $p \leq 0.01$; QWB = Quality of Well Being.**Table 5.** Preoperative correlations of fear of pain with outcome measures for whites

Outcome measures	Fear subscale	Cognitive subscale	Escape avoidance	Physiological anxiety	Total score
QWB	-0.223 [†]	-0.252 [†]	-0.336 [†]	-0.228 [†]	-0.331 [†]
WOMAC function	0.214 [†]	0.166 [†]	0.275 [†]	0.167 [†]	0.254 [†]
WOMAC pain	0.2 [†]	0.149*	0.203 [†]	0.203 [†]	0.217 [†]
WOMAC total	0.245 [†]	0.190 [†]	0.261 [†]	0.214 [†]	0.273 [†]
SF-36 physical function	-0.126*	-0.125*	-0.265 [†]	-0.141*	-0.221 [†]
SF-36 bodily pain	-0.173 [†]	-0.170 [†]	-0.203 [†]	-0.202 [†]	-0.228 [†]
SF-36 general health	-0.262 [†]	-0.229 [†]	-0.101	-0.195 [†]	-0.242 [†]
SF-36 social function	-0.161 [†]	-0.148*	-0.230 [†]	-0.140*	-0.222 [†]

* $p \leq 0.05$; [†] $p \leq 0.01$; QWB = Quality of Well Being.**Table 6.** Postoperative correlations of fear of pain with outcome measures for blacks

Outcome measures	Fear subscale	Cognitive subscale	Escape avoidance	Physiological anxiety	Total score
QWB	-0.170	-0.184	-0.351*	-0.129	-0.287
WOMAC function	0.332*	0.248	0.217	0.216	0.340*
WOMAC pain	0.407 [†]	0.333*	0.171	0.185	0.382*
WOMAC total	0.309*	0.301*	0.264	0.236	0.374*
SF-36 physical function	-0.107	-0.100	-0.188	-0.050	-0.168
SF-36 bodily pain	-0.248	-0.180	-0.242	-0.269	-0.280
SF-36 general health	-0.201	-0.231	-0.298*	-0.221	-0.333*
SF-36 social function	-0.370*	-0.308*	-0.476 [†]	-0.145	-0.405 [†]

* $p \leq 0.05$; [†] $p \leq 0.01$; QWB = Quality of Well Being.**Table 7.** Postoperative correlations for fear of pain with outcome measures for whites

Outcome measures	Fear subscale	Cognitive subscale	Escape avoidance	Physiological anxiety	Total score
QWB	-0.139*	-0.180 [†]	-0.174 [†]	-0.157*	-0.214 [†]
WOMAC function	0.023	0.102	0.084	0.173 [†]	0.112
WOMAC pain	0.025	0.035	0.058	0.140*	0.074
WOMAC total	0.013	0.088	0.063	0.168 [†]	0.093
SF-36 physical function	-0.081	-0.168 [†]	-0.240 [†]	-0.160*	-0.220 [†]
SF-36 bodily pain	-0.098	-0.169 [†]	-0.160*	-0.170 [†]	-0.212 [†]
SF-36 general health	-0.191 [†]	-0.267 [†]	-0.186 [†]	-0.216 [†]	-0.283 [†]
SF-36 social function	-0.211 [†]	-0.207 [†]	-0.276 [†]	-0.169 [†]	-0.296 [†]

* $p \leq 0.05$; [†] $p \leq 0.01$; QWB = Quality of Well Being.

both urban and suburban areas from different parts of the country. Ethnicity should be accounted for in future investigations.

Many studies have reported on the efficacy of joint arthroplasty in improving functional outcomes and decreasing pain [25, 28]. Although in most patients, there is improved function and decreased pain postoperatively, differences in outcomes between races have been reported [9, 24]. In our study, for most dependent measures, blacks presented with worse scores than whites before surgery and continued to score worse than whites postoperatively. Specific reasons for the disparities in well-being and physical function between races and ethnic groups have been studied. Comparative studies have reported significant racial disparities between blacks and whites in conditions such as perirectal fistulas in Crohn's disease [18], glomerular filtration rate after kidney transplant [31], and heart failure in young adults [4] (Table 8). Emejuiwe et al. suggested factors such as an individual's willingness to consider joint arthroplasty and an individual's expectations on joint arthroplasty outcomes could explain these differences [10]. Skinner et al. reported black men were less likely than white men to undergo TKA, even after adjusting for regional variations [36]. In another study, blacks had lower expectations of TKA outcomes and were less likely to believe preoperatively that TKA would improve knee pain or their current health [12]. Most studies have focused on expectations, access to care, and the use of healthcare services among racial and ethnic groups as well as rate of complications as a function of ethnic and racial backgrounds [12, 24]. Regardless of reason, our data clearly show that race is an important factor in determining outcome in arthroplasty.

Black adults in this cohort experienced higher fear of pain before surgery when compared with whites. These data agree with Riley et al. who reported a stronger association between emotions and pain behavior in blacks when compared with whites [34]. Our findings and that of Riley

and colleagues are similar to the pain experience described between racial groups and reported by Ruehlman et al. [35]. The authors noted that compared with whites, blacks reported greater pain-related interference with daily living, deficiencies in coping, had counterproductive attitudes and beliefs, and perceived their general health in less positive terms than whites. Another study at the University of Michigan reported chronic pain adversely affects the quality of life and health status of blacks to a greater extent than white Americans before initial presentation for treatment [15].

Crombez et al., evaluating a group of patients with low back pain at a rehabilitation center, reported a high correlation among pain-related fear measures and measures of self-reported disability and behavioral performance [7]. In contrast, our results indicated fear of pain associated with the procedure had a poor to low association with dependent measures for both blacks and whites. Although the associations were quite low, fear of pain perceived by blacks in our study accounted for more of the variance in explaining outcomes more than whites for many dependent measures before and after surgery. Postoperatively, blacks had much higher associations of the fear subscale, cognitive subscale, escape avoidance, and total PASS score with the WOMAC physical function, pain, and total scores.

Several authors have described suboptimal outcomes when arthroplasty surgery is delayed [8, 14] and in patients with worse preoperative baseline functional status [13]. We have previously reported patients with severe functional impairment preoperatively had worse 3-year outcomes when compared with patients undergoing surgery when their functional levels were better [23]. The preoperative differences reported in our study between races could reflect a longer wait before coming for surgery rather than actual racial disparities in the surgical outcome. Avoidance of surgical interventions resulting from fear could also explain racial disparities in outcome. The medical establishment may be mistrusted by the black communities.

Table 8. Comparative results between races for other conditions

Author(s)	Race	Number	Incidence of perirectal fistula in Crohn's disease	Incidence of heart failure in young adults	Loss of estimated GFR (per 1.73 m ²) after kidney transplant	Average fear dimension score of PASS	Average PASS total score
Jackson et al. [18]	Black	55	58%	—	—	—	—
	Whites	44	28%	—	—	—	—
Bibbins-Domingo et al. [4]	Black	2637	—	2%	—	—	—
	Whites	2477	—	0.08%	—	—	—
Parasuraman and Venkat [31]	Black	54	—	—	39.8 mL/min	—	—
	Whites	49	—	—	30.4 mL/min	—	—
Lavernia et al. [current study]	Black	48	—	—	—	14.44	68.98
	Whites	281	—	—	—	10.24	56.75

GFR = glomerular filtration rate; PASS = Pain Anxiety Symptom Scale.

Blacks and Hispanics mostly get health advice from family, clergy, and community leaders before turning to the medical community [21]. Another factor that could influence outcomes and fear of pain is the dearth of minority physicians. Blacks and Hispanics account for less than 10% of all physicians in the United States [33]. Thus, minorities who prefer a “culturally alike” physician will be limited in the availability of care and may not seek medical advice, which could negatively affect health and increase risk of death [6]. These factors may help explain the differences in outcome we have reported and further explain why blacks receive joint arthroplasty two-thirds less often than whites [16].

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