Ethnic Considerations for Metabolic Surgery

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Obesity and diabetes represent twin health concerns in the developed world. Metabolic surgery has emerged as an established and enduring treatment for both obesity and diabetes. As the burden of obesity and diabetes varies upon the basis of ethnicity, it is also apparent that there may be differences for indications and outcomes for different ethnic groups after metabolic surgery. Whereas there appears to be evidence for variation in weight loss and complications for different ethnic groups, comorbidity remission particularly for diabetes appears to be free of ethnic disparity after metabolic surgery. The impacts of access, biology, culture, genetics, procedure, and socioeconomic status upon metabolic surgery outcomes are examined. Further refinement of the influence of ethnicity upon metabolic surgery outcomes is likely imminent.

Chronic medical conditions, including diabetes, hypertension, hyperlipidemia, stroke, and heart disease, are closely correlated with obesity. There is a dose-dependent effect of obesity upon the prevalence of these medical conditions. Higher stages of obesity are associated with higher mortality rates that are likely a result of the increased burden of disease of these obesity-associated medical conditions. In the general U.S. population, there are significant variations in the prevalence of obesity by ethnicity. Non-Hispanic blacks have the highest age-adjusted rates of obesity (47.8%), followed by Hispanics (42.5%), non-Hispanic whites (32.6%), and non-Hispanic Asians (10.8%) (1). In the 2011–2012 National Health and Nutrition Examination Survey (NHANES) population, the unadjusted prevalence for total diabetes was 14.3% (2). In the article by Menke et al. (2), the age-standardized prevalence of total diabetes was higher among non-Hispanic black participants (21.8%, $P < 0.001$), non-Hispanic Asian participants (20.6%, $P = 0.007$), and Hispanic participants (22.6%, $P < 0.001$) compared with non-Hispanic white participants (11.3%). From the population prevalence data, it may be surmised that the greatest risk for obesity and diabetes occurs in Hispanic and non-Hispanic black American adults, and although Asians have lower prevalence of BMI >35 kg/m^2, they are at increased risk (nearly equal to Hispanics and non-Hispanic blacks). Indeed, Asians have increased risk for type 2 diabetes and other disease at lower BMI levels. Obesity and its associated medical conditions, including diabetes, can be treated very effectively by metabolic surgery with a concomitant decrease in mortality (3). This evidence from this surgical cohort study demonstrates mortality benefit, but the population was largely non-Hispanic white. There are conflicting data to support that ethnicity may negatively influence medical care, from screening to hospitalization outcomes (4). In addition, there may be a double jeopardy for ethnic minorities who are obese who have progressively less preventive care provided when their weight increases (5). The literature was reviewed utilizing the search terms "ethnic" and "bariatric surgery." The purpose of this review is to demonstrate the influence of ethnicity upon indication and outcomes for metabolic surgery as well as to provide a framework for further inquiry.

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INDICATIONS

Traditionally, indications for metabolic surgery have followed 1991 National Institutes of Health (NIH) Consensus Statement guidelines (6). However, given both the demonstration of effectiveness of metabolic surgery at a lower BMI and the earlier burden of diabetes at a lower BMI for Asian minorities, there may be consideration of metabolic surgery at lower BMI levels than 1991 NIH Consensus Statement guidelines (7,8). Of note, both the Blue Cross Blue Shield Technology Evaluation Center and the California Technology Assessment Forum have endorsed metabolic surgery for BMI 30–35 kg/m^2 (9,10). In addition, there are emerging data that metabolic surgery is both safe and effective for Asian patients with diabetes at lower BMI (11,12). In a study of a multiethnic Asian population, there was a 3-year remission rate from 58 to 71% with no mortality. In another study, the metabolic improvement in type 2 diabetes after Roux-en-Y gastric bypass (RYGB) in the mildly obese is improved with a shorter duration of diabetes, higher fasting C-peptide, and more visceral adiposity (13). In a study of two academic centers, ethnicity was not independently associated with likelihood of proceeding with bariatric surgery or having higher illness burden than Caucasian patients (14). One study demonstrated that cultural factors may play a role in why males and African Americans seek out bariatric surgery less frequently (15).

OUTCOMES: WEIGHT REDUCTION AND COMORBIDITY REMISSION

A review of the literature reveals primarily single institution data for demonstration of ethnic difference in weight reduction and comorbidity remission after metabolic surgery. In general, the themes of equivalency of comorbidity remission and normalization of weight variation over time among ethnic groups emerge. In one study of 1,903 patients who underwent gastric bypass or banding, African American patients had a higher postoperative BMI and less postoperative percent excess weight loss (% EWL) than either Caucasian or Hispanic patients. However, African American and Hispanic patients no longer differed by year 3 in RYGB and by year 2 in laparoscopic adjustable gastric banding. Of note, by year 1, there were no significant ethnic differences in remission of diabetes, hyperlipidemia, hypertension, and sleep apnea (16). In another study of 3,268 patients, there were significant differences in 1-year % EWL (66.0 Hispanics, 64.0 non-Hispanic whites, and 54.1 $\pm$ 21.3 non-Hispanic blacks; $P < 0.001$) that remained at 2 years (68.6 $\pm$ 24.1 Hispanics, 69.5 $\pm$ 21.2 non-Hispanic whites, and 57.6 $\pm$ 25.4 non-Hispanic blacks; $P < 0.001$) (17). In a study of 597 patients from Detroit, MI, 86 patients (72.3%) had resolution of diabetes 1 year after surgery with no effect from ethnicity (18).

There are several large data registry studies that do demonstrate ethnic differences. In one publication from an integrated health care system in southern California, a prospective registry of 20,296 patients had the following proportion of procedures: 58% RYGB, 40% vertical sleeve gastrectomy, and 2% rare banding.

This study showed that the type of procedure may have impact on weight loss and ethnic differences (19). At 3 years, non-Hispanic white RYGB patients had a higher % EWL than non-Hispanic black ($P < 0.001$) and Hispanic ($P < 0.001$) RYGB patients; however, there were no differences between sleeve gastrectomy racial/ethnic groups in % EWL.

Another large database (Bariatric Outcomes Longitudinal Database [BOLD]) was used to examine ethnic differences for metabolic surgery outcomes. In this study of 108,333 patients, the ethnic composition was 79% white, 12% black, and 9% Hispanic (20). Fewer black males underwent surgery (15%) compared with white or Hispanic males (22%). Compared with white patients, black patients were heavier (mean BMI, 50 vs. 47.4 kg/m^2), younger (42.7 vs. 46.4 years), and more hypertensive (57 vs. 52%). Other comorbidities were higher in whites. Thirty-day mortality rate was equivalent among all groups (0.23–0.26%), but serious adverse events were higher for blacks (3.65%) versus whites (3.19%) and Hispanics (2.01%). At 1 year, all ethnic groups showed significant improvement in weight and comorbidity burden from baseline but black patients had less improvement in comparison despite adjustment for baseline characteristics.

This same database also examined ethnic differences in metabolic surgery outcomes among adolescents (21). In this study of 827 adolescents, mean estimated weight loss for all ethnic groups differed by a maximum of only 1.5 kg, being 34.3 kg for Hispanics, 33.8 kg for non-Hispanic blacks, and 32.8 kg for non-Hispanic whites.

Whereas most of these publications have focused on 1-year outcomes, this study demonstrated equivalent 3-year outcomes in diabetes remission and weight loss across an ethnically diverse group of 1,603 patients (22). Significant improvements occurred for patients with undiagnosed diabetes who achieved a 43% fasting plasma glucose decrease followed by diagnosed patients with diabetes with a 33% decrease in fasting plasma glucose. As demonstrated in Table 1, there are several large databases that have examined ethnic variations in metabolic surgery outcomes.

OUTCOMES: COMPLICATIONS AND MORTALITY

Most publications regarding ethnic difference in metabolic surgery outcomes address weight or comorbidity remission outcomes. A few large database studies do specifically address complication and mortality outcomes on the basis of ethnicity. In an American College of Surgeons National Surgical Quality Improvement Program study from 2005 to 2007, a total of 18,682 bariatric procedures were identified with ethnicity noted. This study demonstrated that pulmonary embolism was 2.5 times more frequent among black patients and Hispanic patients were nearly four times more likely to have postoperative acute renal failure requiring further intervention. Both American Indians/Alaskan Natives and Hispanics were found to require postoperative transfusions at rates significantly greater than other racial groups (odds ratio 10.40 and 3.10, respectively) (23).

An NIH-funded trial examined perioperative outcomes of metabolic surgery at 10 clinical sites in the U.S. from 2005 through 2007 (24). In this study, a composite end point of 30-day major adverse outcomes (including death; venous thromboembolism; percutaneous, endoscopic, or operative

Table 1—Metabolic surgery outcomes by ethnicity in large databases

Study	*n*	Weight loss	Diabetes remission	Complications	Mortality
Flum et al. (24) Bypass, 71.4% Gastric band, 25.1%	4,776 Black, 10.9% Hispanic, 6.1%	NR	NR	NED	NED
Turner et al. (23) Bypass, 70.3% Gastric band, 25.4%	18,682 ECNR	NR	NR	Hispanic, 4× acute renal failure Black, 2.5× PE Hispanic, 3.1× transfusion	NED
Messiah et al. (21) Bypass, 51% Gastric band, 49%	827 Black, 11% Hispanic, 14.5%	% change in BMI White, 11.4 Black, 11.2 Hispanic, 12.7	NR	NR	NR
Coleman et al. (19) Bypass, 58% Sleeve, 40%	20,269 Black, 18.5% Hispanic, 35%	3-year % EWL White, 62 Black, 58 Hispanic, 60	NR	NR	NR
Sudan et al. (20) Bypass, 100%	108,333 Black, 12% Hispanic, 9%	% change White, 33.6 Black, 30.2 Hispanic, 32.4	% change White, 64.7 Black, 58.6 Hispanic, 60.9	White, 3.19% Black, 3.65% Hispanic, 2%	NED (0.23–0.26%)

ECNR, ethnic composition not recorded; NED, no ethnic differences; NR, not recorded; PE, pulmonary embolus.

reintervention; and failure to be discharged from the hospital) was used for primary metabolic procedures.

Within this group of 4,776 patients, extreme values of BMI were significantly associated with an increased risk of the composite end point, whereas age, sex, race, ethnic group, and other coexisting conditions were not.

In the final study regarding complications, there has been only one to examine differences in micronutrient deficiencies after metabolic surgery. In a study by Clements et al. (25), at 1- and 2-year postoperative follow-up, black patients (vitamins A, D, and B_1 for 1 year and B_1 and B_6 for 2 years) and women (vitamin C at 1 year) were more likely to have vitamin deficiencies.

INFLUENCE OF BIOLOGY

There is demonstrated ethnic variation in metabolic outcomes for weight loss, comorbidity remission, complications, and mortality. The basis of this variation may be attributed to biologic differences, cultural distinctions, and diminished access to care. A plausible biologic influence for ethnic variations in metabolic outcomes may be genetic differences. Genetic factors likely play a role in obesity and the outcomes after bariatric surgery. In a study of two academic centers, 1,276 bariatric patients were genotyped for the INSIG-2, FTO, MC4R, and PCSK-1 obesity single nucleotide polymorphisms.

In white and Hispanic patients with class III obesity undergoing bariatric surgery, significant differences in variants in or near FTO, PCSK-1, and MC4R were noted. In future larger studies, it may be possible to correlate genetic markers with outcomes such as weight loss and surgical morbidities (26).

INFLUENCE OF CULTURE

A potential modifier of metabolic surgery outcomes on the basis of ethnicity may be cultural. The impact of family upon weight outcomes has been well known whereby weight loss can be transmitted to family members, the halo effect (27). The halo effect has been defined as both weight loss occurring in family members of patients undergoing obesity treatment or enhancement of weight loss in patients undergoing treatment by supportive family members. Different cultural norms may influence views of medical effectiveness or appropriate weight. For example, in one study, it was demonstrated that denial of accurate weight might be ethnically different. In this study, 179 female gastric bypass surgery candidates (31 black, 22 Hispanic, and 126 white) had self-reported and actual height and weight obtained. Discrepancy in self-reported and actual height and weight was unrelated to BMI; however, black women underestimated their BMI significantly more than white women, with Hispanic women not differing from the other groups (28). This is a single study and should be interpreted with caution.

INFLUENCE OF ACCESS TO CARE

A unifying cause for ethnic differences in metabolic surgery outcomes is clearly access to care. Different ethnic groups access the health system at different rates, including primary and specialty care, which could lead to more burden of disease. According to one study, there have been fewer minority patients accessing bariatric surgery (29). However, another study from the same institution had the opposite conclusion. In fact, in this study, bariatric surgery rates were highest for black females (29.4 per 10,000), followed by white (21.3 per 10,000) and other racial minority (8.6 per 10,000) females (30). Even if patients have access to care, physician recommendation for therapy can provide additional influence upon metabolic surgery outcomes. In a survey study, if recommended by their doctor, African American and Hispanic patients were more willing to consider bariatric surgery than white patients. However, only 20% of patients reported being recommended for bariatric surgery by their physician and African Americans were less likely to receive this recommendation (31). A study from the U.K. underscores the impact

that insurance coverage has on access to care for minorities (32). The U.K. enjoys universal coverage through the National Health Service. If physician attitudes toward minorities were a factor in access to metabolic surgery, then these attitudes would be manifested in a differential rate of surgery for ethnic groups. In this study using data from the National Bariatric Surgery Registry and census data from the U.K. and Ireland, the number of procedures recorded per 1,000 morbidly obese patients was 5.2 for Caucasian patients, 5.2 for Asian patients, and 5.2 for black patients. Given that the rates are identical across ethnic groups, this indicates that coverage, not physician attitudes, drives access to metabolic surgery and its outcomes.

NEXT STEPS

Ethnic variation in metabolic surgery outcomes includes lower weight loss, equivalent diabetes remission, and increased complications for blacks and Hispanics in comparison with white patients. In a systematic review of 613 publications, 14 studies were selected to demonstrate ethnic variation (33). White patients lost more weight than black patients with a mean % EWL difference of −8.36%. In addition, there is evidence that the indication for metabolic surgery may be different depending upon ethnicity, particularly for Asian patients with diabetes who are preobese. In fact, current screening guidelines for prediabetes and type 2 diabetes call for earlier recognition for different ethnic groups (34). Furthermore, in a study of Asians undergoing metabolic surgery who had a BMI <35 kg/m^2, 100% of patients had diabetes remission and no mortality, major surgical morbidity, or excessive weight loss at 1 year (34). Finally, there are data available to help predict the diabetes remission response to metabolic surgery, including duration of diabetes and fasting C-peptide in 154 Asian patients (35). There is also clearly a need for long-term studies on the safety and efficacy of metabolic surgery in minority populations. In addition, the need for reports in other racial groups, as well as studies in populations from undeveloped countries, should also be encouraged.

In conclusion, ethnic variations in metabolic surgery outcomes exist and further inquiry into the roles that biology, culture, access, and/or medical care provide is imperative to better understand this phenomenon.

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