VARIATION IN CLINICAL CHARACTERISTICS OF WOMEN VERSUS MEN PRE-OPERATIVE FOR LAPAROSCOPIC ROUX-EN-Y GASTRIC BYPASS (LRYGB): ANALYSIS OF 83,059 PATIENTS

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Summary: Variance of obesity related co-morbidities in males and females was analyzed in 83,059 patients who were pre-operative for laparoscopic Roux-en-Y gastric bypass (LRYGB). Among LRYGB patients, men are older, smoke and drink more, and have increased cardiopulmonary, metabolic, and liver disease versus women. In females, somatic pain, gallstones and mental health diagnoses are higher.

Abstract

Background: Variation by sex in pre-operative clinical characteristics of female and male laparoscopic Roux-en-Y gastric bypass (LRYGB) patients has not been evaluated comprehensively. The objective of our study was to identify clinical differences between morbidly obese women and men seeking LRYGB.

Methods: Data from 83,059 patients in the Surgical Review Corporation's Bariatric Outcomes Longitudinal Database (BOLD) who were about to undergo LRYGB was analyzed in two groups: Women (n=65,325) and Men (n=17,734). Statistics were evaluated with analysis of variance and the Chi-squared equation.

Results: Cardiopulmonary co-morbidities affected more men than women ($p \leq 0.0002$) except for female asthma ($p<0.0001$). Diabetes, gout, dyslipidemia, abdominal hernia, liver disease, alcohol and tobacco use, and substance abuse were higher for men ($p<0.0001$). Women had GERD, cholelithiasis, abdominal panniculitis, back pain, musculoskeletal pain, mental health disorders, depression, and impaired psychological status more often ($p<0.0001$).

Conclusions: Among LRYGB patients, men are older, smoke and drink more, and have increased cardiopulmonary, metabolic, and liver disease versus women. Female somatic pain, gallstones and mental health diagnoses are higher. This advance knowledge may aid management of LRYGB patients. By raising the index of suspicion for weight-related co-morbidities, management of non-bariatric surgical patients may be facilitated.

Introduction

With over 36% of Americans having a Body Mass Index (BMI) >30, the obesity epidemic now makes every surgeon's practice a bariatric practice [1]. Every surgeon is likely to operate on morbidly obese patients. In the management of this challenging population, every clinical insight helps to optimize outcomes. Obesity is associated with multiple co-morbidities such as cardiovascular disease, heart failure, and cardiac arrhythmias. Obese patients are also at an increased risk for difficulty with intubation, surgical site infection, and adverse events peri-operatively [2]. Thus, anticipatory preoperative assessment is essential to optimize surgical planning and decrease the risk of preventable morbidity and mortality in the morbidly obese.

Distribution of major medical problems varies between men and women in the general population. For example, in chronic obstructive pulmonary disease (COPD) patients, Dal Negro, et al. found that males more frequently have cardiovascular disorders, pneumonia, pleural effusions, and chronic respiratory failure. Women have more metabolic, digestive, osteoarticular disorders, anemia, gallstones, and osteoporosis [3]. It is unclear whether variations such as these translate to the bariatric population.

Patients undergoing bariatric surgery are more commonly women, and have a lower BMI and age compared to males. Data thus far has shown that males commonly have more pre-operative co-morbidities and develop more post-operative complications [4]. Although studies have been performed on post-operative laparoscopic Roux-en-Y gastric bypass (LRYGB) outcomes, there is minimal data on the presence of specific pre-operative co-morbidities. Whether or not the presence of these co-morbidities

reliably varies significantly between men and women is unknown. The objective of this study was to identify significant variation in baseline pre-operative clinical characteristics between obese men and women seeking LRYGB.

Materials and Methods

With the approval of the Surgical Review Corporation Data Access Committee and the IRB of Our Lady of Lourdes Medical Center, Camden, NJ, this study evaluated pre-operative data from the Surgical Review Corporation's Bariatric Outcomes Longitudinal Database (BOLD) on 83,059 morbidly obese patients who were to undergo LRYGB between June 1, 2007 and December 31, 2010 [5].

Data was evaluated retrospectively in two groups: Women (n=65,325) and Men (n=17,734). Weight, BMI, age, race, health insurance status, and the percent frequency of obesity co-morbidities were obtained from BOLD, including hypertension (HTN), angina, congestive heart failure (CHF), peripheral vascular disease (PVD), pulmonary hypertension (PHTN), obstructive sleep apnea (OSA), obesity hypoventilation syndrome (OHS), asthma, ischemic heart disease, deep vein thrombosis/pulmonary embolism (DVT/PE), abdominal hernia, abdominal panniculitis, cholelithiasis, gastroesophageal reflux disease (GERD), liver disease, stress urinary incontinence, diabetes mellitus, gout, dyslipidemia, polycystic ovarian syndrome (PCOS), pseudotumor cerebri, back pain, lower extremity edema and musculoskeletal pain, mental health diagnoses, impaired functional status, depression, psychological impairment, alcohol use, substance abuse, tobacco use, fibromyalgia, and menstrual irregularity.

Continuous variables were analyzed using ANOVA with treatment in the

models. Pair-wise comparisons were performed on the least squares means of the treatments calculated from the ANOVA model to find differences in the treatment groups. Distribution of obesity co-morbidities was examined by a general linear model with treatment in the model and modified for binomial distribution to account for dichotomous variables [6].

Results:

Age (47.5+-11.5 vs 44.8+-11.5 years), weight (156+-30 vs 127+-23 kg) and BMI (49+-9 vs 47+-8) were higher for men ($p<0.001$). Female/male race distribution (African-American 12%/7%, Caucasian 75%/80%, Hispanic 8.2%/8.6%, Asian 0.22%/0.3%) and health insurance status (Medicaid 7%/4%, Medicare 7.4%/8.9%, Private 83.8%/84.4%, Self-Pay 1.9%/2.6%) varied significantly ($p<0.001$). Unemployment was 25.7% men and 21.4% women ($p<0.0001$).

Cardiopulmonary co-morbidities in obese males versus females are displayed in Table 1. The majority of cardiopulmonary co-morbidities analyzed were significantly more prevalent in men, including hypertension, obstructive sleep apnea, lower extremity edema, angina, CHF, DVT/PE, ischemic heart disease, OHS, PVD, and pulmonary hypertension. Only asthma was significantly more frequent among females.

Endocrine and metabolic co-morbidities among obese males and females are presented in Table 2. Females more frequently had fibromyalgia and pseudotumor cerebri versus males, who had more diabetes mellitus, dyslipidemia, and gout.

The results of abdominal and hepatobiliary co-morbidities are listed in Table 3. Abdominal hernias and liver disease were more frequent in males. Females had more cholelithiasis, GERD, abdominal panniculitis, and stress incontinence.

Somatic co-morbidities between males and females are demonstrated in Table 4. Males more commonly had impaired functional status, but females were more likely to have back and musculoskeletal pain.

Psychological and behavioral co-morbidities between obese males and females are resulted in Table 5. Males had more alcohol use, tobacco use, and substance abuse. Females more frequently had depression, mental health diseases, and psychological impairment.

Overall, Women were highest in 12 co-morbidities and Men had higher rates in 18 co-morbidities.

Discussion

Reports on variance in different pre-operative co-morbidities among patients undergoing LRYGB are scarce. Our review of the literature indicates that these clinically and statistically significant variations by sex in the clinical characteristics of morbidly obese patients pre-operative for LRYGB have not been reported previously in this magnitude.

The results of this study identify significant variations in pre-operative clinical characteristics between morbidly obese men and women seeking LRYGB. Age and BMI were higher for men than women. Females were more often African-American and insured through Medicaid. Cardiopulmonary obesity co-morbidities affected more men

than women. Of these parameters, only female asthma was higher. Diabetes, gout, and dyslipidemia were increased among men. Abdominal hernia and liver disease were higher in men, but women had GERD, cholelithiasis, and abdominal panniculitis more often. Back pain, musculoskeletal pain, mental health disorders, depression, and impaired psychological status were more common in women. Alcohol and tobacco use and substance abuse were higher for men, possibly contributing to increased male liver disease. Overall, 18 obesity–related medical conditions were manifested more frequently among men, and 12 among women, excluding menstrual irregularities and polycystic ovarian disease. Of the categorical parameters analyzed, only lower extremity edema did not vary by sex.

While men are expected to weigh more than women, significantly increased male age and BMI suggest that men may decide to undergo LRYGB at a more advanced stage of morbid obesity. This is consistent with the findings of Regitz-Zagrosek [4]. However, the narrow gap between the observed age and BMI between females and males in this study questions the clinical significance of these observations. Thus, the contribution of increased obesity years and body mass for men to disparities in weight-related problems is not clear from the data.

Adams reported significant pre-operative variations by race among LRYGB patients for fifteen of the parameters studied in the present investigation [7]. Similarly, Blair observed baseline differences by health insurance status in seventeen clinical characteristics, including unemployment [8]. Considering the varied distribution of race and health insurance seen here, one might speculate that these factors could have influenced the disparities by sex in the data.

Although previous reports have identified obese men as at increased risk for cardiovascular illnesses, including hypertension and acute cardiac ischemia [8, 9], the breadth of increased male susceptibility for circulatory pathology seen in this investigation is impressive. Compared with women, men suffered significantly increased angina, congestive heart failure, ischemic heart disease, DVT/PE, peripheral vascular disease, and pulmonary hypertension. Whether or not higher male tobacco abuse was a factor is not clear from the data. Nevertheless, this constellation of factors should be considered in the surgical management of morbidly obese men.

Men in this study also experienced pulmonary obesity co-morbidities more often than women, particularly obstructive sleep apnea and obesity hypoventilation syndrome. Conversely, only asthma was increased among women. These results contrast with those of Stroh and co-workers [9], who found increased OSA in men, but no other gender variation in pulmonary conditions.

Increased incidence of diabetes among obese men versus women in this investigation confirms the findings of earlier papers [8, 9]. Increased male dyslipidemia and gout in the present results complete the list. Perhaps attention to this advance knowledge can facilitate optimum clinical management.

All of the abdominal and hepatobiliary weight-related medical problems in this analysis varied by sex. Women dominated in cholelithiasis, abdominal panniculitis, GERD, and stress urinary incontinence. Abdominal hernia was higher among men. It is possible that increased male liver disease in morbid obesity could be related to higher alcohol consumption by men.

Consistent with prior investigations, morbidly obese women here reported more somatic co-morbidities than did men. These included higher back pain and musculoskeletal pain and fibromyalgia for females. These specific findings were not reported in other investigations [8]

The observation of increased depression and other mental health diagnoses, as well as significantly higher psychological impairment among morbidly obese women, versus men, in this evaluation have not been reported extensively and are important results. Increased pre-operative index of suspicion in these areas may enable targeted behavioral intervention for indicated individuals in their pre-operative care plans.

Gender disparity among patients undergoing weight loss surgery has been well demonstrated in the literature. In a populational study, Zizza et al. demonstrated a significant difference in gender co-morbidities at the state level based on North Carolina Hospital Discharge Data. Gender co-morbidities were compared using a co-morbidity index based on ICD-9-CD codes. This study found that in general, men have a higher co-morbidity burden than women [7]. Unfortunately, individual co-morbidities were not broken down for gender comparison. Our study offers a broader and more in depth assessment of co-morbidities.

Our results shared many similar findings with the study by Stroh et al., conducted using the German Bariatric Surgery Registry, including patients who had a variety of bariatric procedures. Over 10,000 patients in their study received a LRYGB. They also found that the incidence of co-morbidities was significantly higher in males than females. Their results showed that males had a significantly higher incidence of hypertension, diabetes mellitus, and sleep apnea. They did not find any difference

between skeletal disorders or pulmonary embolism [8]. In comparison, our study includes a much larger population and is representative of the diverse patient population within the United States.

There were several limitations to our study. This is a retrospective analysis of prospectively collected data, and, as such, carries many typical confounders. In addition, the patients in this study represent a self-selected population. Diagnosis of co-morbidities was also based on a clinical diagnosis or was self-reported by patients, rather than derived from a pathological diagnosis.

Conclusion

The results of this study identify statistically significant clinical variations by gender in obesity co-morbidities among patients about to undergo LRYGB. Men are older, smoke and drink more, and have increased cardiopulmonary, metabolic, and liver disease versus women. Female somatic pain, gallstones and mental health diagnoses are higher. This advance knowledge may aid in management and pre-operative counseling of LRYGB patients. Although the LRYGB population is a self-selected group of obese patients, gender-based clinical variations described here may be extrapolated to morbidly obese surgical patients overall. By raising the index of suspicion for weight-related co-morbidities, the successful management of non-bariatric surgical patients may be facilitated.

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Table 1. Variation by Sex in Cardiovascular Co-Morbidities.

	Asthma	Hypertension	OSA	LLE	Angina	CHF	DVT/PE	Ischemic HD	OHS	PVD	Pulm HTN
Females (%)	20.34	56.93	43.32	30.14	2.59	1.78	2.77	3.16	1.68	0.97	4.79
Males (%)	12.77	73.22	65.35	30.38	3.95	4.13	3.29	8.9	2.63	2.01	5.46
p-value	<0.0001	<0.0001	<0.0001	0.5358	<0.0001	<0.0001	0.0002	<0.0001	<0.0001	<0.0001	0.0002

HTN: Hypertension. OSA: Obstructive Sleep Apnea. LEE: Lower Extremity Edema. CHF: Congestive Heart Failure. Ischemic HD: Ischemic Heart Disease. OHS: Obesity Hypoventilation Syndrome. PVD: Peripheral Vascular Disease. Pulm HTN: Pulmonary Hypertension.

Table 2: Variation by Sex in Endocrine and Metabolic Co-Morbidities.

	Fibromyalgia	Diabetes	Menstrual Irregularity	PCOS	Pseudotumor Cerebri	Dyslipidemia	Gout
Females (%)	4.4	35.94	30.64	6.97	2.72	40.88	2.48
Males (%)	0.65	49.94	0	0	0.92	52.62	8.38
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

PCOS: Polycystic Ovarian Syndrome.

Table 3: Variation by Sex in Abdominal and Hepatobiliary Co-Morbidities.

	Abdominal Hernia	Cholelithiasis	GERD	Abdominal Pannus	Liver Disease	Stress Incontinence
Females (%)	4.41	24.86	51.54	7.99	6.88	30.18
Males (%)	7.58	9.47	43.11	6.43	8.29	4.24
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Table 4: Variation by Sex in Somatic Co-Morbidities.

	Back Pain	Functional Status	Musculoskeletal
Females (%)	50.46	3.22	46.81
Males (%)	47.74	3.85	44.99
p-value	<0.0001	<0.0001	<0.0001

Table 5: Variation by Sex in Psychological and Behavioral Co-Morbidities.

	Alcohol Use	Depression	Mental Health	Psychological Impairment	Substance Abuse	Tobacco Use
Females (%)	29.94	39.8	12.45	19.06	0.39	6.18
Males (%)	34.72	25.05	7.32	12.99	0.67	8.24
p-value	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001