MEN'S SEXUAL HEALTH

Impact of Bariatric Surgery on Sexual Dysfunction in Obese Men

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ABSTRACT

Introduction: Currently bariatric surgery is the most effective treatment for significant and sustained weight loss. Erectile and endothelial dysfunctions may share some metabolic and vascular pathways in common that may be influenced by weight loss.

Aim: The aim of the study was to assess the impact of surgically induced weight loss on the erectile function on obese patients undergoing laparoscopic sleeve gastrectomy (LSG). We also aimed to examine the proposed underlying mechanism associated with improvement in erectile function after weight loss by LSG.

Methods: Eighty-two consecutive obese men who underwent a LGS were followed up for 12 months. All operations were performed by the same surgeon at a single institution.

Main Outcome measure: Patients were examined both before and after 12 months of LSG for biochemical tests; total serum cholesterol, triglyceride, C-reactive protein, interleukin-6, and endothelial nitric oxide synthase, and for erectile function tests. International Index of Erectile Function (IIEF) scores were recorded.

Results: Eighty-two men (mean age 39 ± 14.6 years, range 24−62; mean BMI 41.2 ± 4.8 kg/m^2) completed all preoperative and postoperative questionnaires and biochemical tests. At 12 months, the mean weight loss was 34.8 kg and the mean BMI decrease was 8.6 kg/m^2. Preoperative and postoperative IIEF scores of the 65 sexually active patients showed significant improvement in erectile function (21.2 ± 5.7 vs 26.5 ± 4.5; $P = .02$). Seventeen (20.7%) men were not sexually active preoperatively; only 5 became sexually active postoperatively. Men had a significant decrease in serum cholesterol and triglyceride levels. Nitric oxide synthase activity showed a significant increase ($P < .02$). In addition, our patients showed a statistically significant decrease in interleukin-6 levels and C-reactive protein compared with preoperative period ($P < .03$ and $P < .01$, respectively).

Conclusion: A significant improvement of erectile function was documented among obese young men undergoing LGS. This improvement was documented both clinically by improvement in IIEF score postoperatively and biochemically. **A Fahmy, H Abdeldaiem, M Abdelsattar, et al. Impact of Bariatric Surgery on Sexual Dysfunction in Obese Men. Sex Med 2021;9:100322.**

Key Words: Bariatric Surgery; Erectile Dysfunction; Obese; Men

INTRODUCTION

Obesity has been viewed as interplay within a pathological loop between chronic inflammation and chronic oxidative stress disorder.[1] Moreover, obesity has been established as a proven and modifiable risk factor for life-threatening diseases, including diabetes mellitus, hyperlipidemia, and cardiovascular disease suggesting common underlying pathophysiological pathways.[1,2] The association between obesity and erectile dysfunction has been widely studied and demonstrated; however, evidences about the underlying pathophysiological mechanisms have been still conflicting and unclarified.[2]

Patients' compliance with life style modification programs promoting loss of weight is usually typically less efficient and unsatisfactory on the long term, while bariatric surgery has proven to be safe, effective, and reliable treatment modality for substantial and sustained weight loss in the recent years.[2,3] Endothelial function improvement and increase in androgen level are brought about by rapid weight loss induced by bariatric surgery in obese patients.[3]

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Obesity was positively correlated with metabolic, hormonal, and endothelial dysfunction and increased serum levels of cholesterol, triglyceride, and vascular inflammatory mediators, such as interleukin-6 (IL-6) and C-reactive protein (CRP).[4,5] Reduced activity and diminished production of nitric oxide that may be influenced by weight loss may represents a common metabolic and vascular pathways shared by both erectile and endothelial dysfunctions[6,7]

How bariatric surgery could impact sexual function in obese men with sexual dysfunction and what the underlying mechanisms are still remain unclear. This study was conducted to assess the impact of surgically induced weight loss on sexual function among obese men with sexual dysfunction undergoing laparoscopic sleeve gastrectomy (LSG). We also aimed to examine the possible underlying mechanism associated with improvement in erectile function after weight loss by LSG.

PATIENTS AND METHODS

Eighty-two consecutive obese men with sexual dysfunction, undergoing sleeve gastrectomy from May 2016 to February 2019 in a single university-affiliated medical center, were prospectively enrolled. The study protocol was approved by Alexandria Faculty of Medicine Ethics committee (approval number: 115/3, 2016).

Exclusion criteria were diabetes mellitus or impaired glucose tolerance (plasma glucose levels of 140-200 mg/dL [7.8-11.1 mmol/L] 2 hours after a 75-g oral glucose load), impaired renal function, pelvic trauma, prostatic disease, peripheral or autonomic neuropathy, hypertension (blood pressure >140/90 mm Hg), cardiovascular disease, and psychiatric problems. History of drug use affecting erectile function such as PDE5i, statins, fibrates, omega3, antidepressants, and psychotropic drugs. Erectile dysfunction patients with hypogonadism or penile diseases were not excluded from the study.

Inclusion criteria were men undergoing bariatric surgery for the indications; class 3 obesity (BMI>40 kg/m^2) or obese patients with BMI 35-39.9 kg/m^2 who previously failed non surgical management. All patients with International Index of Erectile Function (IIEF) scores in domain A (erectile function) lower than 25, had a female sexual partner, and were not allowed to use PDE5i during the study period.

Preoperative demographic data, comorbidities, BMI, physical examination, and laboratory tests were prospectively obtained and documented in a detailed computerized database. Informed consent of the patients before including them to the study was obtained.

Study Design

Eligible patients were prospectively evaluated at the baseline and 12-month follow-up after surgery by validated questionnaires, the IIEF[8] and biochemical tests to study its potential impact on sexual function.

Outcome Measures

The International Index of Erectile Function

IIEF has been a reliable subjective method to assess male sexual function clinically, where participants were asked to answer a questionnaire composed of 15 questions,[9] the answer to each question was given a score from 1 to 5, allowing the assessment of the 5 main domains of male sexual function: erectile function (items 1−5, 15), orgasmic function (items 9,10), sexual desire (items 11,12), intercourse satisfaction (items 6−8), and overall satisfaction (items 13,14).The EF score represents the sum of questions 1 to 5 and 15, with a maximum score of 30.[10] Based on this score, the degree of erectile dysfunction is defined as normal (>25), mild (21 to 24), moderate (16 to 20), and severe (<15). For the purpose of this study, a score of less than 25 indicates erectile dysfunction.

Biochemical Tests

Assays for serum levels of total cholesterol and triglycerides were performed in the hospital's chemistry laboratory. Nitric oxide synthase (NOS) activity was assayed in RBC lysate. Functional endothelial NOS (eNOS) was found in RBCS as that present into the endothelium.[11] This eNOS can be used as a surrogate measurement of penile eNOS.[12] Validated colorimetric method to assay the activity of eNOS by measuring NO2-concentrations (Ultra sensitive Colorimetric NOS Assay, Oxford Biomedical Research Inc, MI, USA).

Inflammatory cytokines including CRP levels and serum IL-6 levels were measured. Latex agglutination test (CRP Latex Agglutination Kit, ProDia International, U.E.A. proDiagnostics GmbH, Germany) was used for serum CRP measurement. Serum IL-6 was assayed using the enzyme-linked immunosorbent assay technique (AviBion Human IL-6 enzyme-linked immunosorbent assay kit, Ani Biotech Oy, Orgenium Laboratories Division Tiilitie 3, Vantaa, Finland).

Statistical Analysis

Data are summarized as mean ± standard deviation. Statistical analysis was performed using Student's t-test for continuous data or Fisher exact test for categorical data. Kolmogorov-Smirnov test was used to test the parameter distribution. Paired t-test was used to compare normal parameters and analysis of preoperative versus postoperative results (cross over analysis). $P < .05$ was considered statistically significant. Statistical Package for Social Sciences (SPSS), version 15.0, was used for the analysis (SPSS Inc, Chicago, IL, USA).

This study was designed to detect a 20% improvement in erectile function, between the preoperative and 12 month postoperative period, with 80% power, assuming a significant difference level of 0.05. The sample size was estimated to be 80 patients. We aimed to enroll 90 patients to take into account dropout cases.

RESULTS

Eighty-two men (mean age 39 ± 14.6 years, range 24−62; mean BMI 41.2 ± 4.8 kg/m^2) who underwent LSG, completed all preoperative and postoperative questionnaires and biochemical tests. Eight patients did not complete the study because of loss to follow-up or incomplete data. Baseline patient characteristics of the 82 patients included for analysis are shown in Table 1.

All patients lost weight after surgery. This was progressive and noted significantly after 12 months from a mean of 41.2 ± 4.8 to 32.3 ± 5.6 ($P < .001$). At 12 months, the mean weight loss was 34.8 kg and the mean BMI decrease was 8.6 kg/m^2.

Preoperative and postoperative IIEF questionnaire was used to evaluate improvement sexual function (Table 2). Preoperatively, 65 (79.3%) patients (mean age 34.7 ± 8.6 years, mean BMI 40.2 ± 3.8 kg/m2) were sexually active. Seventeen other patients (mean age 42.7 ± 14.3 years, mean BMI 42 ± 6.2 kg/m^2) were not sexually active.

Preoperative and postoperative IIEF scores of the 65 sexually active patients showed significantly improvement in erectile function (21.2 ± 5.7 vs 26.5 ± 4.5; $P = .02$). Moreover, postoperative overall intercourse satisfaction (7.2 ± 3.6 vs8.5 ± 2.2; $P = .01$), as well as overall satisfaction (7.9 ± 2.5 vs 8.9 ± 1.3 $P = .02$), were also significantly improved. Among 17 (20.7%) men were not sexually active preoperatively; only 5 became sexually active postoperatively, inspite of improvement in biochemical tests.

Twelve month postoperatively, men had a significant decrease in serum cholesterol and triglyceride levels. The total cholesterol levels decreased from a mean of 233.7 ± 65.6 to 155.8 ± 64.3 mg/dL ($P < .001$). Triglyceride decreased from a mean of 173.1 ± 60.8to 136 ± 42 md/dL ($P < .001$). NOS activity showed a significant increase from a mean of 53.2 ± 8.2 to 75.42 ± 12.8 ($P < .02$). In addition, our patients showed a statistically significant decrease in IL-6 levels and CRP compared with preoperative period from a mean of 55.7 ± 24 to 36.5 ± 6.8 ($P < .03$) and from a mean of 22.5 ± 19.2 to 10.6 ± 6.82 ($P < .01$), respectively.

DISCUSSION

Many published reports in the literature have showed a good evidence of clinical improvement in male sexual function after overweight optimization, induced either by behavioral modifications programs or following bariatric surgery.[13,14] However, to our knowledge, prevalence of sexual dysfunction before and after weight-reduction surgery in obese men and its potential underlying mechanisms are scarce and controversial. Multiple potential underlying causes have been suggested; however, the actual pathogenic mechanisms explaining these associated finding remain to be identified.[2]

Obesity is interplay of a multitude of pathologic pathways, resulting in increased formation and accumulation of reactive oxygen species and inflammatory mediators.[15] Free oxygen radicals overproduction in obese men could deplete and inactivate nitric oxide at tissue level. Oxidative stress reduction under the effect of bariatric surgery−induced weight loss results in increase in nitric oxide activity and availability.[16]

Endothelial dysfunction has been associated with impaired NO activity and has been identified as an important risk factor in the pathogenesis of erectile dysfunction.[17] A significant correlation was found between levels of CRP and IL-6 and reduced nitric oxide availability and increasing severity of penile vascular disease as measured by penile Doppler.[17] Moreover, consistent findings support a predictive role of CRP and IL-6 for cardiovascular events in different populations.[17,18]

Many studies in the literature have addressed the impact of bariatric surgery−induced weight loss on erectile function in obese men with contradictory outcomes.[19,20] IIEF scores failed to show any improvement after an average of 32 months follow-up period, inspite of significant weight reduction after laparoscopic gastric banding in obese men in a retrospective study.[21]

Di Frega et al looked at 6 men who developed erectile dysfunction and infertility after laparoscopic gastric bypass (LGB) surgery. They attributed these finding to the possible reduced intestinal absorption of vital structures especially zinc, after LGB surgery.[18] However, malabsorption has not been documented after LGB as it is known that LGB induces weight reduction through a restrictive mechanism.

Contrary to the aforementioned studies, a study included 95 men who underwent LGB surgery with a mean age = 48; mean BMI = 51; Dallal et al showed significant positive effects in all parameters of the Brief Sexual Inventory scores (BSFI scores) after surgical intervention with a mean follow-up of 19 months.

Table 1. Changes in biochemical tests both before and after 12 months of bariatric surgery (N = 82)

Variables	Preoperative mean ± s.d.	Postoperative mean ± s.d.	*P* Value
Total cholesterol (mg/dL)	233.7 ± 65.6	155.8 ± 64.3	<.001*
Triglyceride (mg/dL)	173.1 ± 60.8	136 ± 42	<.001*
NOS	53.2 ± 8.2	75.42 ± 12.8	.02*
CRP (mg/L)	22.5 ± 19.2	10.6 ± 6.82	.03*
IL-6 (pg/mL)	55.7 ± 24	36.5 ± 6.8	.01*

CRP = C-reactive protein; IL-6 = interleukin-6; NOS = nitric oxide synthase.
*Statistically significant ($P < .05$).

Table 2. Changes in IIEF score both before and after twelve months of bariatric surgery (N = 65)

Variables	Preoperative	Postoperative	*P*
BMI (kg/m^2)	41.2 ± 4.8	32.3 ± 5.6	<0.001*
IIEF categories			
Erectile function (1–5, 15)	21.2 ± 5.7	26.5 ± 4.5	0.02*
Orgasmic function (9,10)	8.3 ± 1.3	8.2 ± 2.9	0.18
Sexual desire (11,12)	7.3 ± 2.1	7.5 ± 1.5	0.32
Intercourse satisfaction (6–8)	7.2 ± 3.6	8.5 ± 2.2	0.01*
Overall satisfaction (13,14)	7.9 ± 2.5	8.9 ± 1.3	0.02*

BMI = body mass index; IIEF = International Index of Erectile Function.
*Statistically significant ($P < .05$).

They also went on to show that BSFI scores approached those of normal age-related values after average excess weight reduction of 67%, and the degree of improvement was correlated with the amount of weight reduction.[21]

In a randomized controlled trial conducted by Reis et al on 10 morbidly obese men following strict lifestyle modification weight loss program followed by subsequent LGB surgery, significant improvements in erectile function was observed using the abbreviated IIEF-5 after 24-month follow-up.[21] Although IIEF-5 scores of intervention group (mean BMI = 55.7; mean age = 36.7) were higher than the control group (mean BMI = 54.0; mean age = 42.2), small sample size was a major limitation of this study (10 patients in each arm).

In morbidly obese individuals, bariatric surgery has been shown as an effective and reliable way of achieving a significant and profound weight loss—independent effect on endothelial function.[1,22]Endothelial dysfunction is the end result of reduced antioxidant activity, diminished tissue perfusion, and abnormal platelet agglutination brought about by large amount of reactive oxygen species produced in adipose tissues, which was evidenced by increased serum levels of inflammatory biomarkers, such as CRP, IL-6, and IL-8, thereby causing erectile dysfunction.[23]

The present study demonstrates that bariatric surgery can significantly ameliorate erectile function in obese men. Preoperative and postoperative IIEF scores of the 65 sexually active patients showed significant improvement in erectile function ($P = .02$). Moreover, postoperative overall intercourse satisfaction ($P = .01$), as well as overall satisfaction ($P = .02$), were also significantly improved. Symptomatic improvement detected by increase IIEF score was correlated with the observed alteration in the levels of biochemical markers.

Weight reduction revealed a significant enhancement effects on NOS activity ($P = .02$) and improved nitric oxide availability which may be implicated in improvement of obesity-related sexual dysfunction in our series of obese men through correction of postoperative vascular endothelial dysfunction.

This was associated with significant reduction in total serum cholesterol, triglyceride, IL-6, and CRP due to reduced oxidative stress induced by bariatric surgery which may explain erectile function improvement after weight loss. The correlation of total serum cholesterol and triglyceride values with ED strongly promotes the effect of hyperlipidemia treatment in management of ED.[23]

Caution should be taken when interpreting our results because despite improvements in biochemical tests among 17 men (20.7%) who were sexually inactive before surgery, only 5 of them started sexual activity after surgery. The potential presence of other confounding factors, other than weight loss per se, might explain the underlying mechanism of sexual function in obese men preoperatively and postoperatively.

Similar regulatory vascular processes could explain the observed association between IEEF score and biomarkers of endothelial dysfunction in our patients. Impaired endothelium-dependent nitric oxide activity associated with its limited availability may clarify the underlying mechanisms of both conditions.

In obese men, the presence of common metabolic and vascular mechanisms underlying both erectile and endothelial dysfunction has been strongly supported by the association between IEEF score and indices of vascular and inflammatory mediators. A good explanation for these finding is the diminished activity of NO together with reduced tissue availability and increase in serum cholesterol, triglyceride, CRP, and IL-6 levels.[23,24]

The relationship between weight loss after bariatric surgery and postoperative improvement of male sexual function was showed in the present study, symptomatic and objective responses after surgery may explain the underlying mechanisms of association. Overall erectile function showed significant improvement in most men who underwent LSG. Of note, here patients with the highest symptoms scores preoperatively had the greatest improvement after surgery. Our results were consistent with many studies in the literature[24–28] showing that the erectile function score of patients undergoing weight-reduction surgery at 1 year postoperatively was significantly higher than that preoperatively, and the erectile function showed significant improvement.

Our study has several limitations. The relatively small number of patient enrolled in the study with a short period of follow-up. The claimed cause-and-effect relation between biochemical tests and IIEF score before and after weight loss due to LSG and

amelioration of erectile function cannot be adequately supported. Patients were not allowed to take PDE5i during the study period; however, the preoperative IIEF could be affected by previous unreported use of PDE5i.

Erectile dysfunction patients with hypogonadism or penile diseases such as buried penis or penile shorting were not excluded from the study, which may represent possible confounders. Preoperative and postoperative penile sizes were not evaluated. Testosterone and other sex hormonal profile measurement were not assessed in this study group, to look at the alterations in their levels before and after LSG.

Preoperative and postoperative cardiovascular, nutritional, and psychological measurements have not been collected, to control for possible confounders. A better self image brought about by loss of weight in obese men together with relief of stress and anxiety might disclose a psychological element contributing to erectile dysfunction that may have played as a confounding factor in improving erectile function after weight loss. Finally, the use of questionnaires for measuring sexual function based on subjective assessment could have also subjected to recall bias.

Larger future randomized controlled trials with a long-term follow-up period might be required to search for the underlying pathophysiological mechanisms of sexual dysfunction among obese men, as well as the optimal diagnostic workup and therapeutic modalities.

CONCLUSION

A significant improvement of erectile function was documented among obese young men undergoing bariatric surgery. This improvement was documented both clinically by improvement in IIEF score postoperatively and biochemically through reduction of hyperlipidemia and amelioration of both endothelial function and inflammatory cytokines.

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