

The relationships between bariatric surgery and sexual function: current evidence based medicine

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Abstract

Background Controversial remains despite several studies have discussed the role of bariatric surgery for ameliorating male's sexual function. This study aims to evaluate the efficacy of bariatric surgery in promoting male

erectile function. Methods We performed a systematic review or meta-analysis of studies published in PubMed, Embase, The Cochrane Library, CNKI and ClinicalTrials.gov

erectile function is not well interpreted yet, it's supported by our results that bariatric surgery may be effective in sexual function promoting for obese individuals.

Background

Erectile dysfunction, one of the most complained problems during sexual intercourse, is the inability to achieve or maintain an erection sufficient for satisfactory sexual performance[1], which has been paid more and more attention by society for its association with poor quality of male's sexual life[2] and the prevalence goes higher and higher during the past decade. Epidemiological studies indicate that in 1995 erectile dysfunction (ED) affected over 150 million men worldwide and the prevalence will reach 322 million by 2025[3]. Health problems, including sexual dysfunction that is highly prevalent in the general population, impaired the quality of life[4].

Obesity, especially morbid obesity, is associated with a broad range of medical and psychosocial comorbidities which impose a negative effect on patients' lives and health-care systems, including non-insulin dependent diabetes mellitus, coronary heart disease, stroke and hypertension[5-8]. Evidence from a large number of studies have shown relationships between obesity and derangements in sexual functioning[9-11], which was often overlooked referred to the comorbidities of obesity. Some scholars have studied the effects of obesity on men in various aspects, especially in terms of sexual function, which deserves our attention. It was reported that ED was observed a higher morbidity in obese males compared with in males of normal weight[12]. Sarwer et al[11] demonstrated in their study that 36% of men presenting for bariatric surgery reported erectile dysfunction, which is in contrast to 20% of men who sought nonsurgical weight loss and reported ED. Moore et al[13] have reported 45% of obese men who seek weight reduction met diagnostic criteria of erectile dysfunction. Laumann et al[4] reported in the United States that the prevalence of sexual dysfunction in general male population was 31%.

Several managements have been implemented to deal with obesity. Dietary intervention, medications, physical exercise are widely used in case of mild and moderate obesity[14]. Meanwhile, bariatric surgery has become the most effective treatment method for morbid obese patients which can bring great weight reduction obviously and ameliorate the comorbidities[15, 16]. The bariatric surgical procedures, including gastric bypass, vertical sleeve gastrectomy, and biliopancreatic diversion, are recommended for class 2 obesity associated with comorbidities and for class 3 obesity (body index[BMI] 35-39.9kg/m² and >40kg/m²; respectively)[17].

As proved an effective procedure in promoting weight loss and improving obesity-related physical comorbidities, bariatric surgery is now widely performed on obese patients[18-21]. Results of some studies have revealed the bariatric surgery has a significant positive effect on male's sexual function while some studies showed no significant change. The number of studies into the relationship between obesity and male's sexual dysfunction is limited and the results have been controversial. Hence, we performed the systemic review and meta-analysis to investigate the efficiency of bariatric surgery in promoting male's sexual function.

Methods

Before conducting a systematic literature search, we formulated a protocol to standardize the process of literature review and data extraction which is strictly compliance during the procedure.

Inclusion and Exclusion Criteria

Two independent reviewers separately assessed each study based on the inclusion and exclusion criteria to determine whether the study be included. Studies that met the following criteria were included: (1) self-control study, (2) randomized controlled trials which set bariatric surgery as intervention, (3) at least one of the indexes listed above for evaluating male's sexual function (IIEF score and BSFI score) was assessed in the study. For exclusion, we eliminated studies which met the following criteria: (1) only females were recruited as the study subjects, (2) either perioperative data or postoperative data was missing or not recorded, (3) indexes used to evaluate sexual function didn't correlate with our study, (4) reviews, letters, technical reports, case reports, comments or studies consisting of <10 controls. Publications based on the same study (e.g. same authors, institutions, period of study) were discussed, and only the best-quality study was used.

Search Strategy

We searched PubMed, Embase, The Cochrane Library, CNKI and Clinical Trials.gov for English-language studies published before May 2019. Search terms included bariatric, laparoscopic Roux-and-Y gastric bypass, gastric bypass surgery, obesity, erectile dysfunction and sexual function. Supplements retrieved by manually reviewing the references of the included articles enabled us to build a comprehensive analysis.

Study Selection

Two reviewers independently reviewed the titles and abstracts of all retrieved studies for identification of potentially relevant systematic reviews. The full texts of studies which are deemed to be relevant studies were reviewed in details after the initial screening.

Data Extraction

For each included systematic review, we extracted data by two independent reviewers including lead author, country, patients composition, methods for recruitment, baseline IIEF (or BSFI) score, postoperative IIEF (or BSFI) score and postoperative time point for SF assessment. We used the five-question International Index of Erectile Function (IIEF-5) score and BSFI score before and after bariatric surgery as the main reference index to evaluate the erectile function.

Quality Assessment

We used a modified version of the methodological index for non-randomized studies' (MINORS[[22, 23]: Table 3) checklist to assess methodological quality of the included systematic reviews. The checklist contains the following 8 aspects: (1) a clearly stated aim, (2) inclusion of consecutive patients, (3) prospective collection of data, (4) endpoints appropriate to the aim of the study, (5) unbiased assessment of the study endpoint, (6) follow-up period appropriate to the aim of the study, (7) loss to follow up less than 5%, (8) prospective calculation of the study size.

Data Analysis

We perform the meta-analysis by using the Cochrane Review software (Review manager v.5.3 for windows). To analysis the categorical variables, the Cochran-Mantel-Haenszel test was conducted and the forest plots was performed to show the results. Heterogeneity analysis uses the I^2 test to define the statistic heterogeneity between each study. The heterogeneity was deemed to be acceptable and fixed model was used if the I^2 was less than 50%, while the heterogeneity was considered high and the random model was used if the I^2 was greater than 50%.

Results

Study selection

We identified 279 studies totally. After the initial screening through the titles and abstracts, we assessed the full-text articles eligibly for detailed assessment. Finally, 11 studies met the inclusion criteria and were included in the research. The flowchart of the procedure is shown in Fig.1.

Characteristics of the included studies

Of the total 11 studies that are included in our studies, the details of the studies are presented in Table 1.

Results of each study

Results of studies which dedicated to investigate the changes in self-reported sexual function on obese patients who underwent bariatric surgery, have been controversial and were illustrated in Table 2.

Sarwer et al.[11] conducted a prospective cohort study, containing 32 man who underwent a Roux-en-Y gastric bypass, and investigated the sexual function of individuals by using the International Index of Erectile Functioning (IIEF) and sex hormones. The results showed that there was no significant change of the sexual function from the baseline except of overall satisfaction at prospective year 3 ($P = 0.008$), though the men reported improvements in sexual functioning.

On the contrary, the prospective cohort study performed by Reis et al[24]. studied 10 morbidly obese men to measure the degree to sexual function change after life style modifications (exercise and diet) for 4 months and subsequently gastric bypass. Weight loss associated with bariatric surgery was found to improve erectile function quality in the research.

Ranasinghe et al[25]. investigated the effects of weight loss and laparoscopic gastric banding surgery on sexual function among 20 obese men. The results suggested that the IIEF score achieve an improvement significantly after surgery while there existed worsening of erectile index ($P = 0.005$) and orgasmic function ($P=0.002$).

In a prospective study, Mora et al[26]. found the IIEF score increased significantly after 1 year by investigating 39 men undergoing bariatric surgery. Meanwhile, Li et al[27]., conducting a retrospective cohort study, found a significant improvement in IIEF score of 39 obese men after RYGB. Groutz et al[28]. enrolled 39

consecutive obese man, undergoing a laparoscopic sleeve gastrectomy, to investigate the effect of bariatric surgery on male's sexual function in a prospective study. The IIEF were completed preoperatively and postoperatively. The results demonstrated that male's sexual function, including erectile function, overall intercourse satisfaction and overall satisfaction, was significantly improved. Meanwhile, the main finding of the prospective study, performed by Efthymious et al.[14], was that the bariatric surgery could lead to a significant improvement in sexual functioning and especially could be found in the first 6 months postoperatively. In a prospective study of bariatric surgery, which used the IIEF score respectively, Aleid et al[29]. similarly find significant improvements in male erectile function.

Araujo et al[30]. examined the changes following Fobi-Capella gastroplasty in the quality of male's sexual life on 21 men with morbid obesity and favorable changes occurred in sexual function postoperatively.

Dallal et al[31]. compared the Brief Male Sexual Function Inventory (BSFI) before and after gastric bypass surgery to measure its effect to the sexual function in morbidly obese man. On average, the patients reported a significant increase in all domains of BSFI scores post-operatively, compared with preoperative score.

Goitein et al[32]. found the BSFI scores in males increased but did not reach statistical significance ($P = 0.08$). However, general satisfaction, erection and desire were significantly improved within BSFI.

Meta-analysis

279 articles were yielded by our initial search, of which 268 remained after 11 duplicates were removed. Two interviewers independently check these articles and found 11 articles met our inclusion criteria and finally 9 contain the necessary data for quantitative analysis.

The analysis was based on 370 patients from 11 studies with 3 to 24 months follow-up that measured male's sexual function preoperatively and postoperatively. In these studies[11, 14, 24, 26-30], the erectile function was found a 5.33-point increase significantly (Fig 2A 95% CI 4.12-6.54, $p < 0.001$) while there was a 2.57-point increase in the intercourse satisfaction (Fig 2B 95% CI 1.19-3.94, $p = 0.0002$), a 0.50-point increase in orgasmic function (Fig 2C 95% CI 0.60-0.94, $p = 0.03$), a 1.67-point increase in overall satisfaction (Fig 3A 95% CI 0.78-2.56, $p = 0.0002$), a 1.27-point increase in sexual desire (Fig 3B 95% CI 0.61- 1.93, $p = 0.0001$) in those studies[11, 14, 24, 26-30]. Meanwhile, total erectile function showed a 7.21-point increase in these studies (Fig 3C 95% CI 4.33- 10.10, $p < 0.001$). The above articles all used the IIEF as the index to measure the sexual function. However, the articles[33, 34] which used BSFI as the index suggested a 2.53-point increase in erection (95% CI 2.39-2.67, $p < 0.001$), a 1.40-point increase in ejaculation (95% CI 1.28-1.51, $p < 0.001$), a 1.40-point increase in desire(95% CI 1.32-1.49, $p < 0.001$) a 2.20-point increase in problem assessment (95% CI 2.06-2.34, $p < 0.001$) and a 0.70-point increase in sexual satisfaction (95% CI 0.60-0.76, $p < 0.001$).

Discussion

Obesity has been a worldwide epidemic and can adversely affect sexual functioning. In the Massachuseter Male Aging Study[31], the average prevalence of erectile dysfunction in men who were not overweight was 13% while the altered prevalence in those who were overweight at baseline was 22%. Nowadays, the bariatric surgery has become the predominant treatment for morbid obesity and is reported to be the most effective option for weight loss in the severely obese people who have excessive fat accumulation[35]. The previous studies have documented favorable clinical outcomes after bariatric surgery which can lose weight effectively and bring significant specific-disease reduction in the risk of death[18]. However, relevant researches, investigating the correlation between the bariatric surgery and male

sexual function, are sufficient. Meanwhile, the definition of bariatric surgery and male sexual function has been widely used.

To our knowledge, this is the first meta-analysis to include the effect of bariatric surgery on male's sexual function with both IIEF scores and BSFI scores. Though there exists a meta-analysis that investigate the impact of bariatric surgery on erectile function. Glina et al.[33] only use the IIEF score to analysis and their including studies are 7 while our meta-analysis use 2 score indexes and the enrolled studies are 11.

The meta-analysis results indicate that bariatric surgery presents conspicuously effective improvements on male's sexual function by comparing IIEF scores, including erectile function, intercourse satisfaction, overall satisfaction, orgasmic function, sexual desire, total erectile function and BSFI scores, including erection, ejaculation, problem assessment, sexual satisfaction. According to Aleid et al.[29], the male's sexual function improvements caused by bariatric surgery resulting in increasing all the IIEF domains, which agree with the study performed by Efthymious et al.[14] and other researches[24, 26, 27]. In contrast, studies undertook by Ranasinghe et al. [25]and Sarwer et al. [11], which also used IIEF to detect male's sexual function, found no effective improvements reaching statistically significance among obese man undergoing bariatric surgery. Dallal et al.[31], retrospectively studying 97 obese men who had undergone gastric bypass surgery with the mean postoperative follow-up length (19 months). In the study, they addressed that scores improved on all domains of the BSFI postoperatively including sexual drive, erectile function, ejaculatory function and sexual satisfaction by completing the BSFI preoperatively and post-operatively. Meanwhile, the postoperative BSFI scores approached the reference controls. This is in accordance with our findings in which all the domains reached significant improvements.

However, the underlying mechanism of obesity-related sexual dysfunction is multifactorial. Previous studies suggested that psychological and social appearance, such as body image, depression and so on, have a negative impact on self-esteem and the tendency of avoidance and initiation to sexual

behavior[34]. Negative effect of the comorbidities in obese people (diabetes, hypertension, metabolic syndrome, etc.) have already been clearly associated with sexual dysfunction[10, 31, 36]. A correlation of sex hormones to sexual function has also been confirmed that obesity has a link with sexual dysfunction[37, 38]. Meanwhile, a number of biological mechanisms might account for the connection between obesity and sexual dysfunction. Obesity is a condition of inflammation and chronic oxidative stress[39]. It was suggested that obesity is linked to endothelial dysfunction and increased serum concentrations of vascular inflammatory makers[40, 41]. The visceral adipose tissue can secrete biochemical modulators and proinflammatory factors, such as IL-6, TNF- α , angiotensinogen, angiotensin-converting enzyme and so on, which can be obviously associated with systemic and peripheral vascular inflammation. However, that can lead to a decrease in NO synthase and NO activity, an increase in adhesion molecules, MCP-1 and M-CSF, finally causing endothelial dysfunction[42-44]. Moreover, the reduced adiponectin levels is confirmed to be connected with endothelial dysfunction[45, 46]. The endothelial dysfunction causes erectile dysfunction by influencing the structural integrity of the vascular bed in the penis and the progress of penile engorgement by reducing the blood flow of penile[47]. It can ameliorate endothelial function by increasing vasodilation in which the endothelium plays an important role, increasing the level of activation marks of endothelium and decreasing the level of proinflammatory factor when obese patients proceed to loss weights[48]. Furthermore, the sex hormones have considerable correlation with sexual dysfunction. It is reported that the abnormalities in sex hormone regulation and production are related to sexual dysfunction in men[49, 50]. It has been confirmed that androgens are essential to maintain the libido and regulate erectile capacity in man[51]. But BMI is negatively associated with serum testosterone in some studies. It was estimated that a reduction in free testosterone of 1.35pg/mL and a reduction in total testosterone of 11.79 ng/dL while the weight increases 4.5 kg[52]. There are studies found a positive relationship between estradiol levels and BMI index in men[53]. And the reduction of estradiol levels is thought to associate with weight loss. Thus, the feedback inhibition on LH secretion is removed and enhance the testosterone secretion. But the effect of decrease fat mass to increase testosterone is controversial. Bariatric surgery normalized sex hormone levels in both genders[54]. In addition, the comorbidities associated with obesity, such as diabetes, metabolic syndrome, hypertension, coronary heart disease, obstructive sleep apnea, depression and so on, have been clearly risk associated with sexual dysfunction and would ameliorate after bariatric surgery.

There are some limitations of our study. (1) Language bias might limit the generalizability of the findings. (2) Patient self-report is the current standard in the study of male sexual function. (3) Included sample sizes are small. (4) The indexes for evaluating male's sexual function are simple, which mainly are IIEF score and BSFI score are not all included in all studies. (5) The follow-up time is relatively short and the studies lack long-term indexes. Those limitations might lead to the analysis bias and influence the reliability of our study.

Conclusion

We found that the bariatric surgery can reliably ameliorate male's sexual dysfunction, which significantly improves IIEF scores and BSFI scores. These results are in accordance with the recent investigations of male who had undergone bariatric surgery and reported significant improvements in male's sexual function. Considering not only the well-documented quality-of-life benefits of bariatric surgery, but also the improvement in male's sexual function, bariatric surgery is a more effective treatment for obese patients with sexual dysfunction. Furthermore, further studies need to make which can include more samples and provide more reliable conclusions.

Abbreviations

BMI, body mass index; SD, standard deviation; RYGB, Roux-Y gastric bypass; LGB, laparoscopic gastric banding surgery; LSG, laparoscopic sleeve gastrectomy; SG, sleeve gastrectomy; BPD, Biliang pancreatic diversion; BS, bariatric surgery; PS, prospective study; RS, retrospective study; RCT, randomized clinical trial; BSFI, Brief Male Sexual Function Inventory; IIEF, International Index of Erectile Functioning

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

All authors declared no competing financial interests.

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Authors' contributions

LSZ, CDH and RZJ carried out the literature search and data extraction, participated in the data analysis and drafted the manuscript. PL and ZJ participated in the study design and performed the statistical analysis. ZQ and CZY

participated in the data extraction and statistical analysis. AJZ, YL and LLR conceived of the study and participated in its design and coordination and helped draft the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials

All data generated or analyzed during this study are included in this published.

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Figure Legends

Fig. 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 flow diagram[55]

Fig. 2 Meta-analysis on the efficiency of bariatric surgery in promoting male's sexual function. Comparison of Erectile Function domain of IIEF (A), Intercourse Satisfaction domain of IIEF (B), and Orgasmic Function domain of IIEF (C)

Fig. 3 Meta-analysis on the efficiency of bariatric surgery in promoting male's sexual function. Comparison of Overall Satisfaction domain of IIEF (A), Sexual Desire domain of IIEF (B), and Total Erectile Function domain (C)

Figures

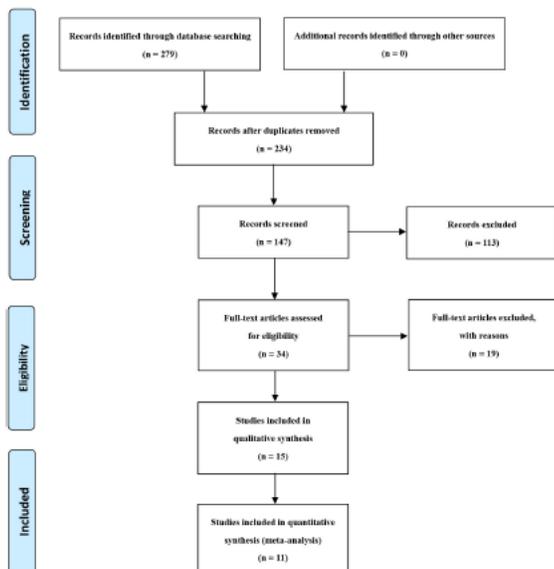


Figure 1

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2009 flow diagram[55]

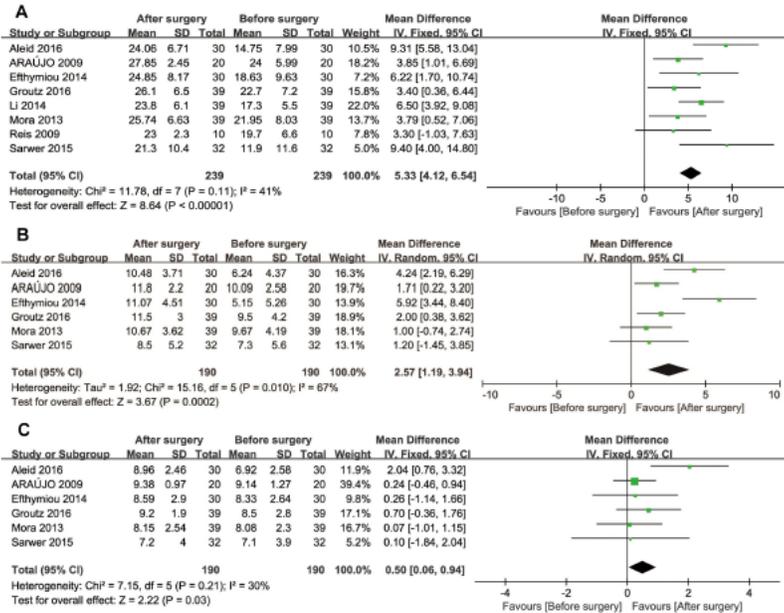


Figure 2
Meta-analysis on the efficiency of bariatric surgery in promoting male's sexual function. Comparison of Erectile Function domain of IIEF (A), Intercourse Satisfaction domain of IIEF (B), and Orgasmic Function domain of IIEF (C)

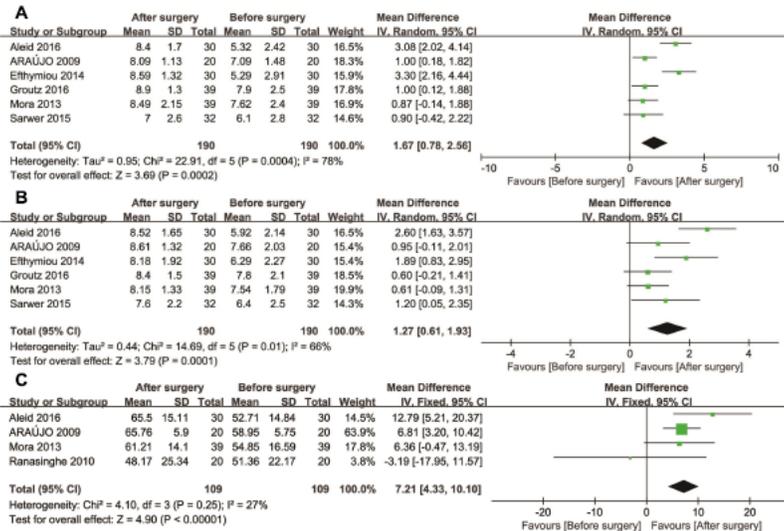


Figure 3
Meta-analysis on the efficiency of bariatric surgery in promoting male's sexual function. Comparison of Overall Satisfaction domain of IIEF (A), Sexual Desire domain of IIEF (B), and Total Erectile Function domain (C)

Supplementary Files

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- [supplement1.pdf](#)