Primary experience of bariatric surgery in a newly established private obesity center

Haider Al-Shurafa, FRCS (Glasg), Ahmed H. Elzaafarany, MSc, MD, Ali Albenmousa, MD, Mona G. Balata, MD.

ABSTRACT

الأهداف: تقييم نتائج عمليات تخفيف الوزن في أحد مراكز علاج السمنة المنشأ حديثاً في القطاع الخاص.

الطريقة: في دراسة استعادية تم ضم المرضى المسجلين في قاعدة بيانات عمليات السمنة في مستشفى الرياض الوطني، الرياض، المملكة العربية السعودية من يناير 2013م إلى سبتمبر 2014م و الذين استكملوا سنة من المتابعة. قام فريق البحث بتجميع وتحليل بيانات المرضى عند بداية البحث و نسبة فقد الوزن الزائد ومعايير السلامة بعد العملية.

النتائج: تم ضم 79 مريض للدراسة. قسمنا المرضى إلى 3 مجموعات بناءا على نوع العملية التي أجريت لهم. ضمت المجموعة الأولى مرضى عملية التحوير بالمنظار الجراحي و الثانية مرضى عمليات التحوير المصغر بالمنظار الجراحي و الثالثة مرضى عملية التكميم بالمنظار الجراحي. بعد سنة من المتابعة فقد مرضى التحوير و التحوير المصغر نسبة أكبر من وزنهم الزائد مقارنة بمرضى التكميم. لم تسجل أي حالة وفاة أو تسريب بعد العمليات، إلا أن احد المرضى خضع لعملية جراحية بسبب حدوث نزيف داخلي. احتاج أحد المرضى للدخول للمستشفى بعد مغادرته و زار 4 مرضى قسم الطوارئ وكانت الأسباب هي استفراغ و جفاف عند حالتين و فقر دم عند حالة واحدة و التهاب موضع العملية عند الرابع.

الخاتمة: عمليات إنقاص الوزن في القطاع الخاص آمنة إذا قام بها جراح ذو خبرة في هذا النوع من العمليات. نتائج هذه الدراسة مشابهة لما تم نشره من قواعد بيانات عمليات السمنة العالمية والتي تضم أعداد كبيرة من المرضى.

Objectives: To assess the outcomes of different types of bariatric surgeries in a single newly established private obesity center.

Methods: Retrospectively, we included patients who were entered in the registry for bariatric surgeries in the Obesity Unit, Riyadh National Hospital, Riyadh, Saudi Arabia between January 2013 and September 2014, and completed one year of follow up. Baseline characteristics, percent excess weight loss, and safety data were collected and analyzed.

Results: A total of 79 patients were included. Based on the type of surgery, patients were divided into 3 groups: laparoscopic Roux-en-Y gastric bypass (RYGB), laparoscopic minigastric bypass (MGBP), and laparoscopic vertical sleeve gastrectomy (SG). After one year, RYGB and MGB patients lost more weight than SG patients. No mortality, or leak were reported and one patient had reoperation after revision laparoscopic RYGB for bleeding. There was one readmission, while 4 patients visited the emergency room for vomiting and dehydration (2 patients), anemia (one patient), and port site infection (one patient).

Conclusion: Bariatric surgeries are safe when carried out by an experienced bariatric surgeon in the private sector. The outcome of this series is similar to the published results from large international obesity databases.

Saudi Med J 2016; Vol. 37 (10): 1089-1095
doi: 10.15537/smj.2016.10.14043

From the Departments of Surgery (Al-Shurafa), Medicine (Albenmousa, Balata), Prince Sultan Military Medical City, General Surgery Department (Hassan), Riyadh National Hospital, Riyadh, Kingdom of Saudi Arabia.

Received 2nd February 2016. Accepted 20th July 2016.

Address correspondence and reprint request to: Dr. Haider Al-Shurafa, Department of Surgery, Prince Sultan Military Medical City, Riyadh, Kingdom of Saudi Arabia. E-mail: haidershurafa@yahoo.com

Disclosure. Authors have no conflict of interests, and the work was not supported or funded by any drug company. Dr. Ali Albenmousa is a member of the Editorial Team, and was therefore excluded from any final editorial decisions regarding this paper.

OPEN ACCESS

Worldwide, overweight and obesity are highly epidemic with a trend toward increase in prevalence in both children and adults. A large systematic review that included 1769 studies, and over 19000 subjects showed that prevalence of overweight has increased between 1980 and 2013 from 28.8% to 36.9% in men, and from 29.8% to 38% in women. Prevalence has increased substantially in children and adolescents in developed countries since 23.8% of boys and 22.6% of girls were overweight, or obese in 2013, while in developing countries the prevalence was 12.9% in boys and 13.4% in girls.[1] Gulf countries have similar prevalence based on the World Health Organization (WHO) report, which stated that 19-36% of men and 32-48% of women in these countries are obese.[2] In Saudi Arabia, the prevalence of obesity in 2010 was 28% in men and 44% in women,[3] and in a recently published report,[4] the authors have estimated the prevalence of obesity will be 41% in Saudi men and 78% in women by year 2022. Strong economic growth, rapid urbanization, lack of physical activity, unhealthy-high calorie diet, and increasing sedentary lifestyles are among several factors blamed for such high prevalence.[5] The rising prevalence of obesity correlated well with the rising prevalence of diabetes, which reached 32% in Saudis aging between 20-79 years in 2009, compared with 10.7% in 1989.[6] Furthermore, over 5 million Saudis are expected to be diabetic by the year 2030.[7] More than 20% of Saudi adults suffer from severe obesity defined as body mass index (BMI) greater than 35 kg/m^2.[8] This has resulted in a major shift among patients and health care professionals towards bariatric surgery with maximum weight loss as the most important outcome of treatment.[9] Several bariatric procedures have been in practiced for the last decade; however, laparoscopic Roux-en-Y gastric bypass (RYGB) and mini gastric bypass (MGB) remain the most commonly performed bariatric surgeries.[10,11] They are preferred due to the durable weight loss, prolonged survival, and high rates of improvement of other elements of metabolic syndrome.[12-14] For the last 5 years, a new "restrictive" procedure named vertical sleeve gastrectomy (SG) has emerged and became a preferred option for many surgeons as a replacement for gastric banding due to its lower complication rates and superior weight loss outcomes.[15,16] In preliminary, short-term studies, SG appears to result in weight loss and improvement in health condition that are similar to those achieved with RYGB.[17] This might be the case in the long term as well with more results emerging from randomized trials.[18,19] Long term results however, are not as extensive as for bypass surgeries since the largest observational studies devoted for examining bariatric surgeries, such as the Swedish Obese Patients study and the US Longitudinal Assessment of Bariatric Surgery, have no, or few SG patients in their cohorts.[20,21]

In Saudi Arabia, different types of bariatric surgeries are being performed by experienced surgeons in large, mostly, governmental hospitals.[22] Additionally, several private hospitals are providing this service although some patients are concerned about the safety of the procedure in this setting. In Riyadh National Hospital (RNH), a large private hospital in the center of Riyadh, a multidisciplinary obesity unit was established on January 2013. The team consists of an experienced surgeon (performing over 300 cases per year), an endocrinologist, nurses, a dietician and a psychologist.

To evaluate the quality measures of bariatric surgeries performed in our center, we created a registry for patients who underwent procedures for weight reduction from January 2013. The aim of this study is to assess the efficacy and safety of various bariatric surgeries performed for patients in the registry and to compare their outcomes to the current national bariatric accreditation databases from the United States.[20,23]

Methods. This study was conducted in the Obesity Unit, RNH, Riyadh, Saudi Arabia, a 250-beds private hospital located in the center of Riyadh. Bariatric surgeries are performed by one surgical team, which includes one experienced consultant bariatric surgeon, 2 surgical registrars, one surgical resident, one consultant endocrinologist, one dietitian, one psychologist, 2 coordinators as well as other supportive services such as radiology, endoscopy, laboratory, anesthesia, and so forth.

Patients were eligible for weight reduction surgery at RNH if they had a body mass index (BMI) of $\geq$40 kg/m^2 with or without obesity related comorbid conditions, or a BMI of 35-39.9 kg/m^2 and at least one obesity-related comorbid condition such as diabetes, hypertension, and/or sleep apnea. Patients were excluded if they had any major contraindication such as significant cardiopulmonary dysfunction, severe neurological disease, or psychiatric illnesses. Patients were included in the analysis if they had bariatric surgery after January 1, 2013 and completed one year of follow up. Demographic data and pre- and post-operative anthropometric measures together with all relevant information were collected from electronic patient files.

Analyses. The RNH bariatric registry data were descriptively analyzed and compared with data from 2 large accrediting bodies for bariatric surgery: The American Society for Metabolic and Bariatric Surgery

(ASMBS) and The American College of Surgeons (ACS). Bariatric Outcomes Longitudinal Database (BOLD) published the data of ASMBS,[19] while the Bariatric Surgery Center Network (BSCN) database published the data of ACS.[23] The extent of weight loss was presented as percent excess weight loss using a BMI of 25 kg/m^2 as "ideal". The following formula was used to calculate the percentage excess weight loss: [BMI at surgery - BMI at time of follow-up]/[BMI at surgery - 25 kg/m^2])*100.[24]

The proportion of patients who achieved 100%, 50%, and 0% or less excess weight loss at one-year post surgery was reported. Although many definitions for successful weight loss exist, depending upon the procedure, it is generally agreed that surgeries resulting in at least 50% excess weight loss are considered successful. A percent excess weight loss of 0 or less (negative numbers) refers to patients who did not lose any weight or gained weight relative to their weight at the time of surgery. A percent excess weight loss of 100 or more refers to patients who lost all of their excess weight or more. Comparison was made between the 2 genders and the type of surgery to assess the extent of weight loss at different times of follow up. Banding procedures were not included in the analyses due to the small sample and rapid decline in use of this procedure worldwide. Other factors such as race and ethnicity could not be assessed due to small sample size although some reports have shown an important association between ethnicity and weight loss after surgery.[25]

Results. *Baseline characteristics and type of surgeries.* Baseline characteristics for RNH patients are presented in **Table 1**. Data from the ASMBS-BOLD and the ACS-BSCN accreditation databases were included for comparison. The RNH bariatric registry has less gastric bypass (GB) (27%) and more SG (72%) procedures than the ASMBS BOLD (53% and 3%) and the ACS BSCN (55% and 2.3%) databases. Conversely, it has fewer gastric band procedures (2%) compared to both databases (43% and 40%). The gender distribution, age and BMI distribution at the time of surgery were similar to the USA national databases.

Weight loss outcomes. **Table 2** summarizes the weight loss outcomes in RNH patients and compares them to USA databases. The extent of weight loss varied based on the procedure performed. One year after surgery, the absolute weight loss in patients who had RYGB was 15-60 kg and they had a median excess weight loss of 68%. This was more than MGB patients who had an absolute weight loss of 26.9-44 kg and a median excess weight loss of 64%, and SG patients who lost 16-40 kg with a median excess weight loss of 58%. Both RYGB and MGB patients had higher rate of successful excess weight loss (defined as ≥50%) compared to SG patients (65%, 57%, and 46%). None of the patients, regardless of type of surgery, regained back his/her pre-surgical weight during the whole year of follow up.

Safety outcomes. The major outcomes post-bariatric surgeries in RNH were summarized in **Table 3** and

Table 1 - Comparison between RNH, ASMBS-BOLD, and ACS-BSCN databases in baseline patients' characteristics.

Patient's characteristics	RNH	ACS-BSCN	ASMBS-BOLD
Number of patients	80	28,616	57,918
Duration	2013-2014	2007-2010	2007-2009
RYGB	9 (11.3)	15,479 (54)	31,668 (55.0)
MGB	58 (72.3)		
SG	12 (15.0)	44 (3)	1328 (2.3)
LAGB	1 (1.2)	12193 (43)	22947 (40.0)
Females	44 (55.0)	78	79
BMI <40	25 (31.3)	6,344 (22)	11,233 (19.0)
BMI 40-49.9	38 (47.5)	15,575 (54)	30,962 (53.0)
BMI 50-59.9	11 (13.8)	5,234 (18)	12,007 (21.0)
BMI ≥60	6 (7.5)	1,282 (4)	3,512 (6.0)

RNH - Riyadh National Hospital, ASMBS-BOLD - American Society for Metabolic and Bariatric Surgery-Bariatric Outcomes Longitudinal Database, ACS-BSCN - American College of Surgeons-Bariatric Surgery Center Network, BMI - body mass index, LAGB - laparoscopic adjustable gastric banding, RYGB - Roux-en-Y gastric bypass, MGB - mini gastric bypass, SG - vertical sleeve gastrectomy

Table 2 - Summary of weight-related outcomes in Riyadh National Hospital (RNH) patients compared with the USA databases.

Outcomes	RYGB n=9	MGB n=12	SG n=58
Weight loss	15 - 60Kg	26.9 - 44Kg	16 - 40Kg
Median EWL % (range)	68 (60-136)	64 (73-121)	58 (87.5-145)
Patient with >100% EWL	1 (11.1)	2 (16.7)	2 (3.4)
Patient with >50% EWL	6 (66.7)	7 (58.3)	27 (46.6)
Patient with <50% EWL	2 (22.2)	5 (41.7)	30 (51.7)
Patient with <0% EWL	0	0	0

RYGB - Roux-en-Y gastric bypass, MGB - mini gastric bypass, SG - vertical sleeve gastrectomy, EWL - percent excess weight loss, BMI - body mass index, *%EWL calculated as ([BMI at surgery - BMI at time of resolution or the end of follow-up]/ [BMI at surgery – 25 kg/m2]) x 100

Table 3 - Major safety outcomes after bariatric surgeries in RNH.

Safety outcomes	RNH	ACS-BSCN	ASMBS-BOLD
Length of stay	2 days	2.5 days	2.5 days
30-days mortality	0	35 (0.12%)	22 (0.04%)
1-year mortality	0	72 (0.25%)	NA
30-days readmission	1 (1.3%)	1289 (4.5%)	1759 (3.0%)

RNH - Riyadh National Hospital, ASMBS-BOLD - American Society for Metabolic and Bariatric Surgery-Bariatric Outcomes Longitudinal Database, ACS-BSCN - American College of Surgeons-Bariatric Surgery Center Network

outcomes from USA databases were reported for comparison.

Effects of gender and procedure type on weight loss. Percent excess weight loss at 6-months and one-year was assessed in males and females and based on the surgeries they had (**Figure 1**). There was no difference in excess weight loss at 6 months, however after one-year, the highest weight loss was achieved in women who had RYGB while lowest was in men who underwent SG. This observation may indicate that female gender and bypass procedures are predictors of more weight loss post surgery. It is important to mention that women were more compliant to follow-up than men (28% versus 20%). This might be a confounder that affected the results since patients who attended more frequent follow up visits were better monitored and instructed by the team on diet and other measures.

Discussion. Being a major risk factor for various metabolic, cardiovascular, and other non-communicable diseases,[26] obesity remains a challenging medical condition attracting a lot of attention from health care providers. The complexity of the disease and its social impact on the patients has contributed to the challenges in treatment.[27] Many treatment modalities have been tried with variable responses achieved based on patient compliance and other factors.[28] Bariatric surgeries are proven effective in reducing significant excess weight with good safety profiles particularly after building good experience in the field.[29,30] Among several surgical techniques, SG is a preferred surgical option by most of the surgeons and patients. It produces volume restriction with early satiety and a corresponding fall in the appetite stimulating hormone "ghrelin". It may be offered as the first stage of a gastric bypass or duodenal switch or as the definitive surgery for obesity.[31]

As an active obesity unit doing over 50 surgeries per year we opted to report our experience over the last 2 years to assess the efficacy and safety of these procedures in the private sector. Our findings have shown that independent of age and baseline BMI, RYGB, and MGB resulted in higher weight loss throughout the one-year follow up period compared with SG. Women had greater percent excess weight loss than men after one-year of follow up. This difference in weight reduction between various procedures has been demonstrated in several reports and meta-analyses. Mechanick et al[32] published a summary table of weight loss findings across 85 studies from 1982-2007, which clearly showed this variability. The range in percent

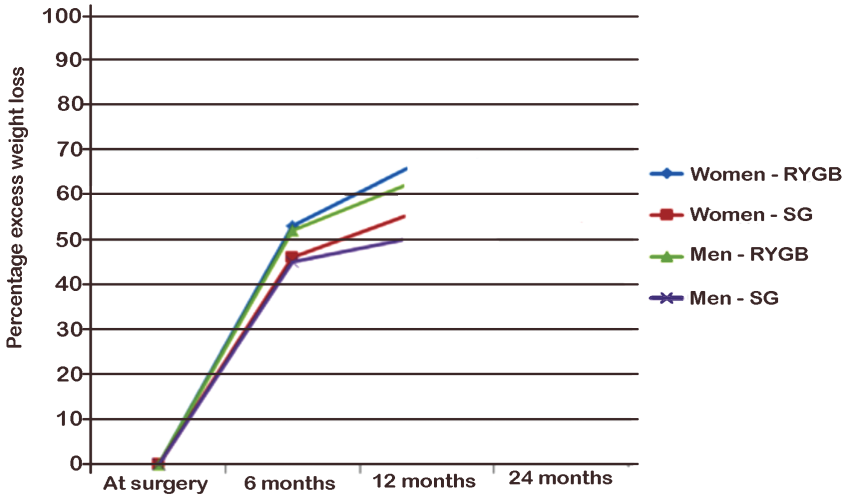

Figure 1 - Percentage excess weight loss by gender (women and men) and procedure type. RYGB - Roux-en-Y gastric bypass, SG - vertical sleeve gastrectomy

excess weight loss for banding procedures after 1-2 years post surgery was 29-87%; for RYGB was 48-85%; and for SG was 33-58%.[20] At one-year post surgery, our patients had similar figures since median percent excess weight loss was 68% in RYGB, 64% in MGB, and 58% in SG.

All patients lost a substantial amount of weight (up to 60 kg for gastric bypass and 40 Kg for SG) in the first year but majority have lost at least 50% of their excess weight. None of our patients has gained any excess weight, but longer follow up is needed since some series like the one reported by Mitchell et al[33] showed that 3 of their 78 RYGB patients had gained weight above their pre-surgical weight at 15 years post-surgery. We are planning to follow our patients for 8 years post operatively to assess the persistence of weight loss at longer follow up. It was proposed from several reports that higher BMI and older age at the time of surgery predict greater operative risks, less weight loss, and disease resolution.[34-38] The evidence for gender effect is conflicting with some reports stating that men and women have equal weight loss while others showed that men have more weight loss than women, but with higher operative risk.[39] Although surgery is a powerful tool for massive weight loss, especially in the first 6 months post-surgery, patients must still have lifestyle modification to continue to lose weight and maintain that weight loss in the long term. In Arabic culture, particularly Saudi Arabia, there are several barriers preventing patients from having a proper healthy lifestyle.[4] These include eating with extended families and community groups that forces patients to eat large amount of calorie-rich diet. Cultural values of beauty coupled to larger body types in women might discourage losing weight. Finally, poor availability of healthy foods and relying on fast food with low physical activity is common among the young population. The choice of surgery depends largely on the patient condition and the surgical experience. A higher prevalence of diabetes in this group of patients will make surgeons prefer RYGB/MGB for them since there is more evidence that this procedure is effective for diabetes resolution, however, paradoxically, it has been shown that patients with a higher and more severe disease burden are less likely to experience resolution of their diabetes, presumably because they do not lose as much weight as their healthier counterparts.[40-42] There is a need however to carefully study the interaction between disease severity and patient characteristics in determining a patient's response to a particular bariatric procedure.

Study limitations. The most important of these are small sample size and a significant rate of missing appointments that was 27% for RYGB, 18% for MGB, and 22% for SG. Despite having a multidisciplinary team, which includes nurses, a surgeon, a physiotherapist and a dietitian that helped in improving the post operative care and monitoring, several patients missed their appointments and missed the counseling and follow up provided by the bariatric unit members. Besides laboratory monitoring and phone counseling over 24 hour/7 days per week several other tools were used to improve the interaction between patients and

health care providers like creating WhatsApp group. Another important limitation of the study is the lack of systematic collection of patient-reported outcomes such as diet, physical activity and quality of life in these patients. These indicators have been shown to have a strong effect on surgical outcomes for bariatric patients. We have been working with the clinical systems that use the registry to incorporate patient-reported outcomes such as quality of life obtained from patients' feedback about themselves; however, implementation of this process will take several years.

In conclusion, bariatric surgeries in private centers are safe and effective when carried out by experienced staff. Gastric bypass procedures are more effective than sleeve gastrectomy in reducing weight and females are more likely to lose their excess weight compared to men. More studies however with larger number of patients are needed to confirm these findings.

Acknowledgment. *We would like to acknowledge the valuable contribution made by clinical care managers and quality assurance personnel of the Riyadh National Hospital (RNH) bariatric registry. Their input has made the database as much more accurate and robust resource for research. We are also especially grateful to all members of our bariatric surgical unit who made the RNH bariatric registry possible.*

References

1. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980-2013: a systematic analysis for the Global Burden of Disease Study 2013. ***Lancet*** 2014; 384: 766-781.
2. World Health Organization. Obesity and Overweight. [Cited 2016 June]. Available from URL: http://www.who.int/mediacentre/factsheets/fs311/en/.
3. Sultan A. Obesity in Gulf Countries. ***Int J Health Sci (Qassim)*** 2014; 8: s79-s83.
4. Al-Quwaidhi AJ, Pearce MS, Critchley JA, Sobngwi E, O'Flaherty M. Trends and future projections of the prevalence of adult obesity in Saudi Arabia, 1992-2022. ***East Mediterr Health J*** 2014; 20: 589-595.
5. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Lifestyle factors associated with overweight and obesity among Saudi adolescents. ***BMC Public Health*** 2012; 12: 354.
6. Alharbi NS, Almutari R, Jones S, Al-Daghri N, Khunti K, de Lusignan S. Trends in the prevalence of type 2 diabetes mellitus and obesity in the Arabian Gulf States: systematic review and meta-analysis. ***Diabetes Res Clin Pract*** 2014; 106: e30-e33.
7. Wild S, Rogli G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. ***Diabetes Care*** 2004; 27: 1047-1053.
8. Dombrowski SU, Knittle K, Avenell A, Araújo-Soares V, Sniehotta FF. Long term maintenance of weight loss with non-surgical interventions in obese adults: systematic review and meta-analyses of randomised controlled trials. ***BMJ*** 2014 14; 348.
9. Weinstein AL, Marascalchi BJ, Spiegel MA, Saunders JK, Fagerlin A, Parikh M. Patient preferences and bariatric surgery procedure selection; the need for shared decision-making. ***Obes Surg*** 2014; 24: 1933-1939.
10. Buchwald H. Consensus conference statement bariatric surgery for morbid obesity: health implications for patients, health professionals, and third-party payers. ***Surg Obes Relat Dis*** 2005; 1: 371-381.
11. Buchwald H, Oien DM. Metabolic/Bariatric surgery worldwide 2011. ***Obes Surg*** 2013; 23: 427-436.
12. Buchwald H, Estok R, Fahrbach K, Banel D, Jensen MD, Pories WJ, et al. Weight and type 2 diabetes after bariatric surgery: systematic review and meta-analysis. ***Am J Med*** 2009; 122: 248-256.
13. Arterburn D, Bogart A, Sherwood NE, Sidney S, Coleman KJ, Haneuse S, et al. A multisite study of long-term remission and relapse of type 2 diabetes mellitus following gastric bypass. ***Obes Surg*** 2013; 23: 93-102.
14. Sjostrom L, Lindroos AK, Peltonen M, Torgerson J, Bouchard C, Carlsson B, et al. Lifestyle, diabetes, and cardiovascular risk factors 10 years after bariatric surgery. ***N Engl J Med*** 2004; 351: 2683-2693.
15. Dapri G, Vaz C, Cadière GB, Himpens J. A prospective randomized study comparing two different techniques for laparoscopic sleeve gastrectomy. ***Obes Surg*** 2007; 17: 1435-1441.
16. Himpens J, Dapri G, Cadière GB. A prospective randomized study between laparoscopic gastric banding and laparoscopic isolated sleeve gastrectomy: results after 1 and 3 years. ***Obes Surg*** 2006; 16: 1450-1456.
17. Benaiges D, Flores Le-Roux JA, Pedro-Botet J, Chillarón JJ, Renard M, Parri A, et al. Sleeve gastrectomy and Roux-en-Y gastric bypass are equally effective in correcting insulin resistance. ***Int J Surg*** 2013; 11: 309-313.
18. Zhang Y, Zhao H, Cao Z, Sun X, Zhang C, Cai W, et al. A randomized clinical trial of laparoscopic Roux-en-Y gastric bypass and sleeve gastrectomy for the treatment of morbid obesity in China: a 5-year outcome. ***Obes Surg*** 2014; 24: 1617-1624.
19. Yang X, Yang G, Wang W, Chen G, Yang H. A meta-analysis: To compare the clinical results between gastric bypass and sleeve gastrectomy for the obese patients. ***Obes Surg*** 2013; 23: 1001-1010.
20. DeMaria EJ, Pate V, Warthen M, Winegar DA. Baseline data from American Society for Metabolic and Bariatric Surgery-designated Bariatric Surgery Centers of Excellence using the Bariatric Outcomes Longitudinal Database. ***Surg Obes Relat Dis*** 2010; 6: 347-355.
21. Sjöström L. Review of the key results from the Swedish Obese Subjects (SOS) trial. A prospective controlled intervention study of bariatric surgery. ***J Intern Med*** 2013; 273: 219-234.
22. Alqahtani AR, Antonisamy B, Alamri H, Elahmedi M, Zimmerman VA. Laparoscopic sleeve gastrectomy in 108 obese children and adolescents aged 5 to 21 years. ***Ann Surg*** 2012; 256: 266-273.
23. Hutter MM, Schirmer BD, Jones DB, Ko CY, Cohen ME, Merkow RP, et al. First report from the American College of Surgeons Bariatric Surgery Center Network: laparoscopic sleeve gastrectomy has morbidity and effectiveness positioned between the band and the bypass. ***Ann Surg*** 2011; 254: 410-420.
24. Deitel M, Greenstein RJ. Recommendations for reporting weight loss. ***Obes Surg*** 2003; 13: 159-160.

25. Admiraal WM, Celik F, Gerdes VE, Dallal RM, Hoekstra JB, Holleman F. Ethnic differences in weight loss and diabetes remission after bariatric surgery: a meta-analysis. ***Diab Care*** 2012; 35: 1951-1958.
26. Lavie CJ, Milani RV, Ventura HO. Obesity and cardiovascular disease: risk factor, paradox, and impact of weight loss. ***J Am Coll Cardiol*** 2009; 53: 1925-1932.
27. Dombrowski SU, Knittle K, Avenell A, Araújo-Soares V, Sniehotta FF. Long term maintenance of weight loss with non-surgical interventions in obese adults: systematic review and meta-analyses of randomised controlled trials. ***BMJ*** 2014; 348: 2646.
28. Dietz WH, Baur LA, Hall K, Puhl RM, Taveras EM, Uauy R, et al. Management of obesity: improvement of health-care training and systems for prevention and care. ***Lancet*** 2015; 385: 2521-2533.
29. Belle SH, Berk PD, Courcoulas AP, Flum DR, Miles CW, Mitchell JE, Pories WJ, et al. Safety and efficacy of bariatric surgery: Longitudinal Assessment of Bariatric Surgery. ***Surg Obes Relat Dis*** 2007; 3: 116-126.
30. Colquitt JL, Picot J, Loveman E, Clegg AJ. Surgery for obesity. ***Cochrane Database Syst Rev*** 2009; (2): CD003641.
31. Kassir R, Tiffet O, Blanc P, Ben Amor I, Gugenheim J. Sleeve gastrectomy. A point of technique. ***Int J Surg*** 2014; 12: 450-1451.
32. Mechanick JI, Kushner RF, Sugerman HJ, Gonzalez-Gomboy JM, Collazo-Clavell ML, Spitz AF, et al. American Association of Clinical Endocrinologists, The Obesity Society, and American Society for Metabolic & Bariatric Surgery medical guidelines for clinical practice for the perioperative nutritional, metabolic and nonsurgical support of the bariatric surgery patient. ***Obesity (Silver Spring)*** 2009; 17: S1-S70.
33. Mitchell JE, Lancaster KL, Burgard MA, Howell LM, Krahn DD, Grosby RD, et al. Long-term follow-up of patients' status after gastric bypass. ***Obes Surg*** 2001; 11: 464-468.
34. Khan MA, Grinberg R, Johnson S, Afthinos JN, Gibbs KE. Perioperative risk factors for 30-day mortality after bariatric surgery: is functional status important? ***Surg Endosc*** 2013; 27: 1772-1777.
35. Ortega E, Morínigo R, Flores L, Moize V, Rios M, Lacy AM, et al. Predictive factors of excess body weight loss 1 year after laparoscopic bariatric surgery. ***Surg Endosc*** 2012; 26: 1744-1750.
36. Dallal RM, Quebbemann BB, Hunt LH, Braitman LE. Analysis of weight loss after bariatric surgery using mixed-effects linear modeling. ***Obes Surg*** 2009; 19: 732-737.
37. Contreras JE, Santander C, Court I, Bravo J. Correlation between age and weight loss after bariatric surgery. ***Obes Surg*** 2013; 23: 1286-1289.
38. Livhits M, Mercado C, Yermilov I, Parikh JA, Dutson E, Mehran A, et al. Preoperative predictors of weight loss following bariatric surgery: systematic review. ***Obes Surg*** 2012; 22: 70-89.
39. Bekheit M, Katri K, Ashour MH, Sgromo B, Abou-ElNagah G, Abdel-Salam WN, et al. Gender influence on long-term weight loss after three bariatric procedures: gastric banding is less effective in males in a retrospective analysis. ***Surg Endosc*** 2014; 28: 2406-2411.
40. Arterburn D, Bogart A, Coleman KJ, Haneuse S, Selby JV, Sherwood NE, et al. Comparative effectiveness of bariatric surgery vs. nonsurgical treatment of type 2 diabetes among severely obese adults. Obes Res Clin Pract 2013; 7: e235-e320.
41. Robert M, Ferrand-Gaillard C, Disse E, Espalieu P, Simon C, Laville M, et al. Predictive factors of type 2 diabetes remission 1 year after bariatric surgery: impact of surgical techniques. ***Obes Surg*** 2013; 23: 770-775.
42. Hamza N, Abbas MH, Darwish A, Shafeek Z, New J, Ammori BJ. Predictors of remission of type 2 diabetes mellitus after laparoscopic gastric banding and bypass. ***Surg Obes Relat Dis*** 2011; 7: 691-696.