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ORIGINAL CONTRIBUTIONS

Sleeve Gastrectomy vs Roux-en-Y Gastric Bypass. Data from IFSO-European Chapter Center of Excellence Program

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Abstract
Background The purpose of this study is to compare sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGBP) performed in Institutions participating in IFSO-European Chapter, Center of Excellence (COE) program.
Methods Since the initiation of the program in January 2010, 6413 SGs and 10,622 RYGBPs performed as primary procedures by December 31, 2014, with at least 12-month follow-up, were retrospectively compared.
Results There were steadily increasing numbers of patients underwent SG from 2010 to 2015. Early (<30 days) postoperative complication rate of 3.02 % for RYGBP was significantly higher than 2.12 % seen after SG (p = 0.0006). Only two patients, one in each group, died in the first 30 postoperative days (0.016 % mortality for SG vs 0.009 % for RYGBP–NS). From SG group, 103 patients, 1.61 %, and 206 patients, 1.94 %, from RYGBP group required readmission following hospital discharge in the first 30 days following bariatric surgery–NS. From the readmitted patients in the SG group, 75.72 % were reoperated vs 50.50 % in the RYGBP group (p < 0.0001). SG patients were heavier (BMI 44.93 vs 43.96 kg/m^2, p < 0.0001). However, significantly better % excess weight loss were seen following RYGBP in all postoperative years (60.36 vs 67.72 %, p = 0.002 at fifth year). Better remission rates were seen for diabetes, arterial hypertension, dyslipidemia, and sleep apnea syndrome after RYGBP in the first postoperative year.
Conclusions Both procedures were performed with very low complications, mortality, readmissions, and reoperations rate. Better weight loss was observed following RYGBP, the first five postoperative years.

Keywords Morbid obesity · Bariatric surgery · Sleeve gastrectomy · Roux-en-Y gastric bypass · Center of Excellence · John Melissas and Konstantinos Stavroulakis contributed equally in this article.

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Introduction

Bariatric surgery is the only effective treatment for severe obesity, offering long-term weight loss and remission or improvement of obesity comorbidities [1].

The "International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO)" has created guidelines [2] for safe and effective bariatric patients' management. Institutions and surgeons fulfilling IFSO requirements (Table 1) and able to prove that they are offering safe and effective management of patients suffering from metabolic disorders may receive the designation as Centers of Excellence (COEs) in bariatric and metabolic surgery. [3].

Table 1 IFSO requirements for COE program participation

Requirements for surgeons
1. Training and experience in gastrointestinal surgery.
2. Successful completion of a training course in bariatric surgery.
3. Careful maintenance of a database of all bariatric cases, including outcomes.
4. Commitment to postoperative life-time follow-up of the patients.
5. Be able to perform revisional surgery.
6. Perform at least 50 bariatric cases per year including a number of revisional cases among them.
7. Attend bariatric meetings regularly and subscribe to at least one bariatric journal.
8. Follow-up for at least 75 % of the operated patients.
Requirements for Institutions
1. Have readily available consultants in cardiology, pulmonology, psychiatry, and rehabilitation with experience in treating bariatric surgery patients.
2. Have anesthesiologists, interventional radiologists, and gastroenterologists with experience in treating bariatric surgery patients and able to take over the nonsurgical management of possible anastomotic leak and strictures.
3. Provide specialized nursing care, dietary instruction, counseling, and psychological assistance if and when needed.
4. Perform at least 50 bariatric surgical cases per year including revisional cases.
5. Ensure that a recovery room and an intensive care unit, capable of providing critical care to morbidly obese patients are available.
6. Ensure that radiology department facilities can perform emergency check X-rays with portable machinery abdominal ultrasonography, upper GI series, and CT scans.
7. Ensure that blood tests can be performed on a 24-h basis and that blood transfusion can be carried out at any time.
8. Have a complete line of necessary equipment, instruments, items of furniture, wheel chairs, operating room tables, beds, radiology facilities such as CT, lifts and other facilities, especially designed and suitable for morbidly and superobese patients.
9. Have a written informed consent process that informs each patient of the surgical procedure, the risk of complications and mortality rate, alternative treatments, the possibility of failure to lose weight, and his/her right to refuse treatment.
10. Maintain details of the treatment and outcome of each patient in a digital database.

The European Accreditation Council for Bariatric and Metabolic surgery (EAC-BS) is an organization formed to examine surgeon's credentials, institutional facilities, services, and surgery outcome to ensure outstanding management of bariatric and metabolic patients in close collaboration with IFSO-European Chapter (IFSO-EC) (WWW.EAC-BS.com).

Preoperative and postoperative data from all patients operated in institutions participating at IFSO-EC COE program are entered anonymously into the International Bariatric Registry (IBAR™) in order to enable the evaluation of each surgeon and institution [3].

This is a retrospective study of prospectively reported data from institutions participating at IFSO's COE program and compares the two most commonly used bariatric operations worldwide [4], Roux-en-Y gastric bypass (RYGBP) and sleeve gastrectomy (SG).

Patients and Methods

Eligibility Criteria

Patients underwent SG and RYGBP as primary procedures, with BMI ≥40 or ≥35 kg/m^2 and obesity comorbidities, with at least 12 months of follow-up were included in the study. Diabetic patients with BMI ≥30–35 kg/m^2 were also included. Technical details of each procedure were appointed at the disposal of the participating surgeons.

Exclusion Criteria

Sleeve gastrectomies originally planned as part of a two stages procedure, have been excluded from this study. Patients younger than 14 years old and those with BMI <30 kg/m^2 were also excluded from the study.

Participating Institutions—Volume of Data

The IBAR™ was formally launched on January 1, 2010, and since that time, 131 bariatric surgeons operating in 82 institutions from 24 countries have been entering their operated patients prospectively. From the participating institutions, 42 (51.2 %) are private hospitals, 21 (25.6 %) are academic hospitals, and 19 (23.2 %) are state hospitals. Thirty-seven (37–45.1 %) have already been designated as COEs, while the rest 45 (54.9 %) are still under evaluation.

The total number of procedures entered in the IBAR™ reached 33,062 by December 31, 2015. Out of those, 6413 SGs and 10,622 RYGBPs performed as primary procedures by December 31, 2014, with at least 12-months follow-up, were retrospectively analyzed.

Definitions

Postoperative cardiac (i.e., myocardial infarction, arrhythmias, etc.), pulmonary complications (i.e., atelectasis, bronchopneumonia, pulmonary embolism, etc.), and deep venous thrombosis were recorded as "general" complications. Rare and unusual postoperative complications (i.e., rhabdomyolysis, acute psychosis, etc.) were recorded as "other" complications.

Remission of obesity comorbidities such as hypertension (HTN), type 2 diabetes mellitus (T2DM), osteoarticular disease, dyslipidemia, and sleep apnea was reported by the attending physician, when the patient ceased medications or the use of C-PAP postoperatively, and remained asymptomatic and within normal laboratory values.

Statistical Analysis and Presentation of Results

All statistical analyses were performed with SPSS 17.0 (SPSS Inc., Chicago, IL, USA). Values are expressed as mean ± SD or number (n) and percentage (%). The t test was used for comparisons between groups (RYGBP vs SG). Frequency analysis was performed by chi-squared test, with Yate's correction. All p values are two tailed. p Value less than 0.05 was considered as statistically significant.

Results

Annual Procedures

There were steadily increasing number of patients who underwent SG from 2010 to 2015, whereas the number of patients who underwent RYGBP has been increasing between the years 2010 and 2012, followed by diminishing numbers up to the end of 2015 (Fig. 1).

Male/Female Ratio

More male patients underwent SG in comparison to gastric bypass, and this was statistically significant ($p < 0.0001$) (Table 2).

Age and BMI Distribution

SG patients were younger (40.78 % < 40 years vs 35.49 % for RYGBP) ($p < 0.0001$) and significantly heavier (mean BMI 44.93 kg/m^2) compared to RYGBP patients (mean BMI 43.96 kg/m^2) ($p < 0.0001$). Additionally, in the SG group, there were more superobese patients (19.35 vs 14.11 %, $p < 0.0001$) (Table 2).

Comorbidity Prevalence

The prevalence of hypertension, T2DM, and dyslipidemia was statistically higher among RYGBP patients ($p < 0.0001$), while osteoarticular disease was more frequent among SG patients ($p < 0.0001$) (Table 3).

Operative Approach

Laparoscopic approach was used in the vast majority of patients for both procedures (6340–98.86 % in SG and 10,573–99.54 % for RYGBP). Conversion to open approach was uncommon (0.17 % for SG and 0.1 % for RYGBP–NS) (Table 4).

Intraoperative Complications

The overall per-operative complication rate for SG group was 1.2 vs 1.04 % for RYGBP group–NS. No death occurred during both procedures (Table 4).

Fig. 1 Annual number of SG and GBP entered in the IBAR™ from January 2010 to December 2015

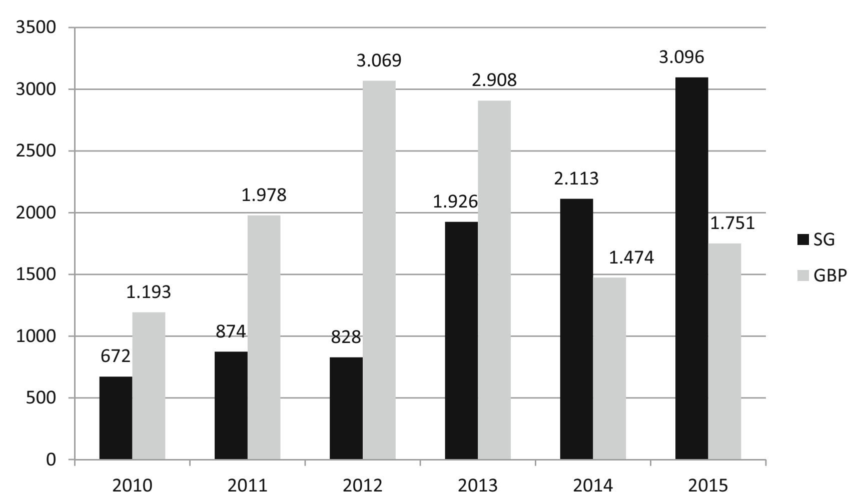

Table 2 Demographic characteristics of patients with a minimum follow-up of 12 months who undergone SG vs GBP from 2010 to 2014

	Sleeve gastrectomy (n = 6413)		Gastric bypass (n = 10,622)		p value
	Patients	%	Patients	%	
Age group					
<20	101	1.57 %	70	0.65 %	<0.0001
20–40	2515	39.21 %	3701	34.84 %	<0.0001
40–60	3231	50.38 %	5860	55.16 %	<0.0001
>60	566	8.82 %	991	9.32 %	NS
Male	1956	30.50 %	2539	23.90 %	<0.0001
BMI (kg/m^2)					
>50 kg/m^2	1241	19.35 %	1499	14.11 %	<0.0001
Median (range)	43.43 (26.95–78.6)		42.46 (26.28–75.5)		<0.0001

Length of Hospital Stay

Same or first postoperative day discharge was reported in 68.36 % of patients with RYGBP and for 40.06 % of patients with SG ($p < 0.0001$). Median length of hospital stay was also statistically significantly shorter ($p = 0.001$) in the RYGBP group [median 2 days (range 0–45 days) vs median 3 days (range 0–38 days)] in the SG group.

Postoperative Complications and Mortality

Early (<30 days) postoperative complications of 3.02 %, observed following RYGBP, was significantly higher ($p = 0.0006$) than the 2.12 % seen after SG. Bleeding was the most common complication for both groups. Postoperative leak rate was significantly higher ($p = 0.01$) in the RYGBP group (Table 5). Only two patients, one in each group, died in the first 30 postoperative days (SG 0.016 % vs RYGBP 0.009 %–NS).

Readmissions and Reoperation Rate

From the SG group, 103 patients, 1.61 %, and 206 patients, 1.94 %, from the RYGBP group required readmission following hospital discharge in the first 30 days following bariatric surgery–NS. One patient was readmitted with two complications after RYGBP. Significantly, more intra-abdominal abscesses were the reason for readmission in the SG group, while no difference in the rest of the complications was presented between the two study groups (Table 6). From the SG group, 78 patients of those who required readmission were reoperated (75.72 %) vs 104 patients (50.50 %) from the RYGBP group ($p < 0.0001$).

Late Postoperative Complication-Reoperation Rate and Late Mortality

More patients from the RYGBP group (351 pts, 3.30 %) developed complications requiring hospital admission in the late postoperative period (>30 days), compared with those from the SG group (61 pts, 0.97 %) ($p < 0.0001$). Six patients after SG developed two complications requiring hospital admission (Table 7). Intestinal obstruction and anastomotic ulcer were the complications most commonly developed in the RYGBP group ($p < 0.0001$). However, the reoperation rate of the readmitted patients in the late postoperative period was not statistically different among both study groups (55.80 % in SG vs 63.50 % in RYGBP, $p = 0.3$ NS) (Table 7).

Weight Loss

Significantly better weight loss was seen following RYGBP in all postoperative years. Weight loss was peaked at the 18th month after surgery for both procedures (Table 8).

Table 3 Comorbidity prevalence

Comorbidities	Sleeve gastrectomy		Gastric bypass		p value
	Patients	%	Patients	%	
HTP	2200	34.31 %	3987	37.54 %	<0.0001
Diabetes	1414	22.05 %	2711	25.52 %	<0.0001
Osteoarticular disease	2049	31.95 %	5167	48.64 %	<0.0001
Dyslipidemia	1856	28.94 %	3388	31.90 %	<0.0001
Sleep apnea	1416	22.08 %	2318	21.82 %	NS

Table 4 Intraoperative approach and outcome

Access	Sleeve gastrectomy (n = 6413)		Gastric bypass (n = 10,622)		p value
	Patients	%	Patients	%	
Laparoscopy	6340	98.86 %	10,573	99.54 %	<0.0001
Laparotomy	62	0.97 %	38	0.36 %	<0.0001
Conversion	11	0.17 %	11	0.10 %	NS
Intra-operative complications					
Bleeding	44	0.69 %	61	0.57 %	NS
Gastrointestinal perforation	10	0.16 %	24	0.23 %	NS
Liver injury	9	0.14 %	9	0.08 %	NS
Major vessel injury	1	0.02 %	1	0.01 %	NS
Splenic injury	6	0.09 %	2	0.02 %	NS
Other	7	0.11 %	13	0.12 %	NS
Death	0	0.00 %	0	0.00 %	NS

Outcome of Obesity Comorbidities

Significantly more patients have their HTN resolved following RYGBP than after SG in the first (48 vs 44 %, $p = 0.018$) and second (55 vs 49 %, $p = 0.023$) postoperative year. However, in the subsequent years, there were no differences in HTN resolution following either procedure.

T2DM resolution was observed in 60.1 % of patients after RYGBP, as compared to 54.2 % following SG, in the first postoperative year ($p = 0.005$). No differences were observed in T2DM resolutions in the subsequent years following the two studied procedures.

Although better sleep apnea remission rate was seen following RYGBP in the first postoperative year (68 vs 60 %, $p = 0.0002$), in the subsequent second, third, fourth, and fifth years after bariatric surgery, there was no statistically significant difference in the remission rate of this comorbidity among the two procedures.

Similar results were observed for dyslipidemia where RYGBP patients showed higher remission rate during the first postoperative year (57 vs 37 %, $p = 0.0001$). However, no statistical difference was observed compared with the SG group in the subsequent five postoperative years.

Finally, significantly better results ($p < 0.0001$ for all comparisons) were seen after SG in the first (44 vs 35 %) and the subsequent postoperative years in terms of treatment of osteoarticular disease (60 vs 47 % in the second, 76 vs 53 %

Table 5 Early (≤30 days) postoperative complications and mortality

Complications	Sleeve gastrectomy (n = 6413) Patients	%	Gastric bypass (n = 10,622) Patients	%	p value
General Complications	13	0.20 %	45	0.42 %	NS
Bleeding	77	1.20 %	108	1.02 %	NS
Leak	10	0.15 %	40	0.38 %	0.01
Intra-abdominal abscess	3	0.05 %	6	0.06 %	NS
Wound infection	3	0.05 %	6	0.06 %	NS
Wound dehiscence	3	0.05 %	3	0.03 %	NS
Intestinal obstruction	0	0.00 %	7	0.07 %	NS
Sleeve/anastomotic stricture	2	0.03 %	7	0.07 %	NS
Vomiting	3	0.05 %	12	0.11 %	NS
Other	22	0.34 %	85	0.80 %	NS
Total	136	2.12 %	319	3.02 %	0.0006
Mortality	1	0.016 %	1	0.009 %	NS

Table 6 Early (≤ 30 days) re-admission and re-operation rates

Readmissions for	Sleeve gastrectomy (n = 6413)		Gastric bypass (n = 10,622)		p value
		%		%	
General complications	6	0.09 %	10	0.09 %	NS
Bleeding	4	0.07 %	24	0.23 %	NS
Leak	17	0.27 %	21	0.20 %	NS
Intra-abdominal abscess	19	0.30 %	10	0.09 %	0.004
Wound infection	4	0.06 %	10	0.09 %	NS
Wound dehiscence	0	0.00 %	2	0.02 %	NS
Intestinal obstruction	4	0.06 %	12	0.11 %	NS
Anastomotic stricture	1	0.02 %	6	0.06 %	NS
Gastric/stomal ulcer	2	0.03 %	10	0.09 %	NS
Vomiting	12	0.18 %	23	0.22 %	NS
Other	34	0.53 %	79	0.74 %	NS
Total	103	1.61 %	207	1.94 %	NS
Patients reoperated	78/103	75.72 %	104/206	50.50 %	<0.0001

in the third, 78 vs 53 % in the fourth, and 78 vs 56 % in the fifth postoperative years).

Discussion

In 2010, a Centre of Excellence Program was initiated in the area of Europe, Middle East and Africa by the relevant IFSO chapter [3].

The major aim of the COE concept was to describe the requirement for improvement of the management offered to morbidly obese patients. Surgeon's experience, volume of patients treated per year, institutional equipment, facilities, and services are of the outmost importance for safe and effective treatment of the morbidly obese patients [2, 5].

Another highly important aspect of the project was the collection, processing, and study of accumulated patients' data from many institutions of the region and the extraction of conclusions concerning unknown or debated aspects of the bariatric procedures [6].

In recent years, SG emerged as a commonly used bariatric operation. It is, therefore, very interesting to be compared with the old standard procedure, the RYGBP, for treatment of severe obesity [7–9].

Data from the IBAR™ shows that SG has gained popularity in the last 5 years and is now the mostly used bariatric operation among the surgeon's participating at the COE program in the area of Europe, Middle East, and Africa. This observation is consistent with other studies from different geographic areas [1, 7].

Table 7 Late (>30 days) complication and re-operation rates

Complications	Sleeve gastrectomy (n = 6413)		Gastric bypass (n = 10,622)		p value
		%		%	
GERD–esophagitis	2	0.03 %	4	0.04 %	NS
Gastric/stomal ulcer	2	0.03 %	36	0.34 %	0.0001
Anastomotic stricture	4	0.06 %	2	0.02 %	NS
Vomiting	8	0.12 %	23	0.22 %	NS
Protein malnutrition	2	0.03 %	5	0.05 %	NS
Liver failure	1	0.01 %	0	0.00 %	NS
Incisional hernia	5	0.07 %	12	0.11 %	NS
Intestinal obstruction	12	0.18 %	63	0.59 %	0.0002
Other	31	0.46 %	206	1.93 %	<0.0001
Total	67	0.99 %	351	3.30 %	<0.0001
Patients readmitted/operated	61/34	55.80 %	351/223	63.50 %	NS

Table 8 Annually % excess weight loss

		Patients	Median	Range	p value
12th month	SG	2995	66.67	−11.57–120.00	<0.0001
	GBP	6109	71.19	−17.18–120.63	
18th month	SG	1761	68.89	−15.18–122.81	<0.0001
	GBP	2603	74.54	−10.11–123.08	
24th month	SG	1338	68.00	−14.72–121.21	<0.0001
	GBP	2291	73.80	−12.13–121.21	
36th month	SG	598	63.79	−11.07–121.88	<0.0001
	GBP	854	70.97	−12.08–122.89	
48th month	SG	184	61.46	9.13–112.87	0.002
	GBP	255	68.89	−7.94–119.35	
60th month	SG	151	60.27	−11.53–109.62	0.002
	GBP	123	67.82	−8.84–114.42	

This can be explained due to the simplicity and efficacy of this operation. This procedure was the surgeon's preference in case of adolescence and superobese cases in this study. This preference for performing SG in adolescence and patients with higher BMI was also reported previously [10–12].

However, in case of comorbid condition, such as diabetes type 2 and hypertension, most surgeons had chosen RYGBP [12, 13], possibly due to the fact that this procedure is used for longer period of time having proven its ability to treat obesity comorbidities particularly type 2 diabetes [14].

As this study shows, both procedures were performed laparoscopically in the vast majority of the cases with the same conversion rate, even when SG was utilized in heavier individuals. There were also no statistically significant differences concerning intraoperative complications (0.11 % for SG and 0.12 % for RYGBP), nor in the 30-day mortality which was extremely low for both procedures (0.016 % for SG and 0.009 % for RYGBP). In a study from the USA with 57,918 operated patients [5], the incidence of intraoperative complications was similar for both procedures (1.35 % for SG and 1.41 % for RYGBP). In another study from the same country with 11,023 patients, the majority of whom underwent laparoscopic or open RYGBP and the reported 30-day mortality was 0.2 % [15]. The result of our study, as far as intraoperative complications and 30-day mortality rate are concerned, compares favorably with the above two studies. It is also noticeable that mortality and readmission rates in accredited high-volume centers are lower than in nonaccredited low-volume institutions [6, 16].

However, there were more postoperative complications in the RYGBP group with leak rate 0.36 vs 0.15 % in the SG group ($p < 0.01$). This finding is in agreement with other studies that are reporting postoperative complications to occur more often after RYGBP [17].

There were no differences in the readmission rate between the two procedures, although more patients were readmitted due to intra-abdominal abscess following SG. The low readmission rate (1.61 % for SG and 1.94 % for RYGBP), reported from the participating at IFSO-EC COE program institutions, compares favorably with the reported 7.3 % readmissions after RYGBP reported from Saunders et al. [16], and provide support to the conclusions of Nguyen et al. [6] and Weller et al. [18] that readmissions and reoperations are less likely in high-volume accredited centers.

From those patients who were readmitted in the SG group, 75.72 % required reoperation and this is statistically significant, as compared with the 50.50 % reoperations in the RYGBP group. The results of this study do not support the observation of Helmio et al. [19] that there are no significant differences in major complications and early reoperations following both procedures.

As far as the long-term outcome following RYGBP is concerned, there were significantly more complications (3.30 %) requiring admission in the hospital, compared to the long-term complications noticed after SG (0.99 %). This finding is in agreement with other investigators as far as the life time risk for reintervention after RYGBP [20] but do not support the observation of Park et al. [12] that there are no differences regarding complications and reinterventions up to four postoperative years among both procedures.

However, from the re-admitted patients, re-operation required for 55.8 % in the SG group and this is not statistically different from the 63.5 % of the re-operated patients after RYGBP.

The weight loss after RYGBP was significantly greater than after SG in all postoperative years of the study on the 12th–60th postoperative month, and this is in alignment with others that are reporting better weight loss following RYGBP [8, 21]. However, our findings do not support studies reporting equal weight loss for RYGBP as compared to SG [12, 22] in the first 12 and up to 36 postoperative months.

Significantly better results in remission of diabetes, dyslipidemia, and sleep apnea syndrome occur after RYGBP in the first postoperative year. In the following second, third, fourth, and fifth years of follow-up, both procedures proved to be equally capable to treat the above conditions. RYGBP showed better results in the treatment of hypertension on the first and the second postoperative year, while in the subsequent years of follow-up, there were no statistically significant differences in the ability of both procedures to treat this disease.

The better results seen after RYGBP in the early postoperative period in controlling the above conditions can be partially explained by the greater weight loss observed after this procedure. Other mechanisms such as bypassing the pylorus after RYGBP, different gut hormonal signals, lower plasma C-reactive protein, and better improvement of central obesity in the first 12 postoperative months might be involved [21, 23]. The results of this study agree with those of Iannelli et al. [13] and Huang et al. [9]. Both observed better remission of T2DM after RYGBP at 12 postoperative months. Our results are also in accordance with those published by Cutolo et al. [24] and Yang et al. [25] having reported same results in diabetes remission at 24- and 36-month follow-up, respectively, and Vix et al. [26] having observed better triglyceride reduction and better improvement of HDL cholesterol after RYGBP at 12 months postoperative. Our results, on the other hand, do not support the observation by Keidar et al. [27] showing no superior effect of the RYGBP in comparison to SG with regard to HbA1c levels or weight loss during 12 months of follow-up and to others reporting that both procedures are equally capable to control T2DM and all obesity comorbidities at the first postoperative year [17, 28].

However, in the later postoperative period and up to the fifth postoperative year and despite the greater weight loss after RYGBP for all postoperative years, no difference in remission rate was noted between the two bariatric operations. Our findings for T2DM remission at 24 and subsequent postoperative months agree with those of Park et al. [12] and with the meta-analysis of 16 recent studies published by Li et al. [14], concluding that equal long-term results as far as T2DM remission is concerned are seen after either SG and RYGBP.

On the contrary, better remission rate for osteoarticular disease was evidenced after SG in the first and all subsequent years of the study. This may be explained by the higher incidence of this condition preoperatively in the heavier patients that underwent SG. It is remarkable that studies of the outcome of obesity comorbidities following SG and RYGBP, with sufficient patients to minimize biased results and with long-term follow-up, 5 and up to 10 years, are missing. Therefore, in order to draw definitive and solid conclusions, such studies are needed.

The strength of this study lies on the large number of patients studied, the prospective entry of data and the verification of the reported data by an auditing process. However, this study has a number of limitations. The reported results are representative of the management offered to morbidly obese patients in highly specialized centers by experienced bariatric surgeons fulfilling the IFSO requirements for the safe and effective management of the severely obese individuals.

Therefore, this may not accurately represent the average outcome of the bariatric procedure in the region of Europe, Middle East, and Africa.

Additionally, the reported data in the IBAR™ are verified by site visitation, not for all 82 participating institutions, but only for 37 (45.1 %) institutions that have already been designated as COEs. It should be noted that 10–15 % randomly selected patients files have been inspected by the auditor at each site visit, and no mismatched data have been so far disclosed. However, the possibility of entering incorrect data, from institutions not yet inspected, cannot be excluded. Therefore, the exact figures for morbidity, mortality, and readmission rates may be slightly different than those reported in this study.

In conclusion, both procedures were performed in institutions participating in IFSO-EC COE program with extremely low morbidity, mortality, complication, and reoperation rates.

Although greater weight loss was noted after RYGBP, the remission of comorbidities such as diabetes, hypertension, and sleep apnea was almost equally satisfying after both procedures in the long term. Further studies are both required and necessary to consolidate our results and provide more clear answers on the long-term % EWL and resolution of obesity comorbidities, following these two procedures. This will enable the extraction of definitive helpful conclusions for the bariatric daily practice.

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Compliance with Ethical Standards

Conflict of Interest Author 1 reports other from EAC-BS, during the conduct of the study, and other from EAC-BS, outside the submitted work. The rest of the authors have nothing to disclose.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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