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HAL Authorization

1 *Specific aspects of bariatric surgery in French Polynesia*

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2 DM+MSB: study conception

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13 Table 1: pre-operative characteristics of patients treated by bariatric surgery

14 Table 2: post-operative characteristics of patients treated by bariatric surgery

15 Table 3: follow-up of patients treated by bariatric surgery

16 Table 4: post-operative complications of patients treated by bariatric surgery

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19 *Short-title: Bariatric surgery in Polynesia*

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Specific aspects of bariatric surgery in French Polynesia

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Abstract

Introduction: There is a significant increase in obesity and diabetes mellitus prevalence in Polynesia. The objective of this study was to identify the effectiveness and safety of bariatric procedures in Polynesian population in the setting of a structured bariatric program led by a single bariatric surgeon.

Methods: This was a single-center study with a retrospective analysis of prospectively collected data. We retrospectively reviewed all patients supported in our institution for obesity surgery between May 2011 and June 2017. Sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGBP) were performed.

Results: 458 patients underwent bariatric surgery during the study period. Mean age was 39.5 ± 10 years, mean BMI was 46.8 ± 7.8 . We did 185 RYGBP and 273 SG between 2011 and 2017. There was no statistically significant difference between RYGBP and SG for weight loss and comorbidities improvement or resolution. The risk of a postoperative biliary stones requiring cholecystectomy appeared to be greater after RYGBP than after SG although this difference did not reach statistical significance ($p = 0.08$).

Conclusion: In this isolated population, follow-up programs are difficult to implement. The SG is preferred in French Polynesia in front of its lower morbidity, the lesser seriousness of a non-vitamin supplementation and the reduction of the risks of biliary complications, with comparable results in terms of excess weight lost compared to the RYGBP.

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Keywords: bariatric surgery, remote area, Polynesia, sleeve gastrectomy, safety

Highlights

In the manuscript intitled “*Specific aspects of bariatric surgery in French Polynesia*” we report the implementation of a bariatric program in remote area such as French Polynesia.

- This manuscript gives the opportunity to support a bariatric program in an area with low medical density.
- In this isolated population, follow-up programs are difficult to implement.
- The sleeve gastrectomy (SG) is preferred in French Polynesia because of its lower morbidity, the lesser seriousness of a non-vitamin supplementation and the reduction of the risks of biliary complications, with comparable results in terms of excess weight lost compared to the RYGBP. The paper provides evidence that the SG is a suitable procedure in this setting.

1 **Introduction**

2 High body-mass index (BMI) is an important risk factor for cardiovascular and kidney
3 diseases, diabetes, some cancers, and musculoskeletal disorders [1]. Concerns about the
4 health and economic burden of increasing BMI have led to obesity being included among the
5 global non-communicable disease targets, with a target of halting, by 2025, the rise in the
6 prevalence of obesity at its 2010 level [1,2]. Epidemiological studies have shown substantial
7 risks in people with severe (≥ 35 kg/m²) or morbid (≥ 40 kg/m²) obesity [3].

8 Native Hawaiians and Polynesians living in economically disadvantaged communities suffer
9 disproportionately from many health conditions, especially chronic diseases [4–6]. Regional
10 mean BMI in 2014 was maximum in Polynesia and Micronesia: for men 29.2 kg/m² and 32.2
11 kg/m² for women [2]. During 1980–2009 there were significant increases in BMI and obesity
12 in Polynesia [7]. Physical activity programs are built in urban areas of Polynesian islands to
13 improve physical activity [8,9].

14 Age-standardized adult diabetes mellitus prevalence in 2014 was highest in Polynesia and
15 Micronesia, at nearly 25% [10]. Native Pacific islanders have higher rates of diabetes
16 compared with other races/ethnicities [11]. Also in many remote Pacific islands, health care is
17 not provided [12]; the use of telemedicine in chronic disease management has potential to
18 improve patient care in remote indigenous populations and may supplement patient-provider
19 relationships [13].

20 In 2011 a comprehensive bariatric program was initiated in Polynesia by a single surgeon that
21 had been previously specifically trained in a high-volume bariatric center in France.

22 The objective of this study was to identify the effectiveness and safety of bariatric procedures
23 in Polynesian population in the setting of a structured bariatric program led by a single
24 bariatric surgeon. In addition, we aimed to evaluate the impact of medical observance during
25 post-operative follow-up.

1 **Material and methods**

2 This was a single-center study with a retrospective analysis of prospectively collected data.
3 Patients were then selected preoperatively using the following criteria: 18 years old and less
4 than 65years of age or good general condition, the existence of morbid obesity with BMI
5 greater than 40 or 35 with presence of comorbidities related to obesity - radiologically proven
6 osteoarthritis, hypertension, type 2 diabetes mellitus (T2D) or obstructive sleep apnea
7 syndrome (OSAS). For each patient, the following data were collected prospectively:
8 demographic data (age, gender), morphological and clinical data (weight, height, BMI) and
9 past illness, details of surgery, postoperative complications, mortality, follow-up data
10 (duration of follow-up, body weight, improvement and/or resolution of obesity-related
11 comorbidities, compliance with vitamins and minerals supplementation).

12 We retrospectively reviewed all patients supported in our institution for obesity surgery
13 between May 2011 and June 2017. Surgical technique: we performed sleeve gastrectomy
14 (SG) and Roux-en-Y gastric bypass (RYGBP). Adjustable gastric binding (AGB) procedures
15 were made in another institution.

16 Regarding the surgical technique, the RYGBP were privileged at the beginning of the
17 experience of the center then the SG was quickly preferred to the RYGBP for its low
18 morbidity and the simplicity of the post-operative follow-up. Currently the RYGBP is
19 reserved for SG failure, patients with severe gastroesophageal reflux with erosive esophagitis,
20 biopsy proven Barrett's esophagus. SG failure was defined as an overweight with
21 postoperative one-year weight greater than the preoperative weight. Those patients have been
22 excluded for GBP analysis. Considering the revisions from SG to GBP, analyses of the
23 different outcomes (failure, vitamine intake etc...) were carried out with intention to treat. We
24 did not include these SG failures in the GBP group in the study.

1

2 Definitions: we considered remission for diabetes, hypertension and obstructive sleep apnea
3 syndrome, for patients with glycated hemoglobin (HbA1c) less than 7% without drug therapy,
4 systolic blood pressure lower than 140 mmHg without medication and weaning from
5 nocturnal non-invasive ventilation. Improvement was defined as the reduction in the use of
6 medications for each condition. OSAS improvement was assessed by a pulmonologist using
7 at least a 10% improvement in polysomnography or clinical symptomatology of OSAS.
8 Adherence was defined as daily oral intake of vitamins supplementation. Random or
9 incomplete supplementation was considered nil.

10 The type of the survey is the same for both procedures: medical consultation (every 3 months
11 during the first year and then every 6 months) or a phone call if the patient was not able to
12 come. The follow-up could be different depending of the location of patients. For those living
13 close to Tahiti (the biggest island), it was a clinical follow-up; for inhabitants of remote
14 islands, medical follow-up was generally a phone follow-up.

15 Cholecystectomy was performed after bariatric surgery in case of symptomatic gallbladder
16 lithiasis.

17 Surgical complications were classified according to Clavien-Dindo [14]: stages 1 and 2
18 represent minor complications requiring the introduction of drug therapy without organ
19 failure; stages 3 and 4 represent complications requiring interventional therapeutic under local
20 anesthesia (stage 3a), under general anesthesia (3b) or the existence of organ failure (4a and
21 4b). Death is represented by stage 5. Only surgical complications ≥ 3 were reported.

22 Missing data management: during post-operative follow-up, for patients refusing to come for
23 clinical exam or refusing to give their weight during phone call, we calculated their
24 postoperative BMI from the last known weight or, if not applicable, the preoperative weight.

1

2 Statistical analysis was performed with free software “R” version 3.0.1 (R Development
3 Core Team (2008), *R Software*. R Foundation for Statistical Computing, Vienna, Austria).

4 Univariate analysis was performed by chi-square test and log-rank test. We considered as
5 statistically significant if $p\text{-value} < 0.05$. Multivariate analysis was performed for parameters
6 whose univariate analysis was statistically significant.

1 **Results**

2 In total, 458 patients underwent bariatric surgery during the study period. Median age was
3 39.5 ± 10 years, mean BMI was 46.8 ± 7.8 . We did 185 RYGBP and 273 SG. The
4 demographic data are presented in Table 1. Forty-three patients were in failure of a previous
5 procedure: 40 AGB and 3 SG. Five patients had a BMI less than $35 \text{ kg} / \text{m}^2$ but had a
6 historical BMI greater than 35 with presence of comorbidities related to obesity.

7 The median follow-up of patients is 2.1 years [1.3 – 2.9]. Regarding the follow-up of the
8 patients, 93 of them did not show up for their follow-up visit or did not wish to give their
9 weight by phone.

10 There was no statistically significant difference between RYGBP and SG for weight loss and
11 comorbidities improvement or resolution. Pre-operative and post-operative weight of both
12 groups were different, with higher BMI for SG group. This is due to lower BMI included for
13 bariatric surgery at the beginning of the center's experience. After a learning experience for
14 non-surgical team, maximal BMI limit were increased.

15 The duration of follow-up was not the same between the two groups since the RYGBP were
16 mostly proposed at the beginning of the center's experience (tables 2 and 3).

17 On the other hand, there was no statistically significant difference in vitamin supplementation
18 ($p = 0.395$). Only 300 patients answered to the survey about their vitamin supplementation
19 observance; in addition, the compliance rate was relatively low (52.2%).

20 The risk of a postoperative biliary stones requiring cholecystectomy appeared to be greater
21 after RYGBP than after SG although this difference did not reach statistical significance ($p =$
22 0.08).

1 There were no deaths related to the surgery. The serious complications are presented in table
2 4: three leaks requiring surgical revision (1 for RYGBP and 2 for SG), 1 anastomotic stricture
3 at the gastrojejunal anastomosis for RYGBP, two moderate strictures for SG treated by
4 endoscopy. There was no statistically significant difference between the two surgical
5 procedures with respect to the Clavien-Dindo ≥ 3 complication rate. We did not collect any
6 data about reflux. In our experience we encountered a very low incidence of reflux. We did
7 not need, in this population, to transform SG into RYGBP.

8

9 **Discussion**

10 The present study indicates that a bariatric program can be safely and effectively established
11 in a remote area such as French Polynesia with a low medical density allowing results that are
12 comparable to those obtained in metropolitan France. In our study, with a median 2.1 years
13 follow-up, there was a 10.5 BMI loss and 29.3 kg weight loss for RYGB, and 10.3 BMI loss
14 and 29.7 kg weight loss for SG. There was no statistically significant weight loss between SG
15 and RYGBP (p-value = 0.855). However, the two groups were not strictly identical since the
16 BMI baseline was higher in the SG group. In fact, at the beginning of the experience, RYGBP
17 was the most frequently proposed procedure and the included BMIs were lower.

18 These results are comparable to those reported in the literature with BMI decrease of 13 to
19 14.2 and 31.5 to 36.8 kg weight loss for the RYGB at a mean 2.1 years [15] and BMI
20 decrease of 13 at 2 years follow-up for the SG [16,17].

21 Patients who begin the process for bariatric surgery with the higher BMI will remain with a
22 slightly higher BMI compared to those who went for surgery with a lower BMI. Likewise,
23 those who achieved a lower BMI at the end of the first year following the surgery will have a
24 greater chance of maintaining a lower BMI in the fifth post-operative year. It was observed

1 that patients with higher BMI and lower excess weight loss (EWL) with 1 year of surgery
2 presented higher BMI at 5 years post-operatively [18]. A meta-analysis demonstrated that
3 long-term EWL is independent of baseline BMI and age after RYGBP and SG. In addition,
4 there was no significant association between EWL and length of follow-up after RYGBP and
5 SG that confirmed sustainability of weight loss after these procedures [19]. Weight loss may
6 be associated with geographic location and race; RYGBP is more effective than AGB for
7 reducing weight in America (61.9 vs. 41.7%) and Asia (60.1 vs. 48.2%); however, in Europe
8 the effectiveness of RYGBP is equal to AGB (56.3 vs. 55.9%). In contrast, the effect of SG
9 on weight loss is the same in America, Asia, and Europe [19]. There is no study reporting
10 the %EWL of RYGBP vs. SG in the Pacific area. In our study, the weight loss between SG
11 and RYGBP is the same, while the baseline BMI is higher in the SG group. Even if
12 the %EWL could be lower in the SG group vs. RYGBP, SG remains preferred for its lower
13 morbidity and a lower rate of vitamin deficiencies and gallbladder stones related
14 complications.

15

16 We also found a significant decrease for all obesity-related comorbidities and there was no
17 statistically significant difference in the reduction of comorbidities by type of surgical
18 procedure [20]. However, the comorbidities were not the same between the two preoperative
19 groups: diabetes was more frequent in the RYGBP group ($p = 0.049$). In addition, the BMI
20 was higher in the SG group, which was accompanied by a higher (not significant) incidence
21 of OSAS compared to the RYGBP group. Post-operatively, OSAS and diabetes mellitus were
22 more common in the SG group than in the RYGBP group, but this was not statistically
23 significant. Thus, the RYGBP was more effective for the management of diabetes, in our
24 study but significant differences in patients' characteristics at baseline in the two groups may
25 account for this difference.

1 Although, some studies found a difference in the reduction of diabetes mellitus with a
2 superiority of RYGBP over SG [21–23] a recent randomized trial, the SM-BOSS showed that
3 the two procedures resulted in similar results in terms of weight loss and improvement in T2D
4 at five years [24].

5

6 Adiposity has increased substantially more, in low and middle-income countries than in
7 continental Europe and high-income Asia Pacific countries, especially in women [10].

8 Awareness, treatment, and control of hypertension remains also a challenge in middle- and
9 low-income countries, such as Polynesian islands [7]. Easy access to medical care and
10 aggressive use of pharmacotherapy are the key strategies which have proved to be successful
11 in reducing the burden of hypertension on the population level [25].

12

13 SG has rapidly become the most performed bariatric procedure in France and in the world
14 [26,27]. Indeed, SG carries several advantages over the more complex RYGB, including the
15 easier surgical technique with no digestive anastomosis, the possibility to explore the whole
16 digestive tract endoscopically after the procedure, and the avoidance of intestinal bypass and
17 [28]. SG is also more easily accepted by patients that more easily understand the principles of
18 the procedure and its related constraints that are lighter than those of a RYGB. Our results
19 indicate that both the RYGB and the SG are suitable procedures to start a bariatric program in
20 the setting of a remote area as the French Polynesia with excellent results in terms of safety,
21 especially in case of surgeon already experienced. Interestingly, these procedures were also
22 done in the case of AGB failure with no complication.

23

24 Bariatric surgery is cost-effective in comparison to non-surgical treatment in the reviewed
25 published estimates of cost-effectiveness [20]. Although we were not able to do a medico-

1 economic analysis, as the improvement in obesity-related comorbidities and the rate of
2 complications were comparable to those reported in the literature, it may be speculated that
3 bariatric surgery in this new program may be considered as cost-effective.

4

5 The risk of nutritional deficiencies depends on the percentage of weight loss and the type of
6 surgical procedure performed: RYGB has a malabsorptive component and carries an
7 increased risk of deficiencies as compared to SG [29]. Routine nutritional screening,
8 appropriate supplements and monitoring compliance are imperative, whatever the bariatric
9 procedure [29].

10 In our experience, there was no statistically significant difference in vitamin supplementation:
11 patients who had been operated by SG were more likely to continue vitamin supplementation
12 ($p = 0.395$), in addition, the compliance rate was relatively low (52.2%).

13

14 Enteric hyperoxaluria is often present in patients after RYGB because of due to intestinal
15 malabsorption [30]. This phenomenon contributes to the formation of oxal-calcium vesicular
16 gallstones and increases the incidence of biliary complications in these patients. In our study,
17 there is a trend in performing secondary cholecystectomy after bariatric surgery: 8.4% for SG
18 vs. 14.1% for RYGBP ($p=0.079$).

19 Observations over the last few years in French Polynesia suggest that ongoing nutritional
20 transition points toward an increase of chronic conditions. This phenomenon impacts young
21 people more than older generations who still live according to traditional practices.
22 Adolescent obesity prevention in French Polynesia is a public health imperative, but it is also
23 important for the implementation of intervention programs to be inexpensive and easily
24 reproducible [31]. Wide variations were observed in the prevalence and the management of
25 hypertension between French overseas territories, and an especially challenging low control

1 of hypertension was found in French Polynesia. Obesity appears a key target to prevent
2 hypertension, particularly in French Polynesia [32].

3

4 **Limitations**

5

6 Due to the large distances between the Pacific Islands and the low medical density, prevention
7 and follow-up programs are difficult to implement in these populations. Two thirds of patients
8 (300 out of 458) did answer by phone or physical examination concerning body weight,
9 vitamins observance, comorbidities, etc. ; in many cases, it was difficult to obtain information
10 on body weight, as they have no device or didn't want to clarify their answers on
11 comorbidities. Others simply didn't want to answer. So, for inhabitants of remote islands,
12 RYGBP remains a risky procedure due to the challenge in follow-up and patients' observance.
13 The median surgical follow-up is 2.1 years for a study period of 6 years. This is due to a
14 gradual start-up of the activity which took two years to reach full capacity. This short
15 monitoring is also explained by the monitoring difficulties linked to the long distances
16 between Polynesian islands and archipelagos. However, there are only 3 surgical centers
17 throughout Polynesia and 7 general surgeons; therefore, complications are unlikely to have
18 occurred without our knowledge. Complications occurred throughout the experience of the
19 center, there was, for example, no major morbidity (Clavien-Dindo ≥ 3) the first year of the
20 experience. This is due to the surgeon's surgical training which was carried out for 4 years in
21 a high-volume university center.

22 Regarding the choice of the surgical procedure, we recommend in Polynesia, the SG for its
23 low morbidity, the least need for vitamin supplementation, the lowest proportion of gallstone
24 complications and an equivalent reduction in weight loss and BMI compared to RYGBP, the
25 reduced risk of long-term surgical complications such as intestinal obstruction that may prove

1 life-threatening in such a setting.

2

3 **Conclusion**

4 The rapid increase in obesity is a major public health issue, particularly in poorer areas such
5 as Pacific island populations. In this isolated population, follow-up programs are difficult to
6 implement. Thus bariatric surgery reduces cardiovascular risks with a positive cost-
7 effectiveness balance. The SG is preferred in French Polynesia in front of its lower morbidity,
8 the lesser seriousness of a non-vitamin supplementation and the reduction of the risks of
9 biliary complications, with comparable results in terms of excess weight lost compared to the
10 RYGBP.

11

12 **Conflict of Interest:** The authors declare that they have no conflict of interest.

13 **Funding:** no funding was received for this study

14 **Ethical consideration:**

15 All procedures performed in studies involving human participants were in accordance with
16 the ethical standards of the institutional and/or national research committee and with the 1964
17 Helsinki declaration and its later amendments or comparable ethical standards. For this type
18 of study formal consent is not required.

19

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22

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1 **References**

- 2 1. Zheng W, McLerran DF, Rolland B, Zhang X, Inoue M, Matsuo K, et al. Association
3 between Body-Mass Index and Risk of Death in More Than 1 Million Asians. *N Engl J*
4 *Med.* 2011 Feb 24;364(8):719–29.
- 5 2. (NCD-RisC) NRFC. Trends in adult body-mass index in 200 countries from 1975 to
6 2014: a pooled analysis of 1698 population-based measurement studies with 19.2
7 million participants. *The Lancet.* 2016 Apr 8;387(10026):1377–96.
- 8 3. Kitahara CM, Flint AJ, Gonzalez AB de, Bernstein L, Brotzman M, MacInnis RJ, et al.
9 Association between Class III Obesity (BMI of 40–59 kg/m²) and Mortality: A Pooled
10 Analysis of 20 Prospective Studies. *PLOS Med.* 2014 Jul 8;11(7):e1001673.
- 11 4. Okihiro M, Sehgal V, Wilkinson T, Voloch K-A, Enos R, O'Brien J. Addressing health
12 disparities by building organizational capacity in the community: a case study of the
13 Wai'anae Coast Comprehensive Health Center. *Hawaii J Med Public Health J Asia Pac*
14 *Med Public Health.* 2014 Dec;73(12 Suppl 3):34–9.
- 15 5. Liu DMKI, Alameda CK. Social determinants of health for Native Hawaiian children
16 and adolescents. *Hawaii Med J.* 2011 Nov;70(11 Suppl 2):9–14.
- 17 6. Braden KW, Nigg CR. Modifiable Determinants of Obesity in Native Hawaiian and
18 Pacific Islander Youth. *Hawaii J Med Public Health J Asia Pac Med Public Health.*
19 2016;75(6):162–71.
- 20 7. Linhart C, Tivollier J-M, Taylor R, Barguil Y, Magliano DJ, Bourguignon C, et al.
21 Changes in cardiovascular disease risk factors over 30 years in Polynesians in the French
22 Pacific Territory of Wallis Island. *Eur J Prev Cardiol.* 2016 May;23(8):856–64.

- 1 8. Maddock J, Choy LB, Nett B, McGurk MD, Tamashiro R. Increasing access to places
2 for physical activity through a joint use agreement: a case study in urban Honolulu. *Prev*
3 *Chronic Dis*. 2008 Jul;5(3):A91.
- 4 9. Buchthal V. Insights in public health: Is the gap growing? Patterns in poverty-related
5 disparities in nutrition and physical activity in Hawai'i. *Hawaii J Med Public Health J*
6 *Asia Pac Med Public Health*. 2014 Oct;73(10):332–4.
- 7 10. (NCD-RisC) NRFC. Worldwide trends in diabetes since 1980: a pooled analysis of 751
8 population-based studies with 4·4 million participants. *The Lancet*. 2016 Apr
9 15;387(10027):1513–30.
- 10 11. Uchima O, Wu YY, Browne C, Braun KL. Disparities in Diabetes Prevalence Among
11 Native Hawaiians/Other Pacific Islanders and Asians in Hawai'i. *Prev Chronic Dis*.
12 2019 21;16:E22.
- 13 12. Kupu ST. Health and telecast: a milestone for Tonga into the 21st century. *Pac Health*
14 *Dialog*. 2000 Sep;7(2):54–6.
- 15 13. Hiratsuka V, Delafield R, Starks H, Ambrose AJ, Mau MM. Patient and provider
16 perspectives on using telemedicine for chronic disease management among Native
17 Hawaiian and Alaska Native people. *Int J Circumpolar Health*. 2013;72.
- 18 14. Dindo D, Demartines N, Clavien P-A. Classification of surgical complications: a new
19 proposal with evaluation in a cohort of 6336 patients and results of a survey. *Ann Surg*.
20 2004 Aug;240(2):205–13.

- 1 15. Puzziferri N, Roshek TB, Mayo HG, Gallagher R, Belle SH, Livingston EH. Long-term
2 Follow-up After Bariatric Surgery: A Systematic Review. *JAMA*. 2014 Sep
3 3;312(9):934.
- 4 16. Casella G, Soricelli E, Giannotti D, Collalti M, Maselli R, Genco A, et al. Long-term
5 results after laparoscopic sleeve gastrectomy in a large monocentric series. *Surg Obes
6 Relat Dis*. 2016 May 1;12(4):757–62.
- 7 17. Peterli R, Wölnerhanssen BK, Vetter D, Nett P, Gass M, Borbély Y, et al. Laparoscopic
8 Sleeve Gastrectomy Versus Roux-Y-Gastric Bypass for Morbid Obesity—3-Year
9 Outcomes of the Prospective Randomized Swiss Multicenter Bypass Or Sleeve Study
10 (SM-BOSS). *Ann Surg*. 2017 Mar;265(3):466–73.
- 11 18. da Cruz MRR, Branco-Filho AJ, Zapparoli MR, Wagner NF, de Paula Pinto JS, Campos
12 ACL, et al. Predictors of Success in Bariatric Surgery: the Role of BMI and Pre-
13 operative Comorbidities. *Obes Surg*. 2018 May;28(5):1335–41.
- 14 19. Golzarand M, Toolabi K, Farid R. The bariatric surgery and weight losing: a meta-
15 analysis in the long- and very long-term effects of laparoscopic adjustable gastric
16 banding, laparoscopic Roux-en-Y gastric bypass and laparoscopic sleeve gastrectomy on
17 weight loss in adults. *Surg Endosc*. 2017 Nov;31(11):4331–45.
- 18 20. Colquitt JL, Pickett K, Loveman E, Frampton GK. Surgery for weight loss in adults.
19 *Cochrane Database Syst Rev*. 2014 Aug 8;(8):CD003641.
- 20 21. Panunzi S, De Gaetano A, Carnicelli A, Mingrone G. Predictors of remission of diabetes
21 mellitus in severely obese individuals undergoing bariatric surgery: do BMI or
22 procedure choice matter? A meta-analysis. *Ann Surg*. 2015 Mar;261(3):459–67.

- 1 22. Ribaric G, Buchwald JN, McGlennon TW. Diabetes and Weight in Comparative Studies
2 of Bariatric Surgery vs Conventional Medical Therapy: A Systematic Review and Meta-
3 Analysis. *Obes Surg*. 2013 Dec 28;24(3):437–55.
- 4 23. Madadi F, Jawad R, Mousati I, Plaeke P, Hubens G. Remission of Type 2 Diabetes and
5 Sleeve Gastrectomy in Morbid Obesity: a Comparative Systematic Review and Meta-
6 analysis. *Obes Surg* [Internet]. 2019 Oct 27 [cited 2019 Nov 19]; Available from:
7 <http://link.springer.com/10.1007/s11695-019-04199-3>
- 8 24. Peterli R, Wölnerhanssen BK, Peters T, Vetter D, Kröll D, Borbély Y, et al. Effect of
9 Laparoscopic Sleeve Gastrectomy vs Laparoscopic Roux-en-Y Gastric Bypass on
10 Weight Loss in Patients With Morbid Obesity: The SM-BOSS Randomized Clinical
11 Trial. *JAMA*. 2018 16;319(3):255–65.
- 12 25. Cifkova R, Fodor G, Wohlfahrt P. Changes in Hypertension Prevalence, Awareness,
13 Treatment, and Control in High-, Middle-, and Low-Income Countries: An Update. *Curr*
14 *Hypertens Rep*. 2016;18(8):62.
- 15 26. Lazzati A, Guy-Lachuer R, Delaunay V, Szwarzensztejn K, Azoulay D. Bariatric
16 surgery trends in France: 2005–2011. *Surg Obes Relat Dis*. 2014 Mar;10(2):328–34.
- 17 27. Angrisani L. 2014: The Year of the Sleeve Supremacy. *Obes Surg*. 2017;27(6):1626–7.
- 18 28. Schneck A-S, Lazzati A, Audureau E, Hemery F, Gugenheim J, Azoulay D, et al. One or
19 two steps for laparoscopic conversion of failed adjustable gastric banding to sleeve
20 gastrectomy: a nationwide French study on 3357 morbidly obese patients. *Surg Obes*
21 *Relat Dis*. 2016 May;12(4):840–8.

- 1 29. Ziegler O, Sirveaux MA, Brunaud L, Reibel N, Quilliot D. Medical follow up after
2 bariatric surgery: nutritional and drug issues. General recommendations for the
3 prevention and treatment of nutritional deficiencies. *Diabetes Metab.* 2009 Dec;35(6 Pt
4 2):544–57.
- 5 30. Kumar R, Lieske JC, Collazo-Clavell ML, Sarr MG, Olson ER, Vrtiska TJ, et al. Fat
6 malabsorption and increased intestinal oxalate absorption are common after Roux-en-Y
7 gastric bypass surgery. *Surgery.* 2011 May;149(5):654–61.
- 8 31. Gatti C, Suhas E, Côté S, Anassour Laouan-Sidi E, Dewailly É, Lucas M. Obesity and
9 Metabolic Parameters in Adolescents: A School-Based Intervention Program in French
10 Polynesia. *J Adolesc Health.* 2015 Feb;56(2):174–80.
- 11 32. Atallah A, Atallah V, Daigre J-L, Boissin J-L, Kangambega P, Larifla L, et al. [High
12 blood pressure and obesity: disparities among four French overseas territories]. *Ann
13 Cardiol Angeiol (Paris).* 2014 Jun;63(3):155–62.
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	Total of patients (458)	SG (273)	RYGBP (185)	p-value
Mean age ± SD, y	40.9 ± 10	40.7 ± 10	41.1 ± 10	0.659
Sex ratio, M/F	101/357	68/205	33/152	0.094
Hypertension, %	24.9	26.4	22.7	0.435
OSAS, %	14.7	15.8	13	0.490
T2D, %	16.2	13.2	20.5	0.049
Osteoarthritis, %	11.4	11.4	11.4	1.000
Weight ± SD, kg	133.16 ± 26.9	141.9 ± 29.5	120.3 ± 15.2	< 0.001
Mean BMI ± SD, kg/m²	46.8 ± 7.8	49.3 ± 8.8	43 ± 3.7	< 0.001
BMI <40, %	15.9	13.2	19.5	
BMI 40-50, %	56.8	42.1	78.4	
BMI >50, %	27.3	44.7	2.1	

Table 1: pre-operative characteristics of patients treated by bariatric surgery

SG: sleeve gastrectomy ; RYGBP: Roux-en-Y gastric bypass ; SD: standard deviation ; M: male ; F: female ; OSAS: obstructive sleep apnea syndrome ; T2D: type 2 diabetes mellitus ; BMI: body mass index

	Total of patients (458)	SG (273)	RYGBP (185)	p-value
Hypertension, %	6.6	6.6	6.5	1.000
OSAS, %	3.3	4	2.2	0.404
T2D, %	2.2	2.6	1.6	0.725
Osteoarthritis, %	2.6	2.6	2.7	1.000
Mean BMI ± SD, kg/m2	36.4 ± 8.7	39 ± 8.7	32.5 ± 7.2	0.001
BMI <40, %	68.3	60.4	80	
BMI 40-50, %	24.5	27.5	20	
BMI >50, %	7.2	12.1	0	
Weight loss, kg	29.6	29.7	29.3	0.855
PO cholecystectomy, %	10.7	8.4	14.1	0.079
Vitamins observance, %	52.2	50.5	55.6	0.395
Follow-up, y	2.1	1.9	2.4	< 0.001

Table 2: post-operative characteristics of patients treated by bariatric surgery

SG: sleeve gastrectomy ; RYGBP: Roux-en-Y gastric bypass ; SD: standard deviation ; OSAS: obstructive sleep apnea syndrome ; T2D: type 2 diabetes mellitus ; BMI: body mass index

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	Pre-operative		Post-operative (all)			Post-operative (without lost of view)			
	Weight (kg)	BMI (kg/m ²)	Weight (kg)	Weight loss (kg)	BMI (kg/m ²)	Weight (kg)	Weight loss (kg)	BMI (kg/m ²)	
All procedures	133.2	46.8	103.6	29.6	36.4	96.7	37	34	
RYGBP	120.3	43	90.9	29.3	32.5	83.1	37	29.8	
Sleeve	141.9	49.3	122.2	29.7	39	102.7	32.1	35.87	
Follow-up, y				2.1 [1.3 – 2.9]			2.3 [1.4 – 3.1]		

Table 3: follow-up of patients treated by bariatric surgery

SG: sleeve gastrectomy ; RYGBP: Roux-en-Y gastric bypass ; BMI: body mass index

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Complications	Total of patients (458)	SG (273)	RYGBP (185)
Grade 3a	0		
Grade 3b	7		
leaks requiring surgical revision		2	1
moderate strictures treated by endoscopy		2	
stricture at the gastrojejunal anastomosis			2
Grade 4	0		
Grade 5	0		

Table 4: post-operative complications of patients treated by bariatric surgery (complication classified as Clavien-Dindo ≥ 3).

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