Original Article

The impact of weight reduction following laparoscopic sleeve gastrectomy on thyroid-stimulating hormone level in obese patients with subclinical hypothyroidism: A 3-year retrospective study

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ABSTRACT

Background: The effect of weight-reducing surgeries on thyroid function in morbid obese patients was evaluated by several studies. However, because of the variability of the techniques and the degrees of hypothyroidism, their results were inconsistent. So, our aim in this study was to evaluate the effect of laparoscopic sleeve gastrectomy (LSG) on thyroid function in obese patients with subclinical hypothyroidism (SH) seeking weight reduction as it is considered the most common weight-reducing surgery performed and compare its results with malabsorptive procedures.

Patients and Methods: This is a retrospective study evaluating all obese patients that underwent different weight-reducing procedures with a preoperative diagnosis of SH from June 2020 to June 2023, evaluating the thyroid function in obese patients after surgery.

Results: One hundred thirty-four (9.3%) out of the 1450 morbidly obese patients that underwent LSG (82/813), Roux-en-Y gastric bypass (RYGB) (41/397) and mini-gastric bypass (MGB) (11/240) during the study period were found to have SH during the preoperative investigations. Hypothyroidism improved in 50 (60.9%) patients and completely resolved in 20 (24.3%) patients, while 11 (13.4%) patients experienced no improvement, and one (1.4%) patient developed overt hypothyroidism following LSG after 1 year of follow up. Hypothyroidism improved in 16 (39%) patients and completely resolved in 23 (56%) patients, while two (5%) patients experienced no improvement following RYGB after 1 year of follow-up. Hypothyroidism improved in four (36.3%) patients and completely resolved in six (54.5%) patients, while one (9.2%) patient experienced no improvement following MGB after 1 year of follow-up. The mean excess weight loss after 1 year of surgery was 43.7% after LSG, 49.2% after RYGB, and 50.1% after MGB.

Conclusion: Obesity itself has a significant impact on thyroid function, and different bariatric surgeries produce a significant improvement of SH.

Key Words: Bariatric, hypothyroidism, sleeve.

Received: 6 June 2024, **Accepted:** 9 July 2024, **Published:** 4 October 2024

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ISSN: 1110-1121, October 2024, Vol. 43, No. 4: 1501-1505, © The Egyptian Journal of Surgery

INTRODUCTION

Obesity is now presenting one of the most critical health issues, which is markedly associated with profound metabolic, cardiovascular, hormonal, psychological and musculoskeletal disorders. Bariatric surgeries now are not only aiming at effective weight reduction but also, to a great extent, raise attention towards its metabolic effect and its marvelous results in resolving obesity-related comorbidities, especially those three most commonly performed procedures worldwide, namely, sleeve gastrectomy, the classical Roux-en-Y gastric bypass (RYGB) and the one anastomosis gastric bypass or mini-gastric bypass (MGB)[1].

Although hypothyroidism is a global health problem that affects 0.5–5% of the world population and around a large percentage of morbid obese patients reaching up to 11%, have either overt or subclinical hypothyroidism (SH), most studies focused only on assessing the efficacy of bariatric surgeries in management of hypertension, type II diabetes mellitus or dyslipidemia and marginalize its effectiveness on endocrinological disorders especially overt or SH[2,3]. Obesity and hypothyroidism relationship is well established. Hypothyroidism is a well-known weight gain-associated endocrinal disorder that is explained by the lowered metabolic rate and thermogenesis in the body caused by defective thyroid gland secretion. However, recent studies confirmed that obesity itself can cause thyroid dysfunction.

A large meta-analysis including 22 different studies showed that obesity itself markedly increases the risk of hypothyroidism and is significantly correlated with high levels of thyroid peroxidase antibody. Also, the dose of levothyroxine needed postoperatively is reduced[4].

DOI: 10.21608/EJSUR.2024.295763.1095

Also, in another study of 93 morbid obese hypothyroid patients, Khan and colleagues observed that the dose of levothyroxine after bariatric surgeries was lowered in 55.8% of patients[5,6].

This study aimed at assessing the impact of bariatric surgery on morbidly obese patients with SH.

PATIENTS AND METHODS:

This is a retrospective study conducted at the General Surgery Department, Faculty of Medicine, Tanta University Hospitals, documenting the results of morbidly obese patients with SH that underwent different bariatric surgeries during the period from June 2020 to June 2023.

All adult obese patients (≥18 years) with a BMI more than or equal to 40 kg/m2 or with BMI more than or equal to 35 kg/m^2 in association with any other obesity-related comorbidity, with a preoperative diagnosis of SH that underwent either sleeve gastrectomy or bypass surgeries were included. Patients younger than 18 years of age and those with a history of thyroid cancer treatment or postthyroidectomy hypothyroidism were excluded from this study.

Study objectives

The primary endpoint of this study is to evaluate the effect of sleeve gastrectomy in contrast to other bypass surgeries regarding thyroid-stimulating hormone (TSH) levels and dose of levothyroxine supplement needed after surgery for the management of SH. The secondary endpoint is the assessment of weight reduction as excess weight loss (EWL) after surgery and correlating these data with the net effect on hypothyroidism.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package, version 20.0. (IBM Corp., Armonk, New York, USA). Categorical data were represented as numbers and percentages. The χ^2 test was applied to compare between two groups. Alternatively, the Monte Carlo correction and Fisher exact correction test were applied when more than 20% of the cells had an expected count of less than 5. For continuous data, they were tested for normality by the Kolmogorov–Smirnov Quantitative data were expressed as a range (minimum and maximum), mean, SD and median Student t test was used to compare two groups for normally distributed quantitative variables while. On the other hand, Mann–Whitney test was used to compare two groups for not normally distributed quantitative variables. The significance of the obtained results was judged at the 5% level.

RESULTS:

Our study included 1450 morbidly obese patients, out of which 134 (9.3%) were found to have SH during the preoperative investigations. Those 1450 patients were divided as follows: 813 underwent laparoscopic sleeve gastrectomy (LSG), out of which 82 had SH, 397 patients underwent RYGB, out of which 41 and 240 patients underwent MGB, out of which 11 had SH. The study population's demographic data are presented in (Table 1). The median age of the studied patients with SH was around 34 years. Most of them were females (70.89%). Diabetes mellitus was the most commonly presented comorbidity (12.68%).

The median preoperative TSH level was around 8 mU/l, while the median preoperative free T4 level was around 0.55 pmol/l. Meanwhile, the median postoperative TSH levels after 1 year of surgery were about 3.3 mU/l, and median postoperative free T4 levels were about 1.2 pmol/l. Regarding weight loss, the median EWL after 1 year of surgery was about 45.8%, and there was no statistically significant difference between the three types of surgery regarding weight loss as shown in (Table 2). There was a statistically significant decrease in postoperative TSH and a statistically significant rise in postoperative free T4 after 1 year of surgery, especially after MGB.

This postoperative improvement of the hypothyroidism status was reflected in the thyroid hormone replacement (THR) dose. Although LSG group had the highest percentage of patients who reduced their THR dose (60.9%), followed by the RYGB group (39%) then MGB (36.3%), the RYGB group had the highest percentage of patients who were off their THR dose (56%), followed by the MGB group (54.5 and 24.3%) for the LSG group which had the lowest percentage of patients who were off their THR dose with a statistically significant difference as shown in (Table 3).

Only one patient in the LSG group developed overt hypothyroidism and had to increase the THR dose (1.4%), while none of the patients in the MGB or RGB groups had an increased THR dose.

Table 1: Demographic data of the studied groups

	Sleeve gastrectomy (*N*=82)	RYGB (*N*=41)	MGB (*N*=11)	Test of significance	*P*
Age					
Mean±SD	35.7±7.2	34.4±6.41	32.3±6.1	*F*: 0.657	0.419
Median (minimum–maximum)	34.5 (24.0–51.0)	34.0 (23.0–51.0)	32.0 (22.0–50.0)		

Sex [*n* (%)]					
Male	27 (32.9)	9 (21.9)	3 (27.2)	χ^2: 1.618	0.446
Female	55 (67.1)	32 (78.1)	8 (72.8)		
Comorbidities [*n* (%)]					
No	64 (79.2)	29 (70.7)	7 (63.6)		
Asthmatic	3 (2.6)	3 (7.4)	0		
Diabetic	10 (12.2)	4 (9.7)	3 (27.2)	χ^2: 5.132	0.527
Hypertensive	5 (6.0)	5 (12.2)	1 (9.2)		
BMI					
Mean±SD	45.02±3.43	44.54±3.37	47.21±2.64	*F*:1.071	0.359
Median (minimum–maximum)	45.0 (40.0–50.0)	44.0 (40.0–50.0)	47.0 (40.0–50.0)		

MGB, mini-gastric bypass; RYGB, Roux-en-Y gastric bypass.
F: analysis of variance test.
χ^2, χ^2 test.
P: P value for comparing between the studied groups.

Table 2: Preoperative and postoperative data after 1 year

	Sleeve gastrectomy (*N*=82)	RYGB (*N*=41)	MGB (*N*=11)	*F* test	*P*
Pre-TSH					
Mean±SD	8.27±0.63	9.12±0.23	8.57±0.24	8.326	0.001*
Median (minimum–maximum)	7 (6.5–9.8)	9 (6–11.2)	8 (6.3–10.5)		
Pre-free T4					
Mean±SD	0.53±0.11	0.57±0.23	0.61±0.16	2.012	0.156
Median (minimum–maximum)	0.48 (0.2–0.7)	0.55 (0.25–0.8)	0.58 (0.35–0.77)		
Post-TSH					
Mean±SD	3.45±0.37	3.2±0.58	2.81±0.27	4.985	0.006*
Median (minimum–maximum)	3.4 (2.7–4.5)	3.3 (1.5–4.6)	2.8 (1.3–3.76)		
Post-free T4					
Mean±SD	1.03±0.34	1.15±0.24	1.46±0.21	5.184	0.001*
Median (minimum–maximum)	0.86 (0.4–1.8)	1.1 (0.9–1.4)	1.4 (1.1–1.6)		
EWL					
Mean±SD	44.2±12.79	46.1±7.62	49.2±13.19	1.635	0.317
Median (minimum–maximum)	43.69 (35.99–51.88)	45.8 (40.3–50.23)	48.56 (45.32–52.61)		

EWL, excess weight loss; MGB, mini-gastric bypass; RYGB, Roux-en-Y gastric bypass; TSH, thyroid-stimulating hormone.
*Statistical significance.

Table 3: Effect of different types of surgery on thyroid hormone replacement dose after 1 year

	Sleeve gastrectomy (*N*=82) [*n* (%)]	RYGB (*N*=41) [*n* (%)]	MGB (*N*=11) [*n* (%)]	χ^2	*P*
THR dose postoperative					
Off	20 (24.3)	23 (56)	6 (54.5)		
Same	11 (13.4)	2 (5)	1 (9.2)	14.238	0.027*
Reduced	50 (60.9)	16 (39)	4 (36.3)		
Increased	1 (1.4)	0	0		

MGB, mini-gastric bypass; RYGB, Roux-en-Y gastric bypass; THR, thyroid hormone replacement.
*Statistical significance.

DISCUSSION

Our study aim was to assess the effect of weight-reducing surgeries on SH in patients with morbid obesity. Our results showed that weight reduction, especially after malabsorptive surgeries had a significant impact on the thyroid function and replacement therapy needed. There was a statistically significant decrease in postoperative TSH after 1 year of surgery, which is consistent with the findings of Pedro *et al*.[7]. Also, Alfaifi *et al*.[8] reported a significant decrease in TSH levels after bariatric surgery.

In this study, there was statistically significant statistically significant rise in postoperative free T4 after 1 year of surgery. These data are consistent with the findings found by Cordido *et al*.[3], who reported a significant rise in free T4 levels after bariatric surgery. These changes demonstrate that the thyroid hormone metabolism is improved after bariatric surgery. The results are consistent with previous studies that reported similar findings. Garcia-Moreno *et al*.[9] reported that bariatric surgery improved hypothyroidism in 44.5% of patients, and the condition is completely resolved in 22.2% of patients.

Our results were also comparable with the results of the large meta-analysis published in 2019 that compares the effect of different bariatric surgeries on thyroid function and the dose of replacement therapy in patients with hypothyroidism, as our results showed a higher percentage of patients that stopped their levothyroxine dose, especially after MGB and RYGB[10].

The highest results concerning patients who reduced their dose of replacement therapy were following LSG, RYGB, and MGB. Garcia-Moreno *et al*.[9] reported nearly the same results following sleeve gastrectomy in the improvement of the thyroid function status. Also, Khan *et al*.[6] reported LSG to be the owner of the highest success rate regarding the reduction of the postoperative dose of levothyroxine. A higher incidence of complete replacement treatment abandonment was also recorded by Rudnicki *et al*.[2] after LSG. On the contrary, Azran *et al*.[10] documented that RYGB was the founder of the highest success rate in dose reduction among other bariatric surgeries. However, several other controlled clinical trials did not succeed in distinguishing the superiority of one procedure over the other like Garg *et al*.[11] and Fierabracci *et al*.[12].

Only one patient in the LSG group converted to overt hypothyroidism and had to increase the dose of the replacement therapy (1/134, 0.74%), which is consistent with Khan *et al*.[6], who reported that 4.3% of patients had to increase their THR doses after bariatric surgery. Although there was no statistically significant difference between the three types of surgery regarding weight loss, there was a significant weight loss after bariatric surgery documented by the high median EWL after 1 year of surgery, that was about 45.8%. This is consistent with the findings of Juiz-Valiña *et al*.[13], who also reported a mean EBMIL of 72.2% after bariatric surgery. Also, Khan *et al*.[6] reported the EWL postoperative as 58.9%.

CONCLUSION

All well-known bariatric surgeries, including both restrictive and malabsorptive procedures, have a significant impact on postoperative thyroid function and the THR dose in patients with preoperative diagnosis of SH. The type of surgery also affects results with still the high upper hand of the malabsorptive procedures.

CONFLICT OF INTEREST

There are no conflicts of interest.

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