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The Prevalence of Subclinical Hypothyroidism in the Obese Population and Effect Following Bariatric Surgery

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Abstract: Background: The purpose of our study was to analyze the clinical and biochemical characteristics of obese patients with subclinical hypothyroidism (SCH). The study pertains (shown) to the clinical efficacy of bariatric surgery on sub-clinical thyroid function in obese patients. Methods: A total of 130 obese patients (M=24, F=106) who underwent bariatric surgery in our hospital between June 2018 and December 2019 were considered for the study. These patients were further divided into two sub-groups: SCH (22 cases) & NSCH (108 cases). The thyroid hormones and their relevant metabolic indexes were then subsequently compared using a t-test. The effect of the bariatric surgery on the SCH group was then analyzed. Results: Among 130 cases, the prevalence of the SCH group was in 22 patients accounting for 16.92%. The prevalence of SCH with metabolic syndrome (MS) was in 13 patients accounting for 59.09%. The prevalence of NSCH with metabolic syndrome was seen in 30 cases accounting for 27.77%. Consequently, this indicates a significant disparity between these two groups ($P<0.05$). The SCH group patients were followed up for 12 months of surgery. The study showed that post-bariatric surgery the average TSH level (6.07±1.68IU/mL) had drastically dropped (2.88±0.56 IU/mL) indicating a staggering statistical improvement amongst the SCH group ($P<0.05$). Conclusion: The study showed that the obese patients associated with Subclinical hypothyroidism who underwent bariatric surgery saw a significant reduction and improvement in their TSH levels. The prevalence of subclinical hypothyroidism in the SCH group of obese patients was 16.92%. There was a higher MS occurrence rate amongst SCH patients. SCH could is a type of metabolic syndrome. Post-bariatric surgery has shown a significant decrease in TSH levels and acts as an effective treatment for SCH in obese patients.

Keywords: Subclinical Hypothyroidism, Bariatric Surgery, Metabolic Syndrome, Morbid Obesity, Laparoscopic Sleeve Gastrectomy

1. Introduction

Obesity is becoming a major health issue in 21st Century. [1-3] It's a preventable cause of morbidity mortality worldwide. [4] About 30% of the population, approximately 2.1 billion, are either obese or overweight. [5] Obesity is associated with comorbidities like subclinical hypothyroidism, types 2 diabetes, hyperlipidemia, sleep apnea, hypertension, polycystic ovarian syndrome, and coronary heart disease. [6, 7] Weight reduction bariatric surgeries are performed increasingly, with an estimated 344,000 such procedures worldwide in 2011. [8] Biliopancreatic diversions is the common procedure (92%), laparoscopy a preferable choice including laparoscopic Roux-en-Y gastric bypass (LRYGB)more common (47%) than laparoscopic adjustable gastric banding (LAGB) (42%) and sleeve gastrectomy (5%). [6]

Subclinical hypothyroidism (SCH) is the mild elevation of serum thyroid-stimulating hormone (TSH) with normal thyroxine (T4) and tri-iodothyronine (T3). [9] The SCH is seen in up to 10% and increases with weight to 14% in BMI of 30 - 40 kg/m^2, and to 25% in BMI>40 kg/m^2. [6] The SCH has no clear clinical symptoms and is difficult to find [1]. Hormone replacement in patients with increased TSH is still controversial but delay in treatment of SCH may escalate to typical hypothyroidism. Bariatric surgery is beneficial for SCH, hence this study was done to investigate SCH in obese patients and the outcome of bariatric surgery.

2. Method

A chart review of cases of bariatric surgery from June 2018 and December 2019 at shanghai southeast hospital, Tongji University, Shanghai, China. The study was approved by the Ethical Review Committee. Personal identifiers of patient data were not collected. The gender, BMI, thyroid function status (subclinical hypothyroidism and normal), Glycosylated Hemoglobin, lipid profile,

Inclusion criteria for laparoscopic sleeve gastrectomy (LSG) were BMI ≥ 28.0 kg/m^2 with or without metabolic syndrome after evaluation and counseling for lifestyle and risk of surgery. Patients with autoimmune thyroiditis, thyroid iodine excess, history of thyroid injury (surgery, radiation, iodine 131), and drugs such as amiodarone, lithium, alpha interferon were excluded.

Subclinical hypothyroidism [11] was based on the criteria of patients without symptoms of hypothyroidism but with elevated serum TSH>reference upper limit (0.27-4.2mmol/L); and, normal serum tri-iodothyronine (T3), thyroxine (T4), free T3 (FT3), and free T4 (FT4).

Postoperative complications and follow-up dates for 3, 6, and 12months were analyzed for BMI, fasting blood glucose, blood lipid level, thyroid function index. The SPSS 20 was used for statistical analysis, for mean and standard deviation, and the measurements were compared with T-test, P<0.05 considered statistically significant.

3. Result

A total of 130 cases successfully underwent LSG, 106 females and 24 males, mean age 29.4±6.8 years and mean BMI 33.3±4.2 kg/m^2. The SCH group had 22 patients, and NSCH 108, Table 1.

Table 1. *The preoperative comparison of age, weight, BMI, THS, blood sugar, and other parameters between the two groups.*

Research factor	NSCH group (N=108 cases)	SCH group (N=22 cases)	T	P-value
Age	29.64±7.6	29.4±6.5	-0.02	0.967
Weight (Kg)	92.35±13.42	100.5±16.40	1.618	0.901
BMI (Kg/m^2)	33.6±7.1	35.7±4.7	2.713	0.005
TSH	2.23±1.03	6.03±1.58	10.781	0.000
Blood sugar (mmol/L)	5.29±0.82	6.82±1.63	3.505	0.003
SBP	131.8±10.4	138.7±6.4	1.463	0.907
SDP	81.8±8.7	86.9±7.8	1.402	0.876
TGR	1.80±0.97	1.67±0.27	-0.388	0.688
TC	4.84±0.93	4.69±0.66	-0.696	0.519
HDL	4.94±0.94	1.2±0.32	0.242	0.810
LDL	3.45±0.34	3.38±0.82	-1.676	0.090

BMI=Body Mass Index, TSH=Thyroid Stimulating Hormone, SBP=Systolic Blood Pressure, DBP=Diastolic Blood Pressure, TGR=Triglyceride, TC=Total Cholesterol, HDL=High-Density Lipoprotein, LDL=Low-Density Lipoprotein
Note: SCH- subclinical hypothyroidism, NSCH- Non-subclinical hypothyroidism, T=t-test value, p<0.5 significant (in bold).

The operation time was 96.6±27.5 minutes, blood loss (55±13) ml, the post-operation liquid diet was tolerated on average 3.7±1.5 days.

Among SCH sub-group metabolic syndrome (MS) was 59.09%, and NSCH 27.77%, p<0.05.

There were no postoperative leakage and bleeding. The postoperative hospitalization 7.8±1.7 days. In-hospital mortality was nil. After 3 months of surgery, TSH levels decreased to normal ranges and continued to decline further during 12 months. The BMI and glucose index, triglyceride, and total cholesterol levels improved significantly after surgery, p<0.05), Table 2.

Table 2. *Weightloss after LSG and changes in metabolic parameters of TSH, Blood sugar, Lipid profile.*

Parameters	Pre-operative	Post-operative			T	p-value
		3 month	6 month	12 month		
TSH (IU/Ml))	6.07±1.68	3.66±0.44	2.95±0.68	2.88±0.56*	6.723	0.000
Weight (kg)	100.6±16.48	83.50±11.47	75.14±9.53	68.43±9.30*	6.360	0.000
BMI (kg/m^2)	35.95±4.71	29.94±3.58	26.97±3.15	24.50±2.69*	7.901	0.000
Blood sugar (mmol/L)	6.92±1.54	5.02±0.39	4.48±0.33	4.54±0.26*	5.731	0.000
Triglyceride	1.69±0.79	1.63±0.38	1.03±0.12	0.94±0.09*	3.553	0.001
Total cholesterol	4.76±0.77	4.18±0.49	2.86±0.63	2.47±0.58*	8.853	0.000

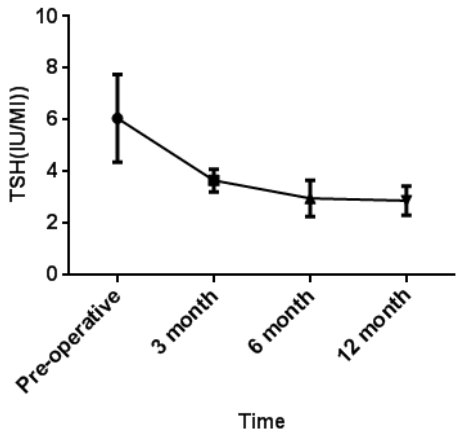

Figure 1. *Indicate significant changes in TSH levels during 12 months postoperative of SCH group data are reported as mean ± SD.*

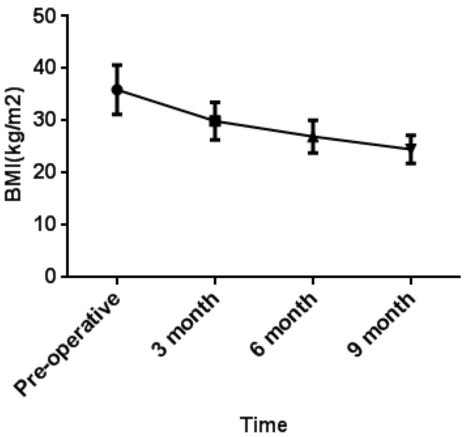

Figure 2. *Indicate significant changes in BMI levels during 12 months postoperative of SCH group data are reported as mean ± SD.*

4. Discussion

A decrease in thyroid hormone (T3, T4, FT3, FT4) synthesis or release disorders cause a rise in the thyroid-stimulating hormone (TSH). The high levels of TSH stimulate the thyroid gland to release thyroid hormones. The thyroid hormone levels in patients with SCH are within normal ranges and area common endocrine metabolic disorder seen in communities from 3% to 15%. [5, 6]

There is a strong relationship between obesity and subclinical hypothyroidism. Evaluation of 350 patients with morbid obesity revealed SCH in 13.7%. [14] Studies have confirmed that obesity has a positive correlation with serum TSH levels. [15] Among 4082 cases of obesity (BMI ≥ 23 kg/m^2) patient's serum TSH levels were directly proportional to BMI. [16] Long-term follow-up also found that there was a correlation between TSH and an increase in BMI. [17] The possible mechanism is increased leptin level in obese peoples which has a 'knock-on effect in increasing the TSH secretion. Thus is results in TSH secretion which is directly proportional to the leptin concentration and BMI levels [18, 19] The low inflammation state of obesity can lead to cytokines increase such as IL-6 and IL-l. These cytokines can inhibit the activity of iodine uptake by thyroid follicular cells and human thyroid cell sodium iodide symporter mRNA, and cause increased levels of TSH through compensatory mechanism. [20]

In the present study, among 130 cases of obese patients, subclinical hypothyroidism was seen in 16.92% (22/130). The level of TSH had significantly decreased within 3 months after receiving LSG. The level of TSH further decreased during the 12 months after the surgery, a positive influence of bariatric surgery in controlling the metabolic syndrome, and correction of hypothyroidism.

Thyroid hormones play an important role in the body's metabolism. [21] The impaired synthesis and release of the thyroid hormones directly affect lipid metabolism, blood glucose, and lead to a series of changes in metabolism. With the increase of TSH level, a variety of metabolic abnormalities are manifested as metabolic syndrome (MS), commonly seen in patients with SCH. [22] Bariatric surgery improves the metabolic rate by regulating gastrointestinal hormones, improving the environment of the intestinal flora, regulating bile acids, and fat absorption.

This study highlights that obese patients in the SCH group had increased metabolic syndrome compared to that of the NSCH group. Bariatric surgery's main aim is to treat metabolic syndrome, including a cure for SCH. Thus SCH appears to be a manifestation of a metabolic syndrome rather than an isolated entity.

5. Conclusion

The incidence of subclinical hypothyroidism SCH in the obese patient was the group was 16.92%. Bariatric surgery effectively reduced the TSH level in these patients and a cure for SCH in obese individuals.

Declarations

Competing Interests

The authors declare no conflict of interest, financial or otherwise.

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Author Contributions

We declare that all the listed authors have participated actively in the clinical study conducted in the bariatric and Metabolic Surgery, East Hospital, Tongji University School of Medicine. Prof. ZF designed the clinical study and arranged devices. RG, YY performed the research/study and wrote the manuscript. RG, PJ, accomplished the literature searches and analysis. RB and MC reviewed the manuscript. At the end of the study, all authors have read and approved the manuscript.

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