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Postoperative first-month biochemical parameters in laparoscopic sleeve gastrectomy patients

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ABSTRACT

Introduction: Sleeve gastrectomy (SG), which was first described as a part of the duodenal switch procedure, has become the most commonly used type of metabolic surgery in Turkey and the world. This study is an evaluation of the effects of SG surgery on the levels of glucose metabolism, liver enzymes, and thyroid hormones in the first postoperative month, according to age and gender.

Materials and Methods: A total of 124 consecutive patients who underwent SG at a single center between January 2018 and September 2019 were retrospectively evaluated for enrollment. The biochemical parameters of the patients measured at the first postoperative month were evaluated and any differences between female and male patients were analyzed.

Results: Twenty-five patients were excluded from the study due to insufficient data and the study was performed using the records of 99 patients. Of the group, 70 (70.7%) were female and 29 (29.3%) were male, with a mean age of 35.42±11.47 years (range: 18–68 years). Preoperative alanine aminotransferase (ALT), aspartate aminotransferase (AST), and gamma-glutamyl transferase (GGT) values were found to be significantly higher in male patients ($p<0.05$). No significant difference was observed between the male and female patients in terms of free-T4 and thyroid-stimulating hormone values, ($p>0.05$) whereas there was a significant difference between the genders in terms of free-T3 (fT3) thyroid hormone ($p<0.05$). There was no significant difference between the female and male patients in terms of glucose, glycated hemoglobin (HbA1c), or age.

Conclusion: SG was found not only to have mechanical effects but also to cause many metabolic changes. There are currently too few studies in the literature examining how these metabolic changes alter the biochemical parameters. According to the results of a small number of studies, SG significantly reduces body mass index, and the levels of AST, triglycerides, and HbA1c. The results of this study indicated that AST, ALT, GGT, and fT3 levels were higher in men after SG than in women.

Keywords: Biochemical parameters; laparoscopic sleeve gastrectomy; liver functions; morbid obesity; thyroid functions.

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Introduction

Obesity is defined as abnormal or excessive fat accumulation associated with serious health problems. Surgical treatment is currently the most effective treatment modality with the highest proven efficacy in the treatment of obesity. Obesity is associated with an increase in the number of comorbidities (e.g. type 2 diabetes, ischemic heart disease, and hypertension).

Sleeve gastrectomy (SG), which was first described as a part of the duodenal switch, has become the most commonly used metabolic surgery type both in Turkey and the world. It has been found that serum ghrelin hormone level decreased,[1] insulin secretion decreased[2] and glucagon-like peptide-1 (GLP-1) levels increased[3] in patients operated with this method. Metabolic changes after SG have not been fully elucidated yet.

In this study, patients who underwent consecutive SG were evaluated and the effects of surgery on glucose metabolism, liver enzymes and thyroid hormone levels in the first postoperative month were analyzed separately according to age and gender.

Materials and Methods

A total of 124 patients, who were operated consecutively in our clinic between January 2018 - September 2019, were retrospectively evaluated. Biochemical parameters of the patients at the first postoperative month were evaluated and it was investigated whether there was any difference between female and male patients in terms of the parameters. The data were obtained from computer records. Patients who lacked sufficient data were excluded from the study.

Statistical analysis was performed using SPSS version 20.0 software. Independent samples t-test or Mann Whitney U test were used for numerical values. Categorical data were analyzed by using the chi-square test. The numerical values were expressed as mean ± standard deviation (minimum - maximum values).

Results

Twenty-five patients were excluded from the study due to lack of data and the study continued with 99 patients. Of the patients, 70 (70.7%) were female and 29 (29.3%) were male with a mean age of 35.42±11.47 (18–68) years. Table 1 presents the laboratory findings of the patients.

Preoperative alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma-glutamyl transferase (GGT) values were found to be significantly higher in male patients ($p<0.05$). No significant difference was observed between the male and female patients in terms of free T4 and thyroid-stimulating hormone (TSH) values ($p>0.05$) whereas there was a significant difference between the genders in terms of free T3 from thyroid hormones ($p<0.05$). There was no difference between female and male patients in terms of glucose, HbA1c, and age (Table 2).

Discussion

Sleeve gastrectomy is a bariatric surgery technique, which involves the resection of fundus throughout the world,

Table 1. Biochemical test results of patients participating in the study

Parameters	Mean
HbA1c (%)	6.06±1.37 (4.9–12.4)
Glucose (mg/dL)	116.09±54.39 (68–478)
AST (U/L)	25.01±15.06 (12–123)
ALT (U/L)	33.08±27.97 (8–184)
GGT (U/L)	37.77±52.79 (6–465)
TSH (mIU/L)	1.88±2.73 (0.32–25.52)
Free T3 (ng/L)	3.63±0.61 (0.95–5.39)
Free T4 (ng/dL)	0.85±0.13 (0.44–1.23)

HbA1c: Hemoglobin A1C; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; GGT: Gamma-glutamyl transferase; TSH: Thyroid-stimulating hormone.

Table 2. Comparison of patient data according to gender

	Male	Female
Age	32.10±10.84	34.05±11.52
HbA1c (%)	5.93±1.67	5.59±2.07
Glucose (mg/dL)	111.30±37.61	118.07±60.11
AST (U/L)	29.11±11.26*	22.95±16.28
ALT (U/L)	44.51±24.64*	28.34±28.05
GGT (U/L)	43.52±41.17*	30.53±55.00
TSH (uIU/mL)	1.63±1.36	1.90±3.10
free T3 (pg/mL)	3.95±0.35*	3.24±0.70
free T4 (ng/dL)	0.88±0.14	0.79±0.19

*P<0.05. HbA1c: Hemoglobin A1C; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; GGT: Gamma-glutamyl transferase; TSH: Thyroid-stimulating hormone.

and is preferred in patients with comorbidities as it can be applied quickly, is a simple method and is associated with low morbidity rates.[4] Natural gastrointestinal integrity is preserved in SG and no malabsorption is seen. Furthermore, it can be converted to other bariatric surgical procedures if necessary.[5] Although bariatric surgery is the most commonly performed procedure at the present time, its side effects and long-term outcomes are not known well.

The mechanism of action of SG in weight loss does not depend solely on the restrictive mechanism. The removal of the gastric fundus during the operation was found to reduce the hormone level secreted by the fundus ghrelin[1] and insulin secretion through pancreatic beta-cell apoptosis.[2] It has been further seen to increase GLP-1 levels and insulin secretion, to reduce glucagon production and glucose production from the liver and to have, therefore, beneficial effects on glucose metabolism.[3] Sleeve gastrectomy has been understood to have not only mechanical effects but also to cause many metabolic changes. This has led to the necessity of examining a series of metabolic changes in the patient and laboratory results in the postoperative period.

It has been further shown that even if the body mass index (BMI) is the same, there are significant differences between women and men in terms of body fat metabolism.[6] An increase is known to occur in fecal excretion of unesterified fatty acids and bile acids due to SG.[7]

Non-alcoholic fatty liver disease develops as a result of excessive accumulation of triglycerides in the liver. The presence of liver cell damage and inflammation in addition to the accumulation of fat is defined as nonalcoholic steatohepatitis (NASH).[8] In a comprehensive systematic review on steatohepatitis, many studies in this area have reported that the incidence of steatohepatitis in men is higher than in women[9,10] and aminotransferase enzyme levels are also higher in men. However, the female gender has been suggested to be associated with steatohepatitis only in a few studies.[11–13]

In a study examining the relationship between liver fat and gender, the rate of steatohepatitis and serum AST, ALT and GGT levels were found to be higher in men than in women.[14] Considering these findings, it should be clarified what is the reason for the higher AST and ALT levels in male patients in the present study; whether it is a gender-based change or a metabolic differentiation triggered after SG.

Gender was found to be not an effective factor for free T3 and free T4 values in a study where the relationship between gender and these values was investigated.[15] The high levels of free T3 in male patients in the present study can be attributed to the metabolic processes triggered after SG.

With the acceleration of gastric emptying, nutrients reach the intestines quickly and the sense of satiety is achieved more quickly thanks to the neuroendocrine hormones secreted from here, and metabolism changes and re-regulates blood sugar and cholesterol levels.[16] In SG, the undigested food reaches the small intestine very quickly from the stomach and then, to the distal part of the small intestine. Undigested food that reaches the distal part of the small intestine stimulates the intestinal cells, causing GLP-1 and many other incretins to be released. Insulin resistance and glucose metabolism are regulated by these released hormones and incretins. It also stimulates insulin secretion from the pancreas.[17] In a study by Li et al.,[18] it was observed that lipid and glycogen content in the liver decreased and metabolic symptoms improved in obese mice undergoing SG. The possible cause of these changes has been thought to be the differentiation of hypothalamic neuronal populations.

In a study, where biochemical analysis of obese patients undergoing SG and non-surgical medical treatments was performed, pre- and post-operative biochemical analysis results of patients were compared and BMI, AST, ALT, triglyceride, and HgA1c levels were found to be statistically significantly lower in SG group than the group receiving non-surgical treatment, however, HDL levels of SG group was found to be significantly higher.[19]

In the literature, it has been suggested that deficiency in thyroid hormone secretion would lead to weight gain. Indeed, some weight gain has been observed in hypothyroid cases, however, less than 10% of individuals with obesity have hypothyroidism. This rate is much less in individuals with morbid obesity.[20] Thyroid hormones of such individuals are generally within normal limits, but a positive correlation has been observed between TSH and BMI. In studies, TSH was found to be slightly higher in obese individuals compared to individuals with normal weight.[21]

Similarly, in a study conducted in Turkey, TSH levels were found to be significantly higher in obese patients compared to the control group and free T3 levels in severe obesity patients were found to be higher than patients with mild to moderate obesity and control group.[22]

In a study, Nader et al.[23] examined 20 overweight and 30 obese children in terms of TSH levels and found no significant difference between the two groups in this regard. In the same study, the authors reported that there was no difference between the degree of obesity and TSH levels. Similarly, Mutlu et al.[24] found no significant difference between obese patients and the control group in terms of TSH and free T4 levels in their study.

In the present study, postoperative AST, ALT, GGT, and free T3 levels were found to be higher in men than in women. There is limited number of studies in this area and further studies are needed to identify metabolic changes in patients undergoing SG.

Disclosures

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

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