Original Article

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Preoperative and Postoperative (1st and 3rd Month) Metabolic Data of Patients Who Underwent Bariatric Surgery

Bariatrik Cerrahi Yapılan Hastalarımızın Preoperatif ve Postoperatif Metabolik Verileri (1. ve 3. Ay)

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Abstract

Purpose: The growing prevalence of obesity has become a major concern. The efficacy of medical treatment, diet and behavior therapy in morbidly obese patients is limited. Obesity surgery is a treatment option for selected morbidly obese patients.
Material and Method: Data of 47 patients (n=39 women, 8 men) who underwent bariatric surgery were investigated.
Results: Out of 47 patients, 20 underwent Roux-en-Y gastric bypass (RYGB) (43%) and 27 had sleeve gastrectomy (SG) (57%). The mean age of the patients was 37±9.5 (19-59) years. 17% of patients were men and 83% were women. In the analysis of data on weight that could be found for 31 out of 47 patients, we detected preoperative and postoperative (1st and 3rd month) mean weight values as 125.4±15.9 kg, 112.7±13.2 kg (p<0.001) and 100.9±17.5 kg (p<0.001), respectively. In addition, the analysis of the data on mean fasting plasma glucose (FPG) levels which could be found for 23 out of 47 patients, showed us that preoperative and postoperative (1st and 3rd month) FPG levels were 100.9±17.5 mg/dL, 91.6±10.9 mg/dL (p=0.03) and 87.3±2.0 mg/dL, respectively. Only 1 patient had diabetes before the surgery. In the RYGB group, the mean change in weight was 12.4±5.5 kg in the 1st month and 22.2±8.6 kg in the 3rd month (compared to the weights in the preoperative period). Moreover, in the SG group, the mean change in weight was 13.7±4.5 kg in the 1st month and 23.4±5.8 kg in the 3rd month. No statistically significant difference was found between the weight changes in the 1st and the 3rd month as for surgery types.
Discussion: After bariatric surgery, significant loss in weight and reduction in FPG occurred in short-term. *Turk Jem 2015; 19: 14-18*
Key words: Bariatric surgery, obesity, weight change

Conflicts of Interest: The authors reported no conflict of interest related to this article.

Özet

Amaç: Obezite prevalansı gittikçe artan önemli bir sağlık sorunu haline gelmiştir. Obezite için uygulanan tedavilerden; diyet, fiziksel aktivite, davranış terapisi ve kilo verdirici ilaçların etkinliği sınırlıdır. Obezite cerrahisi uygun hasta grubunda seçilebilecek bir yöntem olarak durmaktadır.
Gereç ve Yöntem: Ege Üniversitesi Obezite konseyimizde bariatrik cerrahi kararı alınmış toplam 47 hastaya (n=39 Kadın, n=8 Erkek) bariatrik cerrahi kararı alındı. Sleeve gastrektomi (SG) ve gastrik bypass (GB) olmak üzere iki farklı cerrahi uygulandı. Hastaların kilo değişimi uygulanan cerrahi tipine göre de karşılaştırıldı.
Bulgular: Toplam 47 hastanın 20'sine gastrik by-pass (%43), 27'sine (%57) sleeve gastrektomi uygulandı. Hastalarımızın ortalama yaşı 37±9,5 idi (19-59 y). Cerrahi uygulanan hastalarımızın %17'si erkek, %83'ü kadındı. Toplam 47 hastadan verisine ulaşılabilen 31 hastanın kilo verilerinin analizinde preop ortalama kilo değeri 125,4±15,9 kg iken postop 1. ay ortalama kilosu 112,7±13,2 kg (p<0,001), 3. ay postop ortalama kilosu 100,9±17,5 kg (p<0,001) olarak tespit edildi. Toplam 47 hastadan verisine ulaşılabilen 23 hastanın analizinde preop APG değeri ortalama 102,5±19,2 mg/dL, postop 1. ay APG 91,6±10,9 mg/dL (p=0,03), postop 3. ay APG 87,3±2,0 mg/dL idi. OGTT sonuçlarına göre; %82,1'inde normal glukoz toleransı, %12,8'inde bozulmuş glukoz toleransı, %5,1'inde DM saptandı. GB operasyonu olan grupta 1. ayda ortalama 12,4±5,5 kg, 3. ayda (preoperatif dönem kilosuna göre) ortalama 22,2±8,6 kg kilo değişimi gözlendi. SG olan hastalarımızda kilo değişimi postop 1. ay için 13,7±4,5 kg iken 3. ayda 23,4±5,8 kg olarak tespit edildi. Cerrahi tipine göre 1. ve 3. ay kilo değişimleri arasında anlamlı fark bulunmadı.
Tartışma: Bariatrik cerrahi sonrası yakın dönemde anlamlı kilo değişikliği olmaktadır. Açlık plazma glukozunda da anlamlı düşüş gözlenmiştir. *Turk Jem 2015; 19: 14-18*
Anahtar kelimeler: Bariatrik cerrahi, obezite, kilo değişimi

Çıkar Çatışması: Yazarlar bu makale ile ilgili olarak herhangi bir çıkar çatışması bildirmemiştir.

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Introduction

The increasing prevalence of obesity has become a major concern. Obesity is associated with chronic diseases and increased risk of morbidity and mortality. The risk of type 2 diabetes mellitus (DM) in obese patients is 5% for men and 8-20% for women (1). The efficacy of medical treatment, diet and lifestyle changes in morbidly obese patients is limited (2,3). Bariatric surgery is a treatment option for selected morbidly obese patients (2,3,4). Bariatric surgery is associated with long-term weight loss, cardiovascular improvement, reversed type 2 DM and better quality of life (5).

There are two commonly-used weight loss procedures. Laparoscopic Roux-en Y gastric bypass (RYGB) is considered as the gold standard procedure for its long-term weight loss and decreasing co-morbidity effects. However, it is technically difficult with a long learning curve and associated serious complications. On the contrary, laparoscopic sleeve gastrectomy (LSG) is relatively simpler with a shorter learning curve (6).

Possible mechanisms underlying the success of this surgical treatment are: gastric volume reduction, malabsorption, variations in the feeling of hunger and appetite due to the changes in hormones of the digestive system (1).

In this study, we present preoperative and postoperative (1st and 3rd month) metabolic data of the patients who underwent bariatric surgery according to the approval of a council composed of members from Ege University Faculty of Medicine, Departments of Endocrinology, General Surgery, Gastroenterology, Psychiatry and Pulmonary Diseases.

Materials and Methods

The data of 47 patients (39 women, 8 men) who underwent bariatric surgery were analyzed. Informed consents and ethical approval were obtained. The subjects either had Body mass index (BMI) of >40 kg/m^2 or >35 kg/m^2 with comorbid problems. The patients underwent either sleeve gastrectomy (SG) or RYGB. We assessed BMI, fasting glucose levels, HbA1c, fasting insulin, lipid profiles, liver function tests, vitamin B12, vitamin D, hemoglobin, iron parameters, thyroid function tests, preoperatively and postoperatively (1st and 3rd month). The weight changes in patients were compared in terms of the surgery types. For statistical analysis, IBM SPSS Statistics 21 program was used. Descriptive statistics were obtained for all variables. Analysis of variance (ANOVA) test (for normal distributed variables) for repeated measures was used to analyze preoperative, postoperative 1st month and 3rd month variables. A p value of less than 0.05 was considered statistically significant. If the difference between the 3 groups was significant, the Bonferroni correction was used for comparison of the two groups. Friedman's test was used if the variables were not normally distributed for repeated measure analysis. If a p value was <0.05, the difference was accepted as significant, and then, the Wilcoxon's signed-rank test was used for analysis of the two groups. Independent t-test was used to evaluate whether there was a significant difference in weight loss between the two surgery groups.

Results

Out of 47 patients, 20 underwent RYGB (43%) and 27 had SG (57%). The mean age of the subjects was 37±9.5 (19-59) years. 17% of patients were men and 83% were women. In the analysis of the data on weight that could be found for 31 out of 47 patients, we detected preoperative and postoperative (1st and 3rd month) mean weights as 125.4±15.9 kg, 112.7±13.2 kg (p<0.001) and 100.9±17.5 kg (p<0.001), respectively.

In addition, the analysis of mean fasting plasma glucose (FPG) levels which could be found for 23 out of 47 patients showed us that preoperative and postoperative (1st and 3rd month) FPG were 100.9±17.5 mg/dL, 91.6±10.9 mg/dL (p=0.03) and 87.3±2.0 mg/dL, respectively.

LDL level was 118.9 mg/dL, 99.8 mg/dL and 110.7 mg/dL preoperative and postoperative 1st and 3rd month, respectively. The decrease in LDL levels after operation was significant. There was no significant decrease in triglyceride levels in the postoperative follow-up period (Table 1).

Only 1 patient had DM before the surgery. Oral glucose tolerance test (OGTT) was performed in 39 patients. 82.1% of patients had normal glucose tolerance, 12.8% had impaired glucose tolerance and 5.1% had type 2 DM (Figure 1). Preoperative and postoperative (1st and 3rd month) weight and metabolic parameters of the patients are given in Table 1. In the RYGB group, the mean weight loss was 12.4±5.5 kg in the 1st month and 22.2±8.6 kg in the 3rd month (compared to the preoperative period weight). In the SG group, the mean weight loss was 13.7±4.5 kg in the 1st month and 23.4±5.8 kg in the 3rd month. No statistically significant difference was found between the weight changes in the 1st and the 3rd months according to surgery types (Figure 2). After the bariatric surgery, significant weight loss and reduction of FPG occurred in short-term (Figures 3, 4).

Reoperation was performed only in one patient because of the gastric fistula development. During this 3-month postoperative period, there was no other surgical complication.

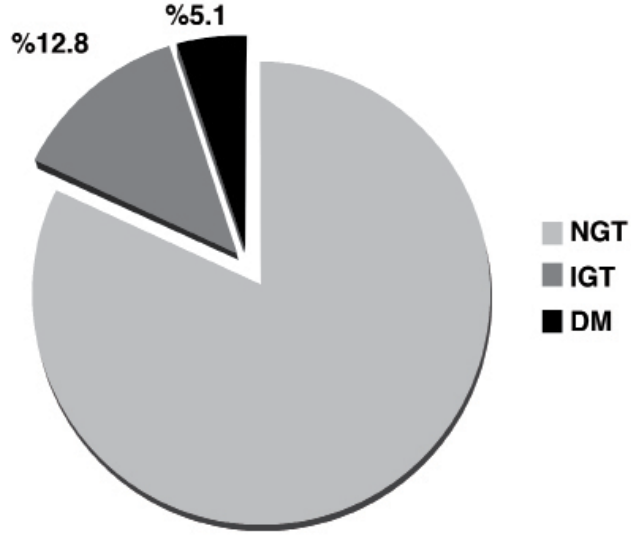

Figure 1. Preoperative OGTT data
OGTT: oral glucose tolerance test, NGT: normal glucose tolerance, IGT: impaired glucose tolerance, DM: diabetes mellitus

Discussion

Obesity has become a foremost health problem both in developing and developed countries. It may lead to comorbid problems, such as hypertension, diabetes, sleep apnea, heart failure, and malignancy (7). Obesity surgery is a treatment option for selected morbidly obese patients (2,3,4). Bariatric surgery is associated with long-term weight loss, cardiovascular improvement, reversed type 2 DM, and better quality of life (5).

RYGP is a commonly preferred surgical technique that reduces gastric volume and causes intestinal malabsorption (8,9). RYGB initially allows a weight loss of 30-40% which reaches to 60-75% in a year. This procedure provides reducing comorbid problems and improved life quality (9). In a study by Al-Sabah et al., SG, which is a safe and effective procedure in obesity treatment, was applied to 135 adolescent patients. In the first 6 months, more than 50% of patients lost weight (men 58.9%, women 52.7%). At the end of the year, the weight loss was over 70% (men 73.8%, women 78%) (10).

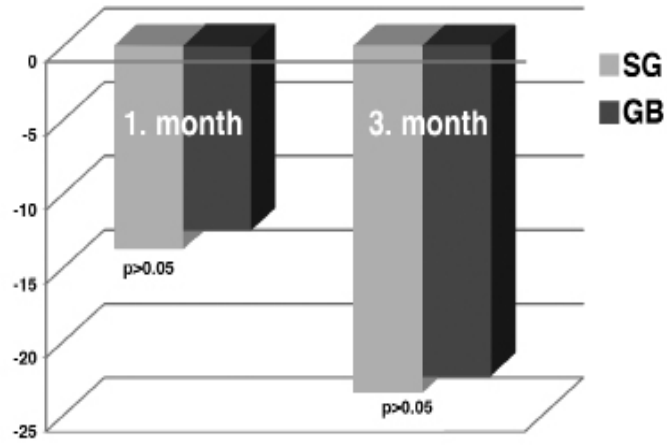

Figure 2. The mean change in weight according to surgery types
SG: sleeve gastrectomy GB: gastric bypass

Table 1. Preoperative and postoperative (1st and 3rd month) metabolic data of the patients

	Preoperative ***mean ± SD** ****median (min-max, IQR)**	**Postoperative 1st month** ***mean ± SD** ****median (min-max, IQR)**	**Postoperative 3rd month** ***mean ± SD** ****median (min-max, IQR)**
Weight (kg)	127.5±15.9 126.0 (98.0-169.0, 17.5)	114.3±13.6 115.0 (87.0-148.0, 17.8)	100.9±17.5 (82.0-138.0, 15.6)
FPG (mg/dL)	100.4±19.4 95.0 (78.0-175.0, 19.0)	91.1±11.2 90.0 (67.0-112.0, 8.5)	88.3±9.5 88.0 (67.0-112.0, 8.5)
Basal insulin (mIU/mL)	22.6±10.4 22.4 (3.7-46.3, 12.2)	13.6±10.7 9.8 (4.7-21.1, 6.0)	12.8±5.0 13.4 (4.7-21.1, 6.0)
ALT (U/L)	25.0±14.6 19.0 (5.0-71.0, 21.0)	36.7±31.5 27.0 (6.0-181.0 16.7)	19.3±8.0 19.0 (4.0-38.0, 6.75)
LDL (mg/dL)	118.9±29.3 118.0 (62.0-182.0, 51.0)	99.8±18.6 98.0 (63.0-142.0, 27.0)	110.7±23.7 11.0 (56.0-153.0, 34.0)
HDL (mg/dL)	48.5±13.6 47.0 (20.0-82.0, 18.0)	40.0±8.7 40.0 (25.0-59.0, 12.0)	44.2±15.7 43.0 (25.0-108.0 14.0)
TG (mg/dL)	123.1±54.9 113.0 (45.0-244.0, 80.0)	114.0±47.9 96.5 (54.0-268.0, 46.5)	118.9±49.2 114.0 (54.0-233.0, 62.0)
Hb (g/dL)	13.1±1.2 13.2 (10.9-15.8, 2.0)	13.0±1.2 12.9 (10.9-15.3, 1.6)	13.0±1.5 12.9 (10.3-15.9, 2.7)
Fe (microg/dL)	60.3±36.2 47.0 (20.0-148.0, 50)	55.2±19.5 59.0 (19.0-91.0, 29.0)	67.4±28.3 66.0 (22.0-125.0, 29.0)
Ferritin (ng/mL)	43.8±40.3 28.6 (5.0-158.6, 40.4)	66.2±48.9 48.9 (7.6-183.8, 53.0)	43.7±43.0 30.3 (2.9-205.0, 30.9)
B12 (pg/mL)	328.2±143.0 304.3 (57.6-797, 149.2)	461.2±278.7 422.9 (122.0-1485, 201.5)	345.3±211.3 274.0 (140-1126, 159)
fT4 (ng/dL)	1.17±0.16 1.1 (0.9-1.5, 0.2)	1.82±2.63 1.1 (0.8-10.9, 0.2)	1.10±0.11 1.0 (0.9-1.3, 0.1)
fT3 (pg/mL)	3.12±0.54 3.1 (1.1-4.2, 0.6)	2.8±0.57 2.7 (2.1-4.4, 0.7)	2.7±0.4 2.7 (1.8-3.7, 0.5)
TSH (microIU/mL)	2.16±1.06 1.99 (0.08-5.08, 1.4)	1.93±0.96 1.89 (0.09-3.49, 1.57)	1.36±1.44 0.95 (0.09-5.87, 1.18)

*mean ± SD, **median (min-max, IQR), FPG: fasting plasma glucose

SG basically decreases the amount of food intake by reducing the gastric volume. Furthermore, ghrelin hormone, which regulates eating, appetite, energy use and is released from the gastric part, is excised in SG. Ghrelin decreases after the surgery and this effect has been shown in all studies. Thus, this hormone is thought to be effective in weight loss (11,12). Out of 47 patients, 20 underwent RYGB (43%) and 27 had SG (57%). In the RYGB group, the mean change in weight was 12.4±5.5 kg in the 1st month and 22.2±8.6 kg in the 3rd month (compared to the preoperative period weight) (Table 1). In the SG group, the mean change in weight was 13.7±4.5 kg in the 1st month and 23.4±5.8 kg in the 3rd month. No statistically significant difference was found between the weight changes in the 1st and the 3rd month as for surgery types. These results were relevant with the literature. In the literature, the only Turkish study regarding bariatric surgery was performed by Taşkın et al. In this study, laparoscopic gastric banding was performed in 50 patients whose preoperative mean body weight and mean BMI were 135.8 kg and 50.4 kg/m^2, respectively. The weight change was 12 kg, 24 kg and 33 kg at postoperative 1st, 3rd and 6th months, respectively (13).

Bariatric surgery is accepted as an effective treatment option in type 2 DM. In a meta-analysis of 621 studies, RYGB was found to improve DM in 70-80% of patients (14). This beneficial effect in glucose metabolism is seen before significant weight loss in the early postoperative period. One of the mechanisms explaining glycemic control after RYGB is changes in gastrointestinal hormone levels (1). After gastric by-pass, absorption declines and food reaches to ileum faster leading to increased glucagon-like peptide 1 (GLP-1) secretion. GLP-1 normalizes glucose levels in diabetic patients regardless of weight. Postprandial hyperinsulinemia contributes to this mechanism (15).

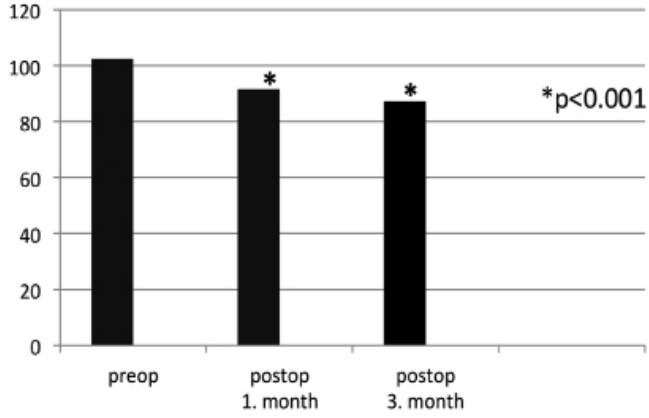

Figure 3. The changes in weight (*p<0.001)

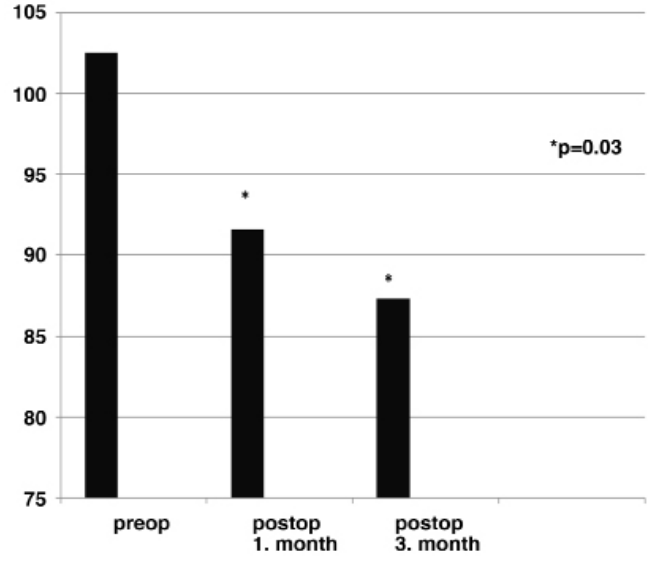

Figure 4. The changes in blood glucose

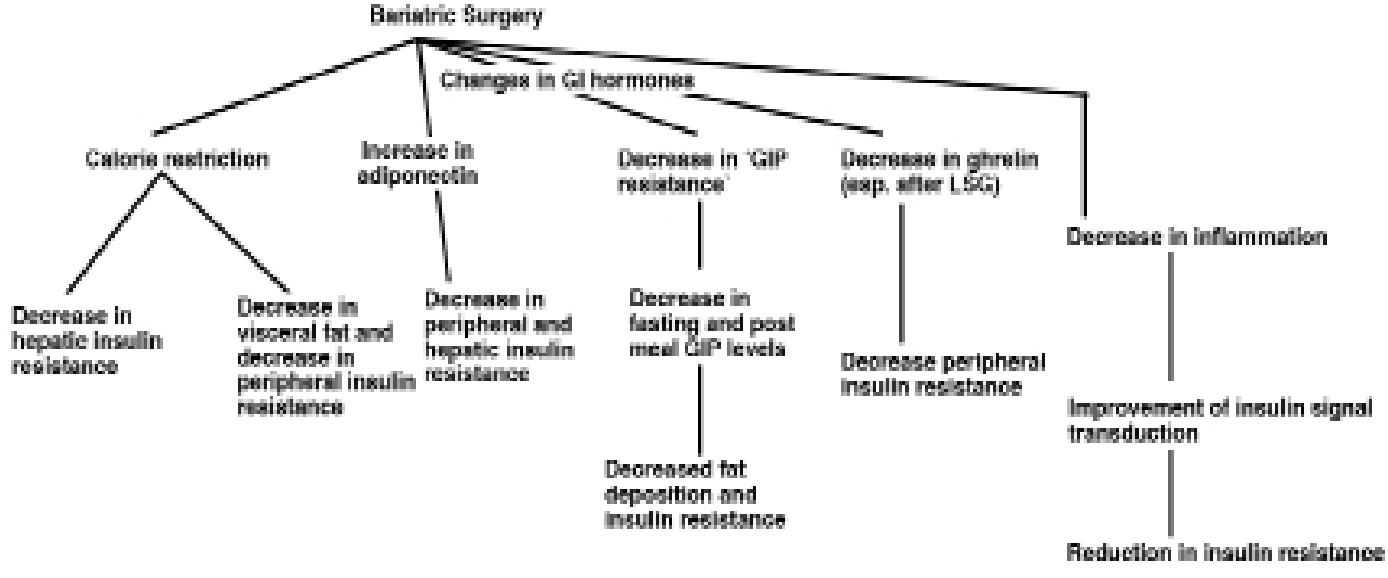

Figure 5. Insulin resistance after bariatric surgery (17)

In a meta-analysis of 27 studies including 673 cases followed for 13.1 months, Richdeep et al. found that 66.2% remission, 26.9% improvement and 13.1% stability were achieved in patients with DM by LSG (16). Responses to mixed-meal tolerance test were compared preoperatively and postoperatively (3rd and 12th months) and the effects of RYGB and SG on glucose metabolism and gastrointestinal hormones were proven. Both surgical procedures were found to be associated with early improvement of glucose metabolism. This improvement was achieved after 3 months, while the patients were still obese, and the glucose levels were at normal levels at the end of the year (1). The mechanism behind LSG and the improvement in type 2 DM has not been clearly explained.

However, there are some theories suggesting that both hormonal and hindgut changes are involved. According to hindgut theory, quick pass of undigested food to distal intestine causes GLP-1 and peptide YY to be released from L-cells. These mechanisms are thought to be factors underlying early improvement of DM after SG. FPG levels in our patients also had a decreasing trend even in their short follow-up period (Figure 4).

Bariatric surgery decreases adipose tissue, especially visceral adipose tissue. With this effect, the inflammations related to obesity are reduced. The changes in insulin resistance after bariatric surgery do not arise from merely weight loss (Figure 5). Hormones, such as GIP and ghrelin, are considered to have a role in these mechanisms (17). In our study, postoperative (1st and 3rd month) insulin levels were lower compared to preoperative levels (Table 1). In such a short period, although our patients were still obese, the reduction in their insulin levels suggests some factors other than weight loss.

In conclusion, bariatric surgery has proven to be an effective method to decrease FPG levels and insulin resistance and weight in morbidly obese patients in short follow-up period. These patients require long-term follow-up of weight, bone metabolism, vitamin and mineral deficiency.

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