

# The Effect of Different Energy Devices on Postoperative Complications in Laparoscopic Sleeve Gastrectomy

## Laparoskopik Sleeve Gastrektomide Farklı Enerji Cihazlarının Postoperatif Komplikasyonlara Etkisi

Gül BORA MAKAL

Yüksek İhtisas University Faculty of Medicine Department of General Surgery, Ankara

### Abstract

The aim of this study is to compare the perioperative results and complication rates of LigaSure™ and Harmonic® scalpel in patients undergoing laparoscopic sleeve gastrectomy (LSG). 152 morbidly obese patients who underwent LSG between March 2015 and April 2020 were included in the study. Intraoperative and postoperative 30-day complications were compared according to the type of energy device used. Comparisons were performed using Pearson's  $\chi^2$  or Fisher's exact test for categorical variables. Continuous data between two independent groups were analyzed using the Mann Whitney U test (nonparametric). Logistic regression analysis was performed to identify risk factors of postoperative complications. A p value less than 0.05 was considered statistically significant. A total of 136 patients were analyzed retrospectively. Statistical analysis did not differ between the two groups in intraoperative and postoperative complication rates (p=786 and p=0.966, respectively). Although the operation time was shorter in Ligasure™, there was no statistically significant difference (p=0.412). The determining factor in the development of postoperative complications was only body mass index (BMI) (OR = 1.08, p = 0.026). LigaSure™ and Harmonic® have no effect on the development of postoperative complications in LSG. The choice of device depends on the surgeon's personal skill and preference.

**Anahtar Kelimeler:** Energy Device, Harmonic®, Laparoscopic Sleeve Gastrectomy, Ligasure™, Postoperative Complication

### Öz

Bu çalışmanın amacı, laparoskopik sleeve gastrektomi (LSG) uygulanan hastalarda LigaSure™ ve Harmonic® el aletinin perioperatif sonuçlarını ve komplikasyon oranlarını karşılaştırmaktır. Mart 2015 ile Nisan 2020 arasında LSG uygulanan 152 morbid obez hasta çalışmaya dahil edildi. İntraoperatif ve postoperatif 30 günlük komplikasyonlar kullanılan enerji cihazı tipine göre karşılaştırıldı. Kategorik değişkenleri karşılaştırmak için Pearson's  $\chi^2$  ve Fisher's exact test kullanıldı. Sürekli verisi olan iki bağımsız grubu karşılaştırmak Mann-Whitney U testi (nonparametrik) kullanıldı. Postoperatif komplikasyonların risk faktörlerini belirlemek için Lojistik regresyon analizi yapıldı. 0.05 ten küçük p değeri istatistiksel olarak anlamlı kabul edildi. Totalde 136 hasta retrospektif olarak incelendi. İstatistiksel analiz iki grup arasında intraoperatif ve postoperatif komplikasyon oranlarında farklılık göstermedi (sırasıyla, p=786 ve p=0.966). Ligasure™ 'de operasyon süresi daha kısa olmasına rağmen, istatistiksel olarak anlamlı bir fark yoktu (p=0.412). Postoperatif komplikasyonların gelişmesinde belirleyici faktör sadece vücut kitle indeksi (VKİ) saptandı (OR = 1.08, p = 0.026). LigaSure™ ve Harmonic®'in LSG'de postoperatif komplikasyonların gelişimi üzerinde hiçbir etkisi yoktur. Cihaz seçimi cerrahın kişisel becerisine ve tercihinine bağlıdır.

**Keywords:** Enerji Cihazı, Harmonic®, Laparoskopik Sleeve Gastrektomi, Ligasure™, Postoperatif Komplikasyon

### Introduction

In recent years, obesity and related metabolic conditions have increased globally, and therefore the popularity of bariatric surgery has increased (1). Indeed, there are two types of surgical procedure in bariatric surgery: restrictive and malabsorptive. LSG is a restrictive, most preferred bariatric surgery due to it being more physiological and shorter learning curve, having similar results with gastric bypass in the weight loss and improvement in the comorbidities (2-5). Nevertheless, we know that some complications may appear in the perioperative period like any operation (2). Developing technology is for reducing these complications and increasing the success rate.

Basically, two types of energy devices are used in bariatric surgery: Electrothermal bipolar-activated devices (LigaSure™) or ultrasonic systems (Harmonic® scalpel). Both were improved for the purpose of rapid dissection and bleeding control and served to the utilization of surgeons. LigaSure™ (Valleylab, Boulder, CO, USA) denatures collagen and elastin of vessels and seals the vessels up to 7 mm using electrothermal energy. Harmonic Ace® (Ethicon Endo-Surgery, Inc.) uses ultrasonic vibration for coagulation and cutting the vessels. It produces minimal thermal injury (6).

The aim of this study is to compare the perioperative results and complication rates of LigaSure™ and Harmonic® scalpel in patients undergoing LSG.

### Materials and Methods

152 morbidly obese patients undergoing LSG between March 2015 and April 2020 were included in the study. Sixteen patients with an ASA score of 4 and above, incomplete information, and revision surgery were excluded and remaining 136 patients were analyzed retrospectively. This study was approved by Yüksek İhtisas University Faculty of Medicine Ethics Committee (code

ORCID No  
Gül BORA MAKAL 0000-0002-0474-5347

Başvuru Tarihi / Received: 03.07.2020  
Kabul Tarihi / Accepted : 25.07.2020

Adres / Correspondence : Gül BORA MAKAL  
Yüksek İhtisas University Faculty of Medicine Department of  
General Surgery, Ankara,  
e-posta / e-mail : gbor78@gmail.com

number:2020/05/04). Informed consent forms were obtained from each individual participating in the study. Patients were divided into two groups according to the energy device used. All demographic, histological, clinical, biochemical, and operative data were recorded from patient files. Intraoperative and postoperative 30-day complications were compared.

Preoperative period; patients were evaluated with upper gastrointestinal system endoscopy preoperatively. Low molecular weighted heparin (LMWH) was given a night before at 22:00 according to BMI (BMI<50 kg/m<sup>2</sup> 40 mg enoxaparin, BMI>50 kg/m<sup>2</sup> 60mg) for prophylaxis of thrombosis.

Surgical procedure; all operations were performed by GBM (same surgeon). The dissection of greater curvature was carried out from 2 cm away from the pylorus and terminated on the angle of His by using Ligasure™ and Harmonic®. Following the preparation of the greater curvature, a gastric sleeve was tailored using a 60mm linear stapler (Tri-staple™; Medtronic®, Minneapolis, MN, USA) and a 36 French bougie. Staple line was reinforced with oversewing (2.0 V-Loc™ suture, Medtronic®, Minneapolis, MN, USA) in both groups. A methylene blue test with 50 mL of saline solution was routinely performed to evaluate possible leaks. The stomach was extracted, and the drainage tube was positioned. Nasogastric tube was not inserted into the stomach after the operation.

Postoperative period; a possible leak was tested with upper gastrointestinal contrast studies. Oral intake was commenced with water. Patients were discharged on postoperative 4th day if no problems were observed.

Statistical analysis was performed with the Statistical Package for Social Sciences (Version 20.0 for Windows; SPSS Inc, Chicago, Ill, USA). The variables were investigated using visual (histograms, probability plots) and analytical methods (Kolmogorov-Smirnov test) to determine whether they are normally distributed. Categorical variables are presented as percentages or medians with ranges. Continuous variables are presented as mean and standard deviation (SD). Comparisons were performed using Pearson's  $\chi^2$  or Fisher's exact test for categorical variables. Continuous data between two independent groups were analyzed using the Mann Whitney U test (nonparametric). Logistic regression analysis was performed to identify risk factors of postoperative complications. A p value less than 0.05 was considered statistically significant.

## Results

A total of 136 patients with a median age of 38 (range, 16-69) years were included in the analysis. Demographic and clinical characteristics of the

patients are summarized in Table 1. 32 of them (23.5%) were men and 104 (76.5%) were women; 82 of them (60.2%) were operated using Ligasure™, and the other 54 (39.7%) were operated using Harmonic®. The most common complications in the intraoperative and postoperative period were omental injury and bleeding, respectively (Table 2).

**Table 1.** Characteristics of study population

	Ligasure™ (n=82)	Harmonic® (n=54)	P value
Age (median) (years)	38 (16-69)	39 (16-62)	0.285
Sex (F/M) (n)	64/18	40/14	0.498
BMI (median) (kg/m <sup>2</sup> )	40 (30-60)	41 (32-59)	0.017*
Length to stay (median) (days)	3 (3-6)	3	0.604
Operation time (median) (minute)	35 (25-40)	47 (40-55)	0.412
<i>Comorbidities</i>			
DM (n)	9	6	0.989
HT (n)	12	8	0.898
HL (n)	34	22	0.899
COPD (n)	3	1	0.193
Hepatosteato- sis (n)	8	24	0.000*
Intraoperative complication (n)	5	3	0.786
Postoperative complication (n)	8	5	0.966

BMI: Body mass index, DM: Diabetes mellitus, HT: Hypertension, HL: Hyperlipidemia, COPD: Chronic obstructive pulmonary disease \*: P value is statistically significant; Mann Whitney U test, Pearson's  $\chi^2$  test, Fisher's exact test

Statistical analysis showed no differences in terms of age, sex, length of stay, comorbidities (diabetes and hypertension, etc), and intraoperative and postoperative complications rates between the two groups (Table 1). Only the rate of hepatosteato- sis was significantly higher in patients operated with Harmonic® (Pearson's  $\chi^2$  test, p=0.000). A significant difference was only found in BMI (Mann Whitney U test, p=0.017). In logistic regression analysis, the determinant factor was only BMI on the development of postoperative complication (OR=1.08, p=0.026). Intraoperative bleeding caused by splenic or hepatic injury or stapling the stomach was observed in 8 patients. None of them required converting to open surgery. Intraoperative and postoperative complications are summarized for each group in Table 2. There was no significant evidence that there is difference between the groups in terms of complication rates (Fisher's exact test). Although operation time was shorter in Ligasure™, there was no statistically significant difference (Mann Whitney U test, p=0.412) between the two groups.

**Table 2.** Intraoperative and perioperative complications of the patients

	Ligasue™	Harmonic®	P value*
<i>Intraoperative complications (n)</i>			
Omental injury	3	1	0.678
Splenic injury	2	1	0.454
Hepatic injury	1	1	0.523
Bleeding from trocar hole	2	2	0.478
<i>Postoperative complications (n)</i>			
Bleeding	5	2	0.555
Splenic infarct/abscess	2	1	0.578
Intraabdominal abscess	0	1	0.249
Staple line leak	0	1	0.249
Pulmonary complications	3	2	0.600
Elevated liver transaminases	3	1	0.989
Reoperation	3	2	0.600
Others	3	1	0.989

\*: Fisher's exact test

## Discussion

Complications seen in laparoscopic sleeve gastrectomy depend on many factors such as the surgeon's experience, the particularity of the patient (comorbidities, drug usage, genetic background), technical infrastructure and the quality of the material used in the operation. All the developments in surgical experience are to reduce the complication rates. In addition to traditional surgical complications in LSG, the most feared complications are bleeding and leakage. In our study bleeding and omental injury are the most common complications observed.

Nowadays, bleeding is controlled with energy devices, electrocautery, clips, vascular staplers, and intracorporeal sutures. Electrocautery is an easy-to-use, but reliability is low due to unsatisfactory hemostasis. Also, it generates high heat in the surrounding tissue and may cause thermal injury especially on bowel wall. (7). Ligasure™ and Harmonic® are the most used energy devices in laparoscopic surgeries. In literature, many studies compared the effectiveness of Ligasure™ and Harmonic® in many different open surgical procedures (8, 9). In a study performed in colorectal surgeries, there was no difference between the duration of surgery in both devices, but bleeding was less in LigaSure™ (6). In another study, two devices were compared in laparoscopic appendectomy and no significant difference in terms of complications were found (10). In a study conducted on patients undergoing laparoscopic colorectal surgery by Rimonda et al., no significant

differences were observed between the two devices in terms of operation time and postoperative morbidity (11). In thyroid surgery, both devices are deemed to be safe, but LigaSure™ produces less heat than Harmonic® (12). These devices were compared in just a few studies for the postoperative outcomes after LSG. All of them emphasized that they are safe for LSG (13, 14). In our study we found similar results.

Although the vessel sealings of these devices were different at the beginning, there is no significant difference between the two devices now (7mm in LigaSure™ and 6mm in Harmonic®) (15, 16). Kırmızı et al. focused on the number of the desufflations due to smoking and found that it was less in Harmonic® (7). In our study, we could not measure the retrospectivity, but it may be related with excessive dissection.

To the best of our knowledge, this study involves the second largest series of patients undergoing LSG in which the differences between Harmonic® and LigaSure™ use were analyzed.

In conclusion, LigaSure™ and Harmonic® have no effect on the development of postoperative complications in LSG. We suggest that LigaSure™ and Harmonic® can be both used safely in bariatric surgery. The rate of complication depends on the surgeon's experience, not on the device. Device selection depends on the surgeon's personal skill and preference.

**Ethics Committee Approval:** Yüksek İhtisas University Faculty of Medicine Ethics Committee Permission was obtained with the letter dated:2020/05/04.

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