*Artur Binda, Adam Ciesielski, Paweł Jaworski, Wiesław Tarnowski

The impact of selected factors on intraoperative blood loss and operative time of laparoscopic sleeve gastrectomy

Wpływ wybranych czynników na śródoperacyjną utratę krwi i czas trwania laparoskopowej, rękawowej resekcji żołądka

Department of General, Oncological and Digestive Tract Surgery, Medical Centre of Postgraduate Education, Warszawa
Head of Department: prof. Wiesław Tarnowski, MD, PhD

Key words

sleeve gastrectomy, operative time, intraoperative blood loss

Słowa kluczowe

rękawowa resekcja żołądka, czas trwania operacji, śródoperacyjna utrata krwi

S u m m a r y

Introduction. Laparoscopic sleeve gastrectomy is one of the most commonly performed bariatric procedures. Despite the popularity of method, there still exist doubts as to the effect of the baseline characteristics of weight, sex of the patients undergoing surgeries and preoperative weight loss for the operative time and intraoperative blood loss.

Aim. The aim of the study was to evaluate the impact of initial body weight parameters, gender of patients, and preoperative weight loss on the operative time of the laparoscopic sleeve gastrectomy and intraoperative blood loss.

Material and methods. We have prospectively assessed data collected on 93 patients operated on due to morbid obesity in the period from January 2010 to April 2012. All of the patients underwent laparoscopic sleeve gastrectomy. In all cases, the staple line was reinforced with a continuous suture. The impact of gender of the surgical patients, weight loss before surgery, the initial weight and BMI on intraoperative blood loss and operative time were assessed.

Results. Laparoscopic sleeve gastrectomy was performed in 93 patients. In any case, there was no conversion. The mean duration of the surgery was 123.1 ± 33.2 min (range: 60-270). Intraoperative blood loss was an average of 46.3 ± 71.6 ml (range: 0-400). There was no significant effect of any of the assessed factors on the operative time and intraoperative blood loss.

Conclusions. Initial body mass index, weight, gender, weight loss before surgery do not have a material impact on the operative time of laparoscopic sleeve gastrectomy and intraoperative blood loss.

S t r e s z c z e n i e

Wstęp. Laparoskopowa, rękawowa resekcja żołądka jest jedną z najczęściej wykonywanych operacji bariatrycznych. Pomimo dużej popularności metody, istnieją wątpliwości co do wpływu wyjściowych parametrów masy ciała, płci operowanych pacjentów oraz przedoperacyjnej redukcji masy ciała na czas trwania operacji i śródoperacyjną utratę krwi.

Cel pracy. Celem pracy była ocena wpływu wyjściowych parametrów masy ciała, płci operowanych pacjentów oraz przedoperacyjnej redukcji masy ciała na czas trwania operacji i śródoperacyjną utratę krwi w trakcie laparoskopowej, rękawowej resekcji żołądka.

Materiał i metody. Ocenie poddano prospektywnie zbierane dane dotyczące 93 pacjentów operowanych w Klinice Chirurgii Ogólnej, Onkologicznej i Przewodu Pokarmowego CMKP z powodu otyłości chorobliwej w okresie od stycznia 2010 do kwietnia 2012 roku. U wszystkich pacjentów wykonano rękawową resekcję żołądka metodą laparoskopową. We wszystkich przypadkach linię zszywek wzmacniano szwem ciągłym. Oceniono wpływ płci operowanych pacjentów, spadku masy ciała przed operacją, wyjściowej wagi i BMI na śródoperacyjną utratę krwi i czas trwania operacji.

Wyniki. W ocenianym okresie rękawową resekcję żołądka metodą laparoskopową wykonano u 93 pacjentów. W żadnym przypadku nie doszło do konwersji. Średni czas trwania operacji wyniósł 123,1 ± 33,2 min (zakres: 60-270). Śródoperacyjna utrata krwi wyniosła średnio 46,3 ± 71,6 ml (zakres: 0-400). Nie odnotowano istotnego wpływu żadnego z ocenianych czynników na czas trwania operacji oraz na śródoperacyjną utratę krwi.

Wnioski. Wskaźnik masy ciała, waga, płeć operowanych pacjentów, spadek masy ciała przed operacją nie mają istotnego wpływu na czas trwania rękawowej resekcji żołądka i śródoperacyjną utratę krwi.

Address/adres:

*Artur Binda
Department of General,
Oncological and Digestive Tract Surgery
Medical Centre of Postgraduate Education
ul. Czerniakowska 231, 00-416 Warszawa
tel. +48 (22) 621-71-73, +48 (22) 584-11-36
fax +48 (22) 622-78-33
quiz0@interia.pl

INTRODUCTION

The operative time and intraoperative blood loss affect the outcomes and costs of bariatric procedures. Extension of the processing time increases the amount of drugs used for anesthesia and total cost of procedure. These costs may rise as a result of the need for blood transfu-

sions in the perioperative period. Prolonged surgeries for patients with high body weight increase the likelihood of rhabdomyolysis, with all its adverse consequences (1, 2). Identifying the factors affecting the duration of the surgery and intraoperative blood loss can contribute to improving the performance and reducing the cost of treatment. In recent years, this latter aspect is becoming increasingly important. Duration of a surgery and intraoperative blood loss can be affected by a variety of factors, such the baseline weight, the baseline body mass index or the gender of the patient operated on. Another important factor influencing both parameters is preoperative weight loss (3). Better exposure around the gastroesophageal junction and fundus, more comfortable operating conditions for the surgeon do not always translate, however, into shorter surgery time and less blood loss (4, 5).

AIM

The aim of the present study was to assess the influence of the initial body mass index, the body weight and the gender of patients undergoing surgeries and preoperative weight loss on the operative time of laparoscopic sleeve gastrectomy and intraoperative blood loss.

MATERIAL AND METHODS

We have assessed prospectively collected data on 93 patients who underwent laparoscopic sleeve gastrectomy in the period from January 2010 to April 2012. Patients were qualified for the surgery on the basis of generally accepted criteria: BMI 35-39.9 kg/m^2, with at least one comorbidity, or BMI $\geq$ 40 kg/m^2. The condition for the surgery was to express an informed, written consent for surgery and having no contraindications to surgery under general anesthesia. The influence of the selected parameters on intraoperative blood loss and operative time was assessed. The study design used to write the following paper was approved by the Bioethics Committee of Medical Center of Postgraduate Education in Warsaw in accordance with Resolution No. 51/PW/2011 dated 08.03.2011.

Surgical technique

Patients underwent a laparoscopically performed procedure in the reverse Trendelenburg position at an angle of 45^0 to the floor. The surgeon stood between the lower limbs of the patient, the assist on the right and the left side of the patient. Pneumoperitoneum, at a pressure of 12 to 15 mmHg, was prepared using the Veress needle. Five trocars technique were used. Using LigaSure (Covidien) or the harmonic scalpel SonoSurg (Olympus), the greater omentum was cut off from the greater curvature, releasing, if necessary, all the adhesions between the posterior wall of the stomach and the pancreas. Using the EchelonFlex (Ethicon Endo-Surgery) or EndoGia (Covidien) staplers, the stomach was cut and the resection began at 4-6 cm from the pylorus. The width of the sleeve was calibrated with a 36Fr gastric bougie. The staple line was in each case reinforced by means of a continuous suture (PDS 3-0 or Maxon 3-0). The leak test was carried out using methylene blue. Suction drain was left along the staple line. After the surgery, the gastric bougie was removed and no nasogastric tube was introduced.

The evaluation of the selected factors

Intraoperative blood loss was assessed basing on the volume of blood in the suction pump, in milliliters, at the end of the procedure. In the case where no suction pump was used during the surgery, intraoperative blood loss was assessed to be 0 milliliters. The operative time was counted from the introduction of the first trocar (optical) to the last skin stitch. The influence of the following factors on both of the parameters was assessed: the initial weight, the initial BMI, gender of patient, and weight loss in the preoperative period. The impact of the initial body weight was assessed in two groups of patients: with a body weight of less than 125 kg and weighing $\geq$ 125 kg (average weight for the whole analyzed group was rounded to the nearest whole). The impact of the initial BMI was assessed in two groups of patients: those with a BMI less below 44 kg/m^2 and BMI $\geq$ 44 kg/m^2 (mean BMI for the whole analyzed group was rounded up to a whole).

Statistical methods

Comparisons between the groups used the Student's t test. The analysis was performed using GraphPad Prism v.5.02 for Windows (GraphPad Software, San Diego California USA, www.graphpad.com). The value of $P < 0.05$ indicated statistically significant differences, while the P value in the range of 0.1-0.05 were considered to be trends.

RESULTS

We analyzed data collected on 93 patients (63 women, 30 men) who underwent the laparoscopic sleeve gastrectomy during the period from January 2010 to April 2012. The average age of the patients was 43.0 ± 10.2 (range: 17-62). The average weight for the entire group before the surgery was 124.9 ± 19.4 kg (range: 82-180), in the group of women 118.8 ± 15.1 kg (range: 82-151) and 137.6 ± 21.3 kg (range: 106-180), $p < 0.0001$, in the group of men. The mean BMI was 43.7 ± 5.1 kg/m^2 (range: 34.2-56.0), for women 43.9 ± 4.8 kg/m^2 (range: 34.8-54.9) for men 43.5 ± 5.6 kg/m^2 (range: 34.2-56), $p = 0.7395$. In four cases (4.3%), concomitant cholecystectomy was performed, due to symptomatic cholelithiasis, and in one case (1.08%) cruroplasty due to large hiatal hernia. The operative time was an average of 123.1 ± 33.2 min (range: 60-270). Intraoperative blood loss was an average of 46.3 ± 71. 6 ml (range: 0-400). No conversion was recorded.

Factors affecting the intraoperative blood loss

Intraoperative blood loss in patients with weight < 125 kg was 53.9 ± 80.6 ml (range: 0-400), while in the group of patients with weight $\geq$ 125 kg was 40.4 ± 58.3 ml (range: 0-250), $p = 0.3665$. Intraoperative blood loss in patients with BMI < 44 kg/m^2 was 39.4 ± 51.5 ml (range: 0-200), while in the group of pa-

tients with BMI ≥ 44 kg/m², 58.3 ± 89.7 ml (range: 0-400), p = 0.2061. This parameter, in the group of women, was 47.9 ± 76.9 ml (range: 0-400), in the group of men, it was 48.2 ± 59. 9 ml (range: 0-250), p = 0.9846. Intraoperative blood loss in patients without weight loss before the surgery was 55.1 ± 73.6 ml (range: 0-400), and in patients with weight loss before the surgery, it was 35.0 ± 66.8 ml (range: 0-350), p = 0.1969. The data are presented in table 1.

Factors affecting the operative time

The operative time in group of patients with body weight < 125 kg was 121.4 ± 33.3 min (range: 60-270), while in the case of patients with body weight ≥ 125 kg it was 125.1 ± 34.1 min (range: 80-240), p = 0.5986. This parameter, in the group of patients with BMI < 44 kg/m², was 119.6 ± 30.7 min (range: 60-240), and in the case of patients with BMI ≥ 44 kg/m², it was 127.3 ± 36.0 min (range: 80-270), p = 0.2711. Duration of the surgery in groups of women and men was 122.3 ± 35.0 min (range: 60-270) and 124.7 ± 29.7 min (range: 90-210), p = 0.7501. Operative time for patients without weight loss before surgery was 125.0 ± 36.0 min (range: 80-270), while in the group of patients with weight loss before surgery, it was 119.5 ± 27.5 min (range: 60-180), p = 0.4516. The results are shown in table 2.

DISCUSSION

In the present study, there was no significant effect of any of the evaluated factors on blood loss during surgery. Reports in the available literature on this subject are contradictory and mostly relate to Roux-en-Y gastric bypass (RYGB). Liu et al., have shown a beneficial effect of weight loss before surgery on the intraoperative blood loss during RYGB. In the group of patients with weight loss before surgery, blood loss was an average of 72.2 ± 40.7 ml, and in the case of patients without weight loss or with increase in body weight, it was 102.4 ± 65.4 ml (6). In the present study, blood loss in patients with weight loss was lower, but the difference was not statistically significant. Large fatty liver makes it difficult to view in the area in which the substantial part of the surgery takes place. The enlarged liver is also more exposed to injuries and bleeding. Technical difficulties caused by the enlargement of the liver in patients with morbid obesity are one of the most frequent causes of conversion during bariatric procedures (7). Excessive amounts of fat in the area of fundus of the stomach and the spleen may significantly impede omentum cut off from the greater curvature or the preparation in the region of the angle of His. Lack of good exposure can promote intensive bleeding from the spleen or the short gastric vessels. Weight loss before the surgery favorably affects surgeon's perceived difficulty of the operation the procedure (4, 5). Decrease in liver volume and intrahepatic fat content, better exposure, greater comfort of the surgeon are not always correlated with less blood lost during the surgery (5). Some papers do not exhibit the beneficial effect of pre-operative weight loss on the levels of blood loss (4, 5). In most our patients, the source of bleeding requiring the use of a suction pump were the short vessels in the area of the fundus. This was especially true of patients with large amounts of adipose tissue in this area and enlarged left lobe of the liver. The present study has not confirmed the adverse impact of higher weight, higher BMI and male sex on greater intraoperative blood loss, despite the subjective experience the impact of these factors on the degree of the difficulty of the procedure. There was no bleeding requiring blood transfusions or revised surgery. This may be for the routine staple line oversewing. The routine staple line oversewing will, however, prolong the surgery (8). It can also facilitate the narrowing of the formed sleeve. Some authors call into question the legitimacy of oversewing (9). Staple line is reinforced nearly by 79% of surgeons performing sleeve gastrectomy, 57% of this group use buttressing materials, and 43% oversew the staple line using a continuous suture (10). There is also no consensus in Poland as to how to strengthen the staple line. In some centers, the staple line is reinforced with a continuous suture (11-13). Some authors do not routinely strengthen the staple line with a continuous suture, using only hemostatic sutures in the case of staple line bleeding (14). In the case of using a buttressing material for the staple, it is strengthened with an absorbable polymer membrane integrated with a stapler cartridge or bovine pericardial strips. The aim is

Table 1. Impact of selected factors on the intraoperative blood loss.

	n	n	Mean ± SD	Range	Mean ± SD	Range	p
Weight < 125 kg vs. weight ≥ 125 kg	52	41	53.9 ± 80.6	0-400	40.4 ± 58.3	0-250	0.3665
BMI < 44 kg/m² vs. BMI ≥ 44 kg/m²	51	42	39.4 ± 51.5	0-200	58.3 ± 89.7	0-400	0.2061
Women vs. men	63	30	47.9 ± 76.9	0-400	48.2 ± 59.9	0-250	0.9846
Without weight loss vs. weight loss	60	33	55.1 ± 73.6	0-400	35.0 ± 66.8	0-350	0.1969

data are shown in milliliters

Table 2. Impact of selected factors on the operative time.

	n	n	Mean ± SD	Range	Mean ± SD	Range	p
Weight < 125 kg vs. weight ≥ 125 kg	52	41	121.4 ± 33.3	60-270	125.1 ± 33.4	80-240	0.5986
BMI < 44 kg/m² vs. BMI ≥ 44 kg/m²	51	42	119.6 ± 30.7	60-240	127.3 ± 36.0	80-270	0.2711
Women vs. men	63	30	122.3 ± 35.0	60-270	124.7 ± 29.7	90-210	0.7501
Without weight loss vs. weight loss	60	33	125.0 ± 36.0	80-270	119.5 ± 27.5	60-180	0.4516

data are shown in minutes

to reduce the risk of leakage or bleeding (15). Dapri et al. compared three ways to strengthen the staple line. The authors focused primarily on the impact of different methods of reinforcing the staple line on the operative time and intraoperative blood loss. It was found that strengthening the staple line using a buttressing material, Gore Seamguard, reduces intraoperative blood loss. No staple line reinforcement statistically decreases the total operative time. There were no statistically significant differences in the percentage of leakages in each group (9). The method of reinforcing the staple line during sleeve gastrectomy also affects the number of leaks. Gagner published an interesting paper on the subject. Rates of leakages, depending on the method used to strengthen the staple line, were at the following levels: absorbable polymer (Gore Seamguard) – 1.09%, continuous suturing – 2.4%, no strengthening – 2.6%, bovine pericardial strips – 3.3%. Differences of the other three methods, as compared to absorbable polymer, reached statistical significance. The average rate of leakage amounted to 2.14% (16). A prospective study comparing the use of Gore Seamguard and oversewing using PDS 2.0, major complications occurred only in the group in which an absorbable polymer was used. Two leakages (4.2%) were found in this group and one case of bleeding (2%). There were no such complications in the group which used PDS 2.0, but the differences did not reach statistical significance. Authors conclude that oversewing the staple line extends the duration of surgery but is less expensive than the use of an absorbable polymer (17). Other papers suggest a positive effect of bovine pericardial strips, as compared to continuous suturing of the staple line on decrease in the percentage of leakages after sleeve gastrectomy (18). In the case of bleeding from the staple line continued after oversewing, the present study assumed additional sutures or clips. It s a commonly accepted way of dealing with such a situation (14). It should be remembered that the source of bleeding outside the staple line can be the vessels from the omentum, the liver and the spleen and, prior to the removal of pneumoperitoneum, these places should be thoroughly checked. The present paper points out the quite long, average duration of the procedure, around 123 minutes. Due to the small number of patients, we have not assessed the impact of the learning curve for intraoperative blood loss and operative time. It is certainly a factor with great importance. Along with the acquired experience, the duration of the sleeve gastrectomy decreases and the surgery can be done completely without loss of blood. At the moment, operative time in patients operated on at the Department of General, Oncology, and Digestive Tract Surgery usually does not exceed 90 minutes. In most cases, weight loss before a bariatric surgery was correlated with shortened surgeries (3, 19-21). Not all authors confirm beneficial effects of weight loss on this parameter (6). In the present study, there was no significant effect of weight loss, although the operative time was shorter and intraoperative blood loss smaller in patients in whom there was a preoperative reduction in body weight. The operative time was shorter in patients with lower BMI and with lower weight but the differences were also not statistically significant.

CONCLUSIONS

Body mass index, weight, gender, weight loss before the surgery did not have a material impact on the operative time of the sleeve gastrectomy and intraoperative blood loss.

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