ORIGINAL PAPER

Nagoya J. Med. Sci. **80**. 21–28, 2018
doi:10.18999/nagjms.80.1.21

Obesity does not affect peri- and postoperative outcomes of transabdominal laparoscopic adrenalectomy

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ABSTRACT

Laparoscopic adrenalectomy is the gold standard procedure for most adrenal tumors. Obesity is considered as a risk factor for surgical complications. This study aimed to evaluate whether obesity affects peri- and postoperative outcomes of transabdominal laparoscopic adrenalectomy using body mass index (BMI). This retrospective study included 98 patients who underwent transabdominal laparoscopic adrenalectomy between January 2011 and December 2016. We divided the patients into 2 groups: non-obese group (BMI < 25 kg/m2) and obese group (BMI ≥ 25 kg/m2). We assessed perioperative outcomes and postoperative complications between the groups. A total of 98 patients were analyzed (70 without obesity and 28 with obesity). There were no significant differences between the non-obese and obese groups regarding operative time (111 vs 107 min; p = 0.795), blood loss (3.5 vs 3.5 ml; p = 0.740), rate of placement of additional trocars (14.3% vs 17.9%; p = 0.657), rate of open conversion (2.6% vs 3.6%; p = 0.853), and postoperative length of hospital stay (6 vs 5 days; p = 0.237). Furthermore, obesity was not a significant risk factor for postoperative complications (postoperative bleeding, wound infection, and pneumonia). There are no significant differences in peri- and postoperative outcomes of transabdominal laparoscopic adrenalectomy in patients with obesity compared with those without obesity. Transabdominal laparoscopic adrenalectomy is feasible and safe for patients with obesity.

Keywords: laparoscopic adrenalectomy, obesity, body mass index, surgical outcome

INTRODUCTION

Laparoscopic adrenalectomy was first introduced in 1992 by Gagner *et al*.[1)] and has become the standard procedure for benign adrenal tumors.[2-4)] The surgical outcomes of laparoscopic adrenalectomy for malignant tumors are equivalent to open surgery. The indication for laparoscopic adrenalectomy is also being expanded to some malignant tumors.[5,6)] The transabdominal and retroperitoneal approaches are used in surgical procedures for laparoscopic adrenalectomy. Both

Received: June 22, 2017; accepted: September 12, 2017

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approaches are considered to be equivalent in surgical outcomes.[3,7]

In recent years, the proportion of people with obesity has progressively increased worldwide. Body mass index (BMI) is widely used as a diagnostic marker for obesity. According to the National Health and Nutrition Survey conducted by the Ministry of Health, Labour and Welfare in Japan in 2014, the proportion of people with obesity (BMI ≥ 25 kg/m^2) was 28.7% for males and 21.3% for females. Obesity is considered to be one of the risk factors for surgical complications.[8-10] Whether obesity adversely affects surgical outcomes is controversial in laparoscopic surgery.[11-13] For laparoscopic adrenalectomy, several studies have reported the effect of obesity on surgical outcomes in which conclusions are inconsistent.[14-20] Therefore, whether obesity adversely affects surgical outcomes of transabdominal laparoscopic adrenalectomy remains unclear.

This study aimed to evaluate whether obesity affects peri- and postoperative outcomes of transabdominal laparoscopic adrenalectomy using BMI as a classifying index.

MATERIALS AND METHODS

Patients and data collection

We retrospectively reviewed data from 98 patients who underwent transabdominal laparoscopic adrenalectomy at Nagoya University Hospital between January 2011 and December 2016. BMI was used as an index of obesity. The obesity diagnostic criteria of The Japan Society for the Study of Obesity in 2011 defined obesity as BMI ≥ 25 kg/m^2. Accordingly, we divided the patients in this study into 2 groups: non-obese group (BMI < 25 kg/m^2) and obese group (BMI ≥ 25 kg/m^2). We assessed baseline characteristics (age, sex, tumor laterality, tumor size, clinical diagnosis, and comorbidity), perioperative outcomes (operative time, blood loss, rate of placement of additional trocars, rate of open conversion, and postoperative length of hospital stay), and postoperative complications. Postoperative complications included postoperative bleeding requiring reoperation, wound infection, and pneumonia requiring medical intervention within 30 days of surgery. Baseline characteristics, perioperative outcomes, and postoperative complications were compared between the non-obese group and the obese group. This retrospective study was approved by the Institutional Review Board and Ethics Committee of Nagoya University Hospital (approved protocol number: 2016-0520). The study was conducted in accordance with the principles of the Declaration of Helsinki.

Surgery

The indication for laparoscopic adrenalectomy in our hospital was based on the Practice Guideline on Endoscopic Surgery by the Japan Society for Endoscopic Surgery. Laparoscopic adrenalectomy was performed by a team including experienced surgeons for the laparoscopic procedure. We usually chose the transabdominal approach unless heavy intraperitoneal adhesion due to previous abdominal surgery was anticipated, and the laparoscopic surgery was performed in the lateral decubitus position. For right adrenalectomy (Fig. 1), a 12-mm trocar for the camera was first placed in a small incision on the right midclavicular line at a level above the umbilicus. Then, as working trocar, a 12-mm trocar was placed on the midpoint between a trocar for the camera and the midline of the body under the right rib and a 5-mm trocar was placed on the posterior axillary line under the right rib, respectively. For placement of a liver retractor, a 5-mm trocar was placed at the midpoint between the xiphoid process and umbilicus. The right lobe of the liver was detached by completely dividing the right triangular ligament to the level of the diaphragm. The adrenal gland was detached from the kidney. The right border of the inferior vena cava was dissected from the adrenal gland and the right adrenal vein was

identified. The right adrenal vein was doubly clipped and cut. The adrenal gland was taken out using a polyurethane pouch. A 19-Fr drain was placed on the bottom of the liver. For left adrenalectomy (Fig. 2), a 12-mm trocar for the camera was first placed in a small incision on the left midclavicular line at a level above the umbilicus. Then, as working trocar, a 12-mm trocar

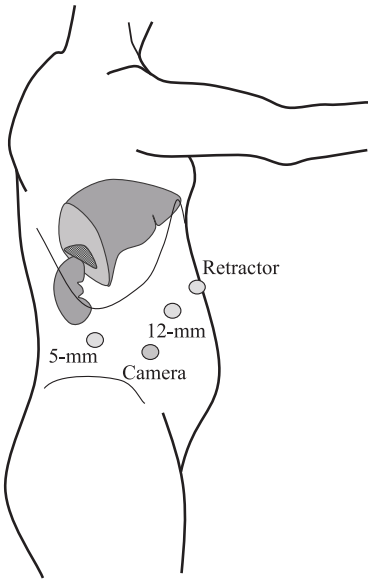

Fig. 1 Trocar placement for right adrenalectomy. The adrenal gland is illustrated by the darker-shaded area.

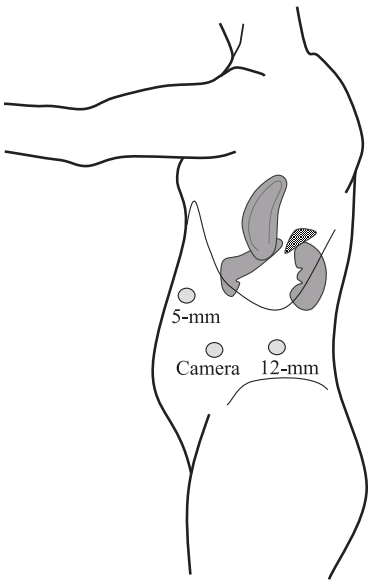

Fig. 2 Trocar placement for left adrenalectomy. The adrenal gland is illustrated by the darker-shaded area.

was placed on the posterior axillary line under the right rib and a 5-mm trocar was placed on the midpoint between a trocar for the camera and the midline of the body under the left rib, respectively. The splenocolic ligament was dissected and the colon was detached to the caudal side. The retroperitoneum outside the spleen was dissected, and the spleen and pancreatic tail were rotated medially. The adrenal gland was detached from the kidney and the left adrenal vein was identified. The left adrenal vein was doubly clipped and cut. The adrenal gland was taken out using a polyurethane pouch. A 19-Fr drain was placed under the left diaphragm.

Statistical analysis

The data are expressed as median (range) or number (%). Differences between parameters were compared with the chi-square test and Mann–Whitney test. A p value of < 0.05 was considered statistically significant. Linear regression analysis and logistic regression analysis were performed to determine whether the patients' characteristics correlated with the peri- and postoperative outcomes.

RESULTS

The patients' characteristics of both groups are shown in Table 1. The median age of the patients was 55 years (range, 17–77 years). There were 41 (41.8%) men and 57 (58.2%) women.

Table 1 Patients' characteristics

Variables	BMI < 25 kg/m^2 (N = 70)	BMI ≥ 25 kg/m^2 (N = 28)	P value
Age (years)	57 (24–77)	44 (17–73)	0.030
Sex			0.300
Male	27 (38.6%)	14 (50.0%)	
Female	43 (61.4%)	14 (50.0%)	
BMI (kg/m^2)	21.5 (14.7–24.9)	26.4 (25.0–34.5)	<0.001
Tumor laterality			0.415
Right	26 (37.1%)	12 (42.9%)	
Left	44 (62.9%)	16 (57.1%)	
Tumor size (mm)	30 (12–60)	24 (0–57)	0.022
Clinical diagnosis			0.422
Primary aldosteronism	15	11	
Pheochromocytoma	20	9	
Preclinical Cushing's syndrome	12	2	
Cushing's syndrome	10	2	
Metastatic adrenal tumor	6	2	
Nonfunctional adrenal tumor	7	2	
Comorbidity			
Diabetes mellitus	8 (11.4%)	7 (25.0%)	0.092
Hypertension	40 (57.1%)	18 (64.3%)	0.516

Data are expressed as the median (range) or number (%).
BMI, body mass index.

Table 2 Peri- and postoperative outcomes

Variables	BMI < 25 kg/m^2 (N = 70)	BMI ≥ 25 kg/m^2 (N = 28)	P value
Operative time (min)	111 (65–295)	107 (66–212)	0.795
Blood loss (ml)	3.5 (0–428)	3.5 (0–444)	0.740
Placement of additional trocars	10 (14.3%)	5 (17.9%)	0.657
Open conversion	2 (2.6%)	1 (3.6%)	0.853
Postoperative length of hospital stay (days)	6 (2–21)	5 (3–21)	0.237
Postoperative complications			
Postoperative bleeding	0 (0%)	1 (3.6%)	0.112
Wound infection	1 (1.4%)	0 (0%)	0.525
Pneumonia	1 (1.4%)	0 (0%)	0.525

Data are expressed as the median (range) or number (%).
BMI, body mass index.

There were 70 (71.4%) patients in the non-obese group and 28 (28.6%) patients in the obese group. Patients in the non-obese group were significantly older (p = 0.030) and had larger tumors (p = 0.022) than did those in the obese group. There were no significant differences in sex, tumor laterality, clinical diagnosis, and comorbidity between the groups.

The peri- and postoperative outcomes are shown in Table 2. There were no significant differences in operative time, blood loss, and postoperative length of hospital stay between the non-obese and obese groups. Obesity did not significantly affect the rate of placement of additional trocars for acquisition of a good surgical field. With regard to the rate of open conversion, 2 patients in the non-obese group and 1 in the obese group were converted to the open procedure, but there was no significant difference in this rate between the groups. The pathological diagnosis of all 3 patients who underwent open conversion was pheochromocytoma. The reasons for open conversion were uncontrollable bleeding from the inferior vena cava or adrenal gland, and difficulty of manipulation due to anatomical abnormality of the adrenal vein. Obesity did not affect the rate of postoperative complications. Postoperative bleeding requiring reoperation was observed in 1 patient in the obese group whose tumor was nonfunctional. Postoperative wound infection and pneumonia were routinely treated with antibiotics and/or drainage. Multivariate analysis was performed with covariates of age and tumor size, showing a significant difference (Table 1), but did not significantly affect operative time (p = 0.277), blood loss (p = 0.420), postoperative length of hospital stay (p = 0.423), placement of additional trocars (p = 0.834), and open conversion (p = 0.389).

DISCUSSION

In our study, the safety of laparoscopic surgery for the adrenal glands in obese patients was shown by equivalent perioperative outcomes and postoperative complications to those in patients without obesity. Obesity is generally considered as a major factor for prolonged operative time, an increase in blood loss, wound infection, and septic complications.[21–23] Especially in open surgery, a large amount of adipose tissue impairs acquisition of a good surgical field, prolonging the operative time and increasing blood loss.[24,25] For acquisition of a good surgical field in

patients with obesity, a large surgical wound is usually required in open surgery. As a result, these patients are restricted to bed because of postoperative pain for a long period. These factors enhance the likelihood of atelectasis and pneumonia.[15,26] Obesity also increases the risk of wound infection because adipose tissue is relatively hypoperfused and tends to be poorly oxygenated.[27] A worse perioperative outcome and increase in postoperative complications significantly cause a prolonged postoperative hospital stay.[18]

The adrenal glands are located deep in the abdominal cavity and are surrounded by adipose tissue, even in people without obesity. Excessive adipose tissue in patients with obesity makes it more difficult to identify the adrenal glands and to safely perform adrenalectomy.[17] Therefore, in the case of surgery for the adrenal glands, obesity is a more important factor for acquisition of a good surgical field than in surgery for other organs.

In our surgical procedure, the size of the surgical wound in patients with obesity was comparable with that in patients without obesity. Therefore, wound pain could be minimized, and even patients with obesity were allowed to begin ambulation at almost the same time as those without obesity. Therefore, obesity might not adversely affect infectious complications and the postoperative stay in the case of laparoscopic adrenalectomy. On the other hand, some studies of laparoscopic adrenalectomy reported that the frequency of postoperative complications, especially infectious complications, significantly increased, and postoperative hospital stay was significantly longer in obese patients.[14,16,18] This may have occurred as a result of decreased functional reserve, an impaired immune system, and delayed ambulation in obese patients.[16]

The difficulty to obtain good visualization of a surgical field in obese patients during laparoscopic adrenalectomy was reported to result in a significantly longer operative time.[15,17,18] In our surgical procedure, we usually place additional trocar(s) when we have difficulty in acquiring a good surgical field. However, the rate of placement of additional trocars for laparoscopic adrenalectomy did not significantly increase, even in patients with obesity, in this series. Therefore, for acquisition of a good surgical field for laparoscopic adrenalectomy, obesity is considered to have no adverse effects. Accordingly, the operative time and blood loss were not significantly affected by obesity in our study. There was also no significant difference in the rate of open conversion, which is mainly affected by blood loss and following poor exposure,[28,29] between the 2 groups. Furthermore, introduction of energy devices (e.g., HARMONIC®, SonoSurg®) may minimize the difficulty of hemostasis in heavy adipose tissue. A further factor that affects surgical outcomes is the skill and proficiency of surgeons.[17,20] We perform the laparoscopic surgery by a team including experienced surgeons, and standardize and unify the surgical procedures.

Our study has several limitations. First, this study was a single-center, retrospective design. Second, the obesity diagnostic criteria of the World Health Organization (WHO) defined obesity as BMI ≥ 30 kg/m^2, and past studies have used this classification.[14–20] Applying WHO criteria the proportion of people with obesity (BMI ≥ 30 kg/m^2) in Japan is 3 %, and only 4.1 % (4 cases) in our study. Therefore, in our study we classified obesity using the diagnostic criteria of The Japan Society for the Study of Obesity. Third, among the main procedures for laparoscopic adrenalectomy, including the transabdominal and retroperitoneal approaches, we did not analyze the retroperitoneal approach. Several studies have indicated the effect of obesity on surgical outcomes in the retroperitoneal approach.[17,18] Fourth, although BMI is the most widely used measure for obesity, several studies have suggested that computed tomography can more accurately evaluate visceral fat[30,31] and predict surgical outcomes compared with BMI.[32,33]

In conclusion, perioperative outcomes and postoperative complications for transabdominal laparoscopic adrenalectomy in patients with obesity are similar compared with patients without obesity. Transabdominal laparoscopic adrenalectomy is feasible and safe for patients with obesity.

CONFLICT OF INTEREST

Takahiro Inaishi and the other co-authors have no conflict of interest.

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