

Feasibility and Safety of Clipless and Sutureless Laparoscopic Adrenalectomy: A 7-Year Single Center Experience

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Purpose: Laparoscopic adrenalectomy (LAD) is considered the gold standard surgical method for resecting adrenal tumors. To date, only few small studies have investigated the safety of clipless laparoscopic adrenalectomy in which the adrenal vessels were controlled by the LigaSure system or bipolar coagulation. The aim of the present study was to evaluate the safety and feasibility of sutureless and clipless laparoscopic adrenalectomy operations performed in our center.

Materials and Methods: All patients with functional adrenal tumors, nonfunctional adrenal tumors larger than 5 cm and secondary adrenal metastases from the kidneys, lungs or breasts who had undergone an LAD procedure between 2012 to 2019 were included in our study. In all of the cases, complete coagulation of adrenal veins was achieved through bipolar cautery and no vascular staplers, clips or other energy sources were used for controlling the adrenal vessels whatsoever. Outcomes of interest included operation time, length of hospital stay, changes of serum hemoglobin level, and occurrence of major complications.

Results: Of a total 251 patients, unilateral right and left-side adrenalectomy was performed in 168 and 67 cases, respectively, and 16 cases had undergone bilateral adrenal resection. The mean age (SD) of patients was 40.7 (13.6) years old at the time of operation and the mean size (SD) of the adrenal lesions was 5.2 (3.1) cm as measured by the greatest diameter. Histological examination showed that the most common pathology of the resected adrenal glands was pheochromocytoma (n=78). None of the laparoscopic operations required a conversion to open surgery. Also, major bleeding or other serious complications did not occur in any of the cases either intraoperatively or postoperatively.

Conclusion: Clipless and sutureless laparoscopic adrenalectomy seems to be feasible and safe for removing adrenal tumors. Moreover, bipolar cautery is associated with an acceptable outcome for vessel closure.

Keywords: laparoscopic adrenalectomy; clipless; sutureless; laparoscopy; adrenal tumors, adrenalectomy

INTRODUCTION

Adrenalectomy is the treatment of choice for most of the malignant and benign tumors of the adrenal. Gagner and his colleagues performed the very first successful laparoscopic adrenalectomy (LAD) surgery in 1992⁽¹⁾. Subsequently, LAD became the gold standard surgical technique for removing adrenal tumors of up to 8-11 cm at many specialized medical centers worldwide⁽²⁾. In the recent years, many attempts have been made to improve the technical aspects of this procedure and also to reduce the surgical morbidities associated with it. To date, only a few small sample-sized studies have reported the safety of clipless laparoscopic adrenalectomy in which the adrenal vessels were closed by the LigaSure system and bipolar coagulation^(3,4). In this study, we report our experience with 267 cases of clipless and sutureless transperitoneal laparoscopic adrenalectomy in terms of safety and surgical outcomes.

MATERIALS AND METHODS

In this retrospective study, we evaluated the efficacy and safety of 267 clipless and sutureless transperitoneal LAD operations performed in 251 patients from January 2012 to March 2019. All patients with functional adrenal tumors, nonfunctional adrenal tumors larger than 5 cm and secondary adrenal metastases from the kidneys, lungs or breasts were selected for this procedure. Unilateral right-side and left-side adrenalectomy was performed in 168 and 67 patients, respectively, and 16 patients had undergone bilateral resection. Selected patients underwent physical examination along with metabolic and hormonal assessment. Imaging studies including computed tomography scan (CT-scan) or magnetic resonance imaging (MRI) were used based on each patient's specific clinical status. Patients with pheochromocytoma were admitted at least one week prior to surgery for adequate alpha blockade with oral phenoxybenzamine. All cases underwent LAD via a transperitoneal approach. The operation was performed under general anesthesia with patients placed

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Table 1. Etiology of the adrenal lesions after histopathological examination (n=267)

Pathology of adrenal tumor	Total number (%)	Left-side (n)	Right-side (n)
Pheochromocytoma	78 (29.2%)	30	48
Conn's adenoma (hyperaldosteronism)	45 (16.8%)	11	34
Adrenocortical hyperplasia	44 (16.5%)	11	33
Non-functional adenoma	37 (13.8%)	8	29
Myelolipoma	20 (7.4%)	8	12
Cushing	17 (6%)	4	13
Adrenocortical carcinoma	7 (2.6%)	3	4
Other (cyst, metastasis, etc.)	19 (7.1%)	8	11

in a lateral decubitus position. For camera insertion, a port was introduced through the umbilicus by applying Hasson technique. After creating a pneumoperitoneum, three 5 mm trocars were inserted under direct vision. For right-side adrenalectomy, another 5 mm trocar was used to retract the liver. Adrenal veins were coagulated by bipolar cautery and then divided. No vascular staplers, clips, or any other energy sources were used for the closure of adrenal vessels. The details of the surgery technique have been explained previously⁽⁵⁾. Adrenal glands were separated from the surrounding tissue by scissors and bipolar cautery and finally, considering the size of the tumor, specimens were retrieved from the abdominal cavity by using the Endobag through the umbilical and lower quadrant port sites.

The outcomes of interest were duration of operation, length of hospital stay, changes in hemoglobin level, and occurrence of major complications.

This study was approved by the ethics committee of Urology and Nephrology Research Center (UNRC), Shahid Beheshti University of Medical Sciences, and was conducted in accordance with the Helsinki Declaration.

RESULTS

Two hundred and sixty-seven clipless LAD procedures were performed in our institute on 251 patients (91 male) during the study period. Of the total 251 patients, 168 had a mass in the right adrenal, 67 in the left, and 16 had bilateral adrenal involvement. The patients' mean age (SD) was 40.7 (13.6) years old. The mean greatest diameter (SD) of adrenal lesions was 5.2 (3.1) cm, ranging from 1-13 cm. The mean overall operation time from trocar insertion was 103 minutes (range: 65-142 minutes) with the operation time not being statistically different across the left- and right-side cases. The mean duration (SD) of hospital stay was 2.2 (0.7) days (range: 1-5 days).

Conversion into open surgery was not necessary in any of the patients and no intraoperative complications such as major bleeding were observed. The mean (SD) pre and post-operative hemoglobin levels were 12.9 (1.3) and 12.6 (0.6), respectively. Also, there was no significant correlation between tumor size and decrease of serum hemoglobin concentration (p -value > .05).

As presented in Table 1, histopathological evaluation showed that the most common etiology of the adrenal lesions was pheochromocytoma (n=78).

DISCUSSION

Previous studies have proposed that laparoscopic adrenalectomy is associated with less post-operative pain and discomfort, minimal surgery-related blood loss, shorter operation and recovery time, and more appeal-

ing cosmetic results in comparison to open surgery^(5,6). Considering these advantages, laparoscopic adrenalectomy has become the standard therapy for treating adrenal masses^(3,7). In the previous decade, many attempts of modifying surgical techniques and laparoscopic instruments have been made to facilitate this surgical procedure and improve its results. With conventional LAD, one of the main concerns is the precise dissection, isolation, and control of adrenal veins with Hemo-Lok clips. This procedure is associated with multiple risks such as the avulsion of short adrenal fragile veins, spontaneous clips displacement, troublesome bleeding, and possible need for conversion into open surgery^(4,5). On the other hand, previous studies have suggested that conventional laparoscopic bipolar electrocoagulation is safe and effective for controlling lesser gastric, mesoappendix, and uterine vessels and also the cystic artery during laparoscopic removal of the respective organs⁽⁸⁻¹⁰⁾. Based on the result of these studies, several urologists have tried to perform clipless and sutureless laparoscopy for the removal of adrenal glands. Chueh and his colleagues reported their experience of performing clipless laparoscopic adrenalectomy with needlescopic instruments in 12 cases. They found that clipless laparoscopic adrenalectomy with needlescopic instruments is feasible for most benign adrenal tumors⁽¹¹⁾. Surgit et al. evaluated the use of the LigaSure vessel closure system during laparoscopic adrenalectomy in 32 patients. They concluded that the LigaSure device system seems to be safe and effective for vessel closure during laparoscopic adrenalectomy⁽⁴⁾.

We have previously reported 13 clipless laparoscopic adrenalectomy surgeries carried out in our center which was limited to pediatric patients⁽⁵⁾. The results of our previous study showed that this approach is likely to have an acceptable outcome if performed by an expert surgeon. In the present study we reported our 7-year experience of performing clipless transperitoneal laparoscopic adrenalectomy for benign and malignant adrenal masses in a relatively large sample population. We applied the conventional bipolar cautery as the vessel-sealing system in all of our cases. No conversion to open surgery was needed during any laparoscopic operation. Furthermore, there were no cases of troublesome bleeding during LAD which showed the effectiveness of conventional bipolar cautery in maintaining hemostasis. The results of the present study were notable in some aspects: Firstly, to the best of our knowledge, no similar study has evaluated the feasibility and safety of clipless sutureless LAD with such a large sample size so far. Second, despite the controversies existing about the maximum size of the adrenal lesions being operable by a laparoscopic approach, we included all cases regardless of their tumor size. The maximum size of an adrenal mass in our series of cases was 13 centime-

ters. Furthermore, our study demonstrated that conventional bipolar cautery besides being safe and effective for controlling the adrenal vessels, is associated with diminished costs compared to Hem-o-Lok and LigaSure. Previous studies have shown that bipolar cautery and LigaSure are both safe for using around the adrenal gland in pheochromocytoma and the present study confirmed their results^(4,5,11).

Also, in this study, the frequency of right adrenalectomy and pheochromocytoma was higher compared to other literature reports. A possible reason is that our hospital is a referral center for urologic diseases.

As to any other study, this study was also associated with few limitations. This was a retrospective case series study and as such all methodological disadvantages of a retrospective study should be considered before interpretation of the findings. Also, all tumors were removed laparoscopically using the transperitoneal approach which is the preferred approach in our institute for LAD in lateral position. Theoretically, controlling the adrenal vessels during retroperitoneal approach is similar to transperitoneal LAD, but our findings cannot completely support the safety of clipless and sutureless retroperitoneal adrenalectomy.

In conclusion, clipless and sutureless transperitoneal laparoscopic adrenalectomy is a safe and effective approach for adrenal mass resection. In addition to the benefits of conventional LAD, clipless laparoscopic adrenalectomy further simplifies this procedure and reduces the operation time and also the associated costs.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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