ROBOTIC-ASSISTED LAPAROSCOPIC TRANSPERITONEAL ADRENALECTOMY: OUTCOMES OF INITIAL FIVE PATIENTS

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ABSTRACT

Objective: To report the outcomes of transperitoneal robotic adrenalectomy (RA) procedures in five initial cases performed at two institutions.
Methods: Between March 2012 and November 2014, five patients underwent RA. A transperitoneal approach was taken by using the da Vinci-S four-arm surgical robot. Outcomes were assessed retrospectively.
Results: Mean patient age was 42.6±5.1 (range: 34-47) years. Mean body mass index was 30.5±4.5 (range: 23.2-35.2) kg/m^2. Median tumour size detected on radiological imaging was 3.1±1.7 (range: 1.2-6.0) cm. Mean operation time was 129.0±12.4 (range: 120-150) minutes and median estimated blood loss was 100.0±119.3 (range: 50-350) ml. No intraoperative or perioperative complications occurred according to the modified Clavien complication scale. Median duration of hospital stay was 2.0±1.7 (range: 2-6) days. The fourth robotic arm was used in two patients. Histopathology results demonstrated: metastasis of renal cell carcinoma occurred in 1 case, adrenal cortical adenoma in 2 cases, pheochromocytoma in 1 case, and hyperplasia in 1 case. After a median follow-up of 17.0±15.0 (range: 3-40) months, no local recurrence was detected.
Conclusion: RA is a safe minimally invasive surgical approach that has excellent surgical and oncological outcomes in the treatment of adrenal masses <7 cm in size.

Keywords: Robotic adrenalectomy, adrenal mass, minimally invasive approach.

INTRODUCTION

Minimally invasive adrenalectomy has become the gold standard treatment of benign adrenal tumours since it was first described in 1992.[1] Recent studies have shown many advantages, including shorter duration of hospital stay, less pain, and decreased blood loss when compared with open surgery.[2-6] After the introduction of the da Vinci robotic system (Intuitive Surgical, Sunnyvale, California, USA), a robotic adrenalectomy (RA) series showing the feasibility and safety of the procedure has been reported.[7] The utilisation of robotic technology in adrenalectomy has facilitated the procedure by providing 3D and magnified views of the operative field and excellent control of robotic instruments. Transperitoneal and retroperitoneal approaches for RA, demonstrating the efficacy of both techniques, have been described in several reports.[8,9] Herein, we describe our surgical technique and report the outcomes of the initial transperitoneal RA procedures performed at two institutions.

PATIENTS AND METHODS

A total of five patients underwent RA transperitoneally between 2012 and 2014, and which utilised the four-arm da Vinci-S robotic surgical system. The indications for RA were: hormone-secreting tumours, solitary small pheochromocytomas, hormone-inactive lesions >3 cm in size and demonstrating growth over time, and lesions >5 cm in size with or without a growing feature. In order to determine the location and size of the adrenal mass, the patients were scanned with abdominal computed tomography (CT) or magnetic resonance imaging (MRI). Serum and urine levels of catecholamines and cortisols were evaluated preoperatively. Intraoperative and perioperative (1-30 days) complications were evaluated with regard to the modified Clavien classification system.[10] In addition, patients' age, tumour side, gender, body mass index (BMI), American Society of Anesthesiologists score, utilisation of the fourth robotic arm, radiological tumour size, histopathological results, duration of hospital stay, operation time, blood loss, and pathological tumour size were determined, and the data were recorded.

Patient Preparation and Positioning

In order to minimise the risk of bleeding, patients using antiaggregants or anticoagulants discontinued these medications at least 1 week prior to surgery. Before the administration of general anaesthesia, thigh-high anti-embolism stockings were applied on both legs in order to prevent deep vein thrombosis and embolisation. Thereafter, the patient was placed in a 60° flank position with the surgical bed flexed, to have a clear view of the surgical field. Depending on the operating surgeon's preference, an intraperitoneal incision was performed by inserting a Veress needle or with the open Hasson's method, approximately 1 cm lateral to the umbilicus to begin surgical access. Pneumoperitoneum at 15 mmHg was maintained with CO_2 insufflation by placing a 12 mm robotic camera trocar. Following that, an 8 mm port was placed approximately 4 cm craniomedial to the spina iliaca anterior superior (SIAS) for the first robotic arm, and an 8 mm robotic port was placed to the arcus costarum at midclavicular line under direct vision for the second robotic arm. A 10 mm assistant port was placed 2 cm medial to the line connecting this robotic port and the camera port. Finally, in cases in which the fourth robotic arm was used, an 8 mm robotic port was placed approximately 2 cm below SIAS under direct vision and at the surgeon's discretion. Port placements were performed similarly for the right and left sides. Following that, the robotic unit was docked with a 15° angle from the back of the patient and the operation was started by connecting the robotic arms and introduction of the robotic instruments through the ports.

Surgical Technique

On the right side, the triangular ligament of the liver is divided and the liver is retracted superiorly with a retractor to exposure the adrenal gland and vein. After the colon medialisation the adrenal gland can be exposed properly. On the left side, splenocolic ligament, splenorenal ligament, and the lateral attachments of the spleen are divided and the colon is medialised completely to expose the adrenal gland and vein. After identifying the adrenal vein, it is cut following application of standard laparoscopic Hem-o-lok® endoclips placed by the bedside assistant. After the control of the adrenal vein, dissection is performed on the superior and lateral borders of the gland. Then, the gland is dissected from the upper kidney pole. The arterial supply can be cauterised by using monopolar and bipolar energy. The gland is placed in an endobag by extracting it with the adipose tissue overlying it. Thereafter, an absorbable fibrin sealant patch (TachoSil®) may be applied if required to the surgical field for adequate haemostasis. Intra-abdominal pressure is decreased to 5 mmHg at the end of the procedure in order to check if haemostasis has been achieved. Lodge drain is inserted through the trocar site. After the robotic unit is de-docked, the specimen is extracted from the abdominal cavity contained within the endobag by enlarging the insertion site of the camera port.

Postoperative Follow-up

Patients were given intravenous fluids, analgesics, and antibiotics postoperatively. Urethral catheters and drains were removed on the first postoperative day and patients were discharged home thereafter. Routine biochemistry and complete blood count tests were carried out immediately after surgery and on the first postoperative day. Following abdominal CT in the third postoperative month, patients with benign histopathological results were followed-up with annual abdominal ultrasonography and hormonal evaluations.

Table 1: The results of selected robotic adrenalectomy series in the literature.

Authors	N	Histopathology (n)	Tumour size (cm)	Operation time (min)	Hospital stay (days)	Complications (n)
Morino et al.[11]	10	Adenoma (3), aldesteronoma (3), pheochromocytoma (4)	3.3	169	5.7	0
Brunaud et al.[12]	100	Adenoma (19), aldesteronoma (39), pheochromocytoma (24), cyst (2), Cushing's adenoma (11), hyperplasia (5)	2.9	171	6.4	Cyst rupture (1), bleeding (3), wound infection (1), urinary infection (1), facial oedema (1), pneumonia (1)
Giulianotti et al.[13]	42	Adenoma (19), aldesteronoma (2), pheochromocytoma (9), cyst (6), Cushing's adenoma (11), hyperplasia (2), others (4)	5.5	118	4	Capsular tear (1)
Karabulut et al.[14]	50	Adenoma (10), aldesteronoma (8), pheochromocytoma (12), Cushing's syndrome (8), others (7), metastasis (5)	3.9	166	1.1	Atelectasis (1)
Agcaoglu et al.[15]	25	Adenoma (7), cyst (5), pheochromocytoma (8), others (5)	6.5	159	1.4	0
Aksoy et al.[16]	42	Adenoma (10), aldesteronoma (6), pheochromocytoma (8), Cushing's syndrome (10), others (8),	4.0	186	1.3	Urinary infection (1), pneumothorax (1)
Our series	5	Adenoma (2), pheochromocytoma (1), hyperplasia (1), metastasis (1)	3.1	129	2.0±1.7 (range: 2-6)	0

The patient with metastatic malignant histopathological findings was followed-up with annual abdominal CT and chest radiography.

RESULTS

The mean age of patients was 42.6±5.1 (range: 34-47) years. The mean BMI was 30.5±4.5 (range: 23.2-35.2) kg/m^2. Median tumour size detected on CT or MRI was 3.1±1.7 (range: 1.2-6.0) cm. Of the 5 cases, 3 procedures were left-sided and 2 were right-sided. Mean operation time was 129.0±12.4 (range: 120-150) minutes and median estimated blood loss was 100.0±119.3 (range: 50-350) ml. No intraoperative or perioperative (0-30 days) complications occurred in any patients, as assessed using the modified Clavien complication scale. The readmission rate during the perioperative period was 0%. Median duration of hospital stay was 2.0±1.7 (range: 2-6) days. The fourth robotic arm was used in two patients.

The indications for adrenalectomy in the 5 patients were: metastasis of renal cell carcinoma in 1 case, adrenal cortical adenoma in 2 cases, benign pheochromocytoma in 1 case, and primary adrenal cortical hyperplasia in 1 case. During the preoperative period, in serum and urine analysis of 3 patients, adrenal derived hormonal and metabolic evaluations revealed no abnormality. Catecholamine levels were elevated in 1 patient with pheochromocytoma, while serum and urine cortisol and glucose levels were elevated in 1 patient with adrenal cortical hyperplasia. Surgical margins were negative in all cases. Median pathological tumour size was detected as 3.5±1.5 (range: 1.7-6.0) cm. After a median follow-

up of 17.0±15.0 (range: 3-40) months, no local recurrence was detected.

DISCUSSION

In the literature there are several reports evaluating the efficacy of RA, which are summarised in Table 1.[11-16] In the first randomised study comparing robotic and laparoscopic adrenalectomy (LA), it was considered that the operative time was longer and the perioperative complication rate was higher in the robotic group.[11] Also, in cost analyses, RA was found to be more expensive than LA. In another study, the authors prospectively evaluated 100 consecutive patients who underwent robotic, unilateral, transperitoneal adrenalectomy,[12] and determined the learning curve for RA and factors that influence operative time and cost. As a result, surgeons' experience, first-assistant level, and tumour size were independent predictors of operative time. In cost analyses, the robotic procedure was 2.3-times more costly than transperitoneal LA. The authors also concluded that, although the robotic approach is expensive, it provided better quality of view and greater ergonomics to the surgeon. In recent publications, it can be seen that the duration of hospital stay is quite short, [9,14-16] which is considered to balance the unfavourable cost of robotic surgery. In our study, even though there have not been any intra or perioperative complications, it was observed that the duration of hospital stay was longer relative to these other publications. Even though the mean tumour size and operation time in our study are similar to those described by these publications, it may be that the longer duration of hospital stay is attributable to being more cautious with the initial cases in the postoperative follow-up.

It is still controversial as to whether the RA should be performed by transperitoneal or retroperitoneal approach. Several surgeons prefer the retroperitoneal technique in patients with tumours <6 cm in size, if the distance between the skin and Gerota's space is 7 cm and the 12th rib is rostral to the renal hilum in order to provide the best ergonomic trocar placement.[17] Although the retroperitoneal technique necessitates previous experience with the transperitoneal approach, a retroperitoneal approach should be preferred in patients with abdominal scarring and adhesions. In our cases, previous laparoscopic transperitoneal experience has been the most significant factor leading us to prefer this approach. In a recent study that analysed intraoperative time use and perioperative outcomes in robotic versus LA for both transabdominal and retroperitoneal approaches, intraoperative time use was similar between the laparoscopic and robotic groups for both transabdominal and retroperitoneal approaches.[14] However, the authors concluded that the morbidity was less and hospital stay was shorter after the robotic procedures.

Obesity is another concern in minimally invasive surgery as it increases complications and morbidity associated with the surgery. In a publication comparing RA with laparoscopic methods in obese patients, it was determined that the tumour size, blood loss, surgery duration, and duration of hospital stay were similar, and there was no significant difference between the operative and perioperative period morbidities of the groups.[16]

In our cases, the histopathological evaluation revealed metastasis of renal cell carcinoma of the contralateral kidney in one case. Metastases are the second most common tumours of adrenals after adenomas.[18] The most common primary malignancies with adrenal metastases are lung, kidney, breast, and colon.[19] It is indicated that patients, especially those with solitary adrenal metastases of smaller tumour size, may benefit from surgical resection.[20] In our cases, the patient with adrenal metastases of renal cell cancer had undergone radical nephrectomy previously. At postoperative Month 40, no tumour recurrence or any lesion involving the kidney was demonstrated in this patient.

In a recent systematic review and meta-analysis of robotic versus LA, including 600 patients (277 robotic and 323 laparoscopic), the authors found no differences in terms of conversion to open surgery rates, operation time, and complications.[21] However, it was concluded that the robotic approach could provide the potential advantages of a shorter hospital stay, less blood loss, and lower occurrence of postoperative complications. The number of robotic operations performed globally is predicted to increase, with an increasing number of centres adopting robotic technology. Despite the advantages that this technology provides, the disadvantage of robotic operations is their high cost. On the other hand, considering shorter hospital stays and recovery, it can be expected that the cost of robotic operations will decrease in time.

CONCLUSION

In our experience, RA is a safe and feasible minimally invasive surgical approach with excellent surgical and oncological outcomes in the treatment of adrenal masses <7 cm in size.

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