

Surgery in Motion

Robot-assisted Laparoscopic Adrenalectomy: Step-by-Step Technique and Comparative Outcomes

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accompanying video.

Abstract

Background: Recent evidence supports the use of robotic surgery for the minimally invasive surgical management of adrenal masses.

Objective: To describe a contemporary step-by-step technique of robotic adrenalectomy (RA), to provide tips and tricks to help ensure a safe and effective implementation of the procedure, and to compare its outcomes with those of laparoscopic adrenalectomy (LA).

Design, setting, and participants: We retrospectively reviewed the medical charts of consecutive patients who underwent RA performed by a single surgeon between April 2010 and October 2013. LA cases performed by the same surgeon between January 2004 and May 2010 were considered the control group.

Surgical procedure: The main steps of our current surgical technique for RA are described in this video tutorial: patient positioning, port placement, and robot docking; exposure of the adrenal gland; identification and control of the adrenal vein; circumferential dissection of the adrenal gland; and specimen retrieval and closure.

Outcome measurements and statistical analysis: Demographic parameters and main surgical outcomes were assessed.

Results and limitations: A total of 76 cases (RA: 30; LA: 46) were included in the analysis. Median tumor size on computed tomography (CT) was significantly larger in the LA group (3 cm [interquartile range (IQR): 3] vs 4 cm [IQR: 3]; $p = 0.002$). A significantly lower median estimated blood loss was recorded for the robotic group (50 ml [IQR: 50] vs 100 ml [IQR: 288]; $p = 0.02$). The RA group presented five minor complications (16.7%) and one major (Clavien 3b) complication (3.3%), whereas four minor complications (8.7%) and one major (Clavien 3b) complication (2.3%) were observed in the LA group. No significant difference was noted between groups in terms of malignant histology ($p = 0.66$) and positive margin rate ($p = 0.60$). Distribution of pheochromocytomas in the LA group was significantly higher than in the RA group (43.5% vs 16.7%; $p = 0.02$).

Conclusions: The standardization of each surgical step optimizes the RA procedure. The robotic approach can be applied for a wide range of adrenal indications, recapitulating the safety and effectiveness of open surgery and potentially improving the outcomes of standard laparoscopy.

Patient summary: In this report we detail our surgical technique for robotic removal of adrenal masses. This procedure has been standardized and can be offered to patients, with excellent outcomes.

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1. Introduction

To date, robotic surgery in urology remains mainly used for extirpative procedures including significant reconstructive components such as radical prostatectomy and partial nephrectomy, whereas its use for purely extirpative procedures such as nephrectomy and adrenalectomy is more limited mainly because of cost issues [1].

Since the report of initial cases in 2002 [2], da Vinci robot-assisted laparoscopic adrenalectomy (RA) has been shown to be safe and feasible [3]. Recent evidence supports the use of robotic surgery for minimally invasive surgical management of adrenal masses and suggests that RA can be effectively performed with operative time and complication rates similar to laparoscopy, but with potential shorter hospital stay and less blood loss [4].

The aim of the study is to describe a contemporary step-by-step technique of RA, to provide tips and tricks to help ensure a safe and effective implementation of the procedure, and to compare its outcomes with those of laparoscopic adrenalectomy (LA) in the experience of a single surgeon at a high-volume center.

2. Methods and patients

2.1. Study design

We retrospectively reviewed the medical charts of consecutive patients who underwent transperitoneal RA performed by a single surgeon (J.K.) in our center between April 2010 and October 2013. Data were acquired from our institutional review board–approved prospectively maintained database.

Transperitoneal LA cases performed by the same surgeon between January 2004 and May 2010 were considered as the control group. The two groups were compared in terms of surgical indications and perioperative outcomes.

2.2. Preoperative assessment and surgical indication

Indications for RA parallel those for LA including hormone-secreting tumors (ie, aldosteronomas, glucocorticoid, androgen- and estrogen-producing adenomas), solitary small pheochromocytomas, hormone-inactive lesions >3 cm demonstrating growth over time on serial imaging studies or >5 cm without observation, and rare lesions such as myelolipomas.

Special indications are the removal of malignant tumors or metastases. Increasing size and the suspicion of malignancy increase the difficulty of the procedure. Contraindications include infiltrative adrenal masses, involvement of large vascular structures or significant involvement of adjacent organs, and large tumors. General contraindications include serious cardiac conditions, severe cardiac insufficiency, and uncorrected coagulopathy.

In general, a multidisciplinary management plan involving an endocrinologist is followed in a patient presenting with an adrenal mass. The adrenal gland is evaluated with a computed tomography (CT) or magnetic resonance imaging to assess the location, size, and functional characteristics of the mass. Metabolic parameters (serum levels of aldosterone, cortisol, and catecholamines, as well as urine levels of metanephrines) are assessed to identify functional masses.

In cases of pheochromocytoma, patients are prescribed a preoperative 2-wk course of oral adrenergic blockade. Blood pressure is carefully

monitored intraoperatively to ensure hemodynamic stability during the procedure and specifically during tumor manipulation.

2.3. Surgical technique

A detailed illustration of the surgical technique for RA can be found in the accompanying video material.

2.3.1. Robotic instrumentation

The da Vinci Surgical System (Intuitive Surgical Inc., Sunnyvale, CA, USA) is used in a three-arm configuration, and the following robotic instruments are used: 30° down scope, ProGrasp forceps, Hot Shears (monopolar curved scissors), and a robotic clip applier. A monopolar cautery hook and Harmonic ACE curved shears (Ethicon Endo-Surgery Inc., CA, USA) can be also used when deemed helpful by the surgeon. We do not routinely use a bipolar energy source.

Laparoscopic instruments are handled by the bedside assistant including a Weck Hem-o-Lok clip applier (Teleflex Medical) and a suction device.

2.3.2. Patient positioning, port placement, and robot docking

The patient is placed in a 60° flank position. Extreme care is taken with pressure points and correctly padding them with pillows and foams. Tapes are used to secure the patient to the surgical table, which is mildly flexed and positioned in a slight Trendelenburg position. The patient's arms are in a comfortable position, either both over a double arm board or one placed along the side of the body.

Similar to laparoscopy, precise port placement is essential to maximize exposure and ease of surgery. Right- and left-side port configurations are shown in Figure 1. After creating pneumoperitoneum by using a Veress needle, a 12-mm port is inserted above and lateral to the umbilicus, at the lateral border of the abdominal rectus muscle across from the 12th rib. Through this first port, the robotic scope is inserted and the abdomen is carefully inspected to rule out any accidental injuries. Then the remaining ports are placed under vision including an 8-mm robotic port at the lateral border of the ipsilateral rectus muscle about 1 in below the costal margin, a second 8-mm robot port about 2 in cephalad to the anterosuperior iliac spine, and a 12-mm assistant port along the lateral border of the rectus muscle, halfway

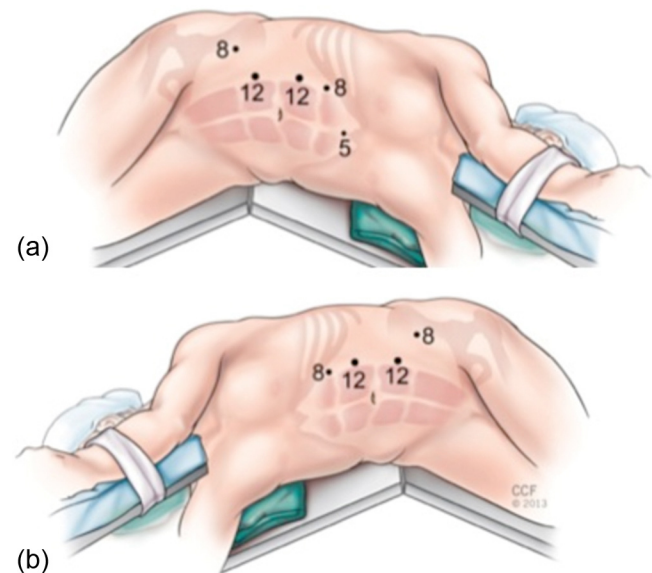


Fig. 1 – Port configuration for (a) right and (b) left robot-assisted laparoscopic adrenalectomy.

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