Asian Journal of Surgery (2017) 40, 221–226

Available online at www.sciencedirect.com

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journal homepage: www.e-asianjournalsurgery.com

ORIGINAL ARTICLE

# Laparoendoscopic single-site adrenalectomy in patients with primary hyperaldosteronism: A prospective study with long-term follow up

Ya-Hui Hu [a], Che-Hsiung Wu [b], Leay-Kiaw Er [a], Chia Da Lin [c], Ying-Buh Liu [c], Shih-Chieh Chueh [d,e], Yao-Chou Tsai [c,f,*]

[a] *Division of Endocrine and Metabolism, Taipei Tzuchi Hospital, The Buddhist Tzu Chi Medical Foundation, Taipei, Taiwan*
[b] *Division of Nephrology, Taipei Tzuchi Hospital, The Buddhist Tzu Chi Medical Foundation, Taipei, Taiwan*
[c] *Department of Surgery, Taipei Tzuchi Hospital, The Buddhist Tzu Chi Medical Foundation, Taipei, Taiwan*
[d] *Glickman Urologic and Kidney Institute, Cleveland Clinic, Cleveland, OH, USA*
[e] *Cleveland Clinic Lerner College of Medicine, Case Western Reserve University, Cleveland, OH, USA*
[f] *Department of Urology, Tzu Chi University, Medical College, Hualien, Taiwan*

Received 14 May 2015; received in revised form 19 August 2015; accepted 14 September 2015
Available online 25 November 2015

**KEYWORDS**
primary aldosteronism;
laparoendoscopic single-site surgery;
adrenalectomy

**Summary** *Objective:* Laparoendoscopic single-site (LESS) adrenalectomy is a promising minimally invasive technique, however, the current evidence has not confirmed its long-term effectiveness in primary aldosteronism (PA). We conducted a study to analyze the long-term efficacy of LESS adrenalectomy in patients with PA.
*Methods:* A total of 49 patients who had been clinically confirmed with PA who had an indication for unilateral adrenalectomy were included in this study. Perioperative data were obtained for all patients. Blood pressure and the levels of serum aldosterone, renin, and potassium were checked periodically. The median follow-up was 16.5 months.
*Results:* No intra- or early post-operative complication occurred. All LESS adrenalectomies were completed successfully, except one with laparoscopic conversion. Hypokalemia was resolved in all cases and no patient required potassium supplements after surgery. Post-operative cure of hypertension was achieved in 63% of our patients. Overall, 84% of our PA patients had clinical improvement in blood pressure control after surgery.

Conflicts of interest: All contributing authors declare no conflicts of interest.

* Corresponding author. Department of Surgery, Taipei Tzuchi Hospital, The Buddhist Tzu Chi Medical Foundation, 289 Jianguo Road, Xindian, Taipei, Taiwan.
*E-mail address:* tsai1970523@yahoo.com.tw (Y.-C. Tsai).

http://dx.doi.org/10.1016/j.asjsur.2015.09.002

*Conclusions:* Our long-term experience revealed that LESS adrenalectomy is a safe and effective approach, which demonstrated comparable long-term cure and improvement of hypertension to a conventional laparoscopic series in treating PA.


## 1. Introduction

Primary aldosteronism (PA) is one of the few surgically curable causes of hypertension. PA is usually caused by aldosterone-secreting adenomas (APA) in the unilateral or bilateral adrenal gland, however, it may also be caused by small hyperplastic or multiple nodular lesions. According to a screening study in Japan, PA is found in 3.3—10% of hypertensive patients and is the most common cause of secondary hypertension.[1—3] To date, unilateral adrenalectomy is still the treatment of choice in patients with APA and unilateral hyperplasia.

Laparoscopic adrenalectomy has become the recommended procedure for unilateral APA or hyperplasia due to less postoperative pain and shorter convalescence when compared with its open surgery counterpart.[4,5] A recent revolution in surgery, the laparoendoscopic single-site surgery (LESS), has been widely implemented in various surgical indications including adrenalectomy.[6—13] Preliminary results have revealed comparable safety and efficacy in removing benign adrenal lesions to the conventional laparoscopic approach, but with additional clinical benefits of less postoperative pain, and a shorter hospital stay.[14,15]

Among a larger series of LESS adrenalectomies, APA is the most common surgical indication, comprising up to 50% of all cases.[11,16—18] However, as a promising and emerging minimally invasive technique, the current evidence has not confirmed its long-term effectiveness in this most common surgical indication. Therefore, we conducted a study to analyze the long-term efficacy of LESS adrenalectomy in patients with PA.

## 2. Materials and methods

### 2.1. Patients

We maintain a prospective database of all LESS performed in our department, including LESS adrenalectomy since January 2007. This study is a retrospective review of prospectively collected data from this database.

Between October 2009 and October 2014, 105 LESS adrenalectomies were performed by a single surgeon (YCT) who is experienced in laparoscopic adrenalectomy. We shifted our adrenalectomy to the LESS approach in 2009, except in cases with a tumor size >6 cm where the risk of malignancy is high, or cases with a body mass index (BMI) > 45 because of difficulty in maintaining pneumoperitoneum under a single port design. Based on this database, we identified 49 patients who had been clinically confirmed (by saline infusion and captopril tests) to have PA to be included in this study. Those PA patients who had inconclusive abdominal contrast-enhanced computed tomography (CT) results underwent adrenal scintigraphy using 131I-6 b-iodomethyl-19-norcholesterol (NP-59) SPECT/CT and/or adrenal venous sampling (AVS) for lateralization. The baseline characteristics of these 49 patients are listed in Table 1.

### 2.2. Operative technique

After induction of general anesthesia, the patient was placed in the prone jack-knife position. LESS adrenalectomy starts with a 2.0—3.0-cm skin incision just beneath the tip of the 12$^{th}$ rib. The subcutaneous tissues and fascia were dissected sharply. Using blunt finger dissection, the retroperitoneal space was created for the single-port placement. A homemade or commercial single port was placed in position through the incision.[13] The capnoretroperitoneum is created by a carbon dioxide pressure of 15—20 mmHg. After pneumoretroperitoneum was established, a rigid 5-mm, 30° laparoscope and conventional 5-mm laparoscopic instruments were used for subsequent manipulation. Step-by-step, after creation of the retroperitoneal space by blunt dissection, the upper pole of the kidney was mobilized. Dissection of the adrenal gland started from medial side of the adrenal gland. For the right adrenal tumors, the adrenal arteries which cross the vena

**Table 1** Patient characteristics and surgical results.

| No. of patients | 49 |
|---|---|
| Age (y) | 50.8 (11.5) |
| Sex (M:F) | 28/21 |
| BMI | 27.8 (7.2) |
| Operative time (min) | 112.7 (52.3) |
| Specimen weight (g) | 18.6 (9.3) |
| Right/left side tumor | 22/27 |
| Histopathology | |
| Adrenocortical adenoma (APA) | 47 |
| Nodular adrenal hyperplasia | 1 |
| Hyperplasia (IHA) | 1 |
| Median follow up (mo), (range) | 16.5 (3—60) |
| No. lost to follow up (%) | 3 (6.1) |

Data expressed as mean (SD) or absolute number of patients.
APA = aldosterone-secreting adenomas; BMI = body mass index; F = female; IHA = idiopathic hyperaldosteronism; M = male; SD = standard deviation.