



ORIGINAL ARTICLE

# Surgical results of reduced port laparoscopic adrenalectomy using a multichannel port in comparison with conventional laparoscopic adrenalectomy



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## KEYWORDS

adrenalectomy;  
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**Summary** *Background:* We introduced a modified laparoscopic technique, dual-incision laparoscopic adrenalectomy (DILA), using a newly designed multichannel trocar, and we evaluated its perioperative outcomes and operative costs and compared them to those of conventional laparoscopic adrenalectomy (CLA).

*Methods:* We retrospectively reviewed the medical records of 127 patients who underwent CLA with four trocars or DILA with two trocars at Seoul St. Mary's Hospital, Seoul, Korea between October 2007 and September 2014. We analyzed the patients' surgical outcomes and perioperative morbidities.

*Results:* DILA was performed in 45 patients and CLA in 82 patients. There were no significant differences in operative time (DILA:  $77.1 \pm 28.4$  minutes vs. CLA:  $76.6 \pm 28.0$  minutes,  $p = 0.595$ ) or estimated blood loss during surgery (DILA:  $150.0 \pm 85.5$  mL vs. CLA:  $175.5 \pm 50.5$  mL,  $p = 0.697$ ). There were no differences in postoperative hospital stay, visual analog scale pain score, or postoperative complication rates between the two groups. However, the operative cost was significantly lower in the DILA group (DILA  $813,603 \pm 48,600$  Korean won vs. CLA  $968,368 \pm 56,456$  Korean won,  $p < 0.001$ ).

*Conclusion:* This study demonstrated that DILA is a safe and feasible surgical approach for adrenal diseases. DILA may reduce the operative cost significantly compared with CLA.

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

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## 1. Introduction

Since laparoscopic adrenalectomy was first reported in 1992 by Gagner et al,<sup>1</sup> it has become widely accepted as a standard operative modality for various adrenal gland diseases. The advantages of laparoscopic surgery over conventional open surgery are shorter hospital stays, more rapid recovery, reduced incisional morbidity, improved cosmesis, and greater cost effectiveness.<sup>2–4</sup> To date, several modified and less invasive techniques, such as single port laparoscopic adrenalectomy (SPLA), have been reported by several investigators.<sup>5,6</sup> However, there have been controversies concerning whether single port surgery (SPS) has significant advantages over conventional laparoscopic surgery using multiport approaches, specifically in the area of a solid organ surgeries such as adrenalectomy.<sup>7</sup> These techniques have not yet gained definite momentum because of their intrinsic technical difficulties, including loss of triangulation and interference between instruments, as well as a lack of suitable instruments. Furthermore, SPS generally requires a longer operative time, specially designed equipment and a highly experienced surgeon.<sup>8,9</sup>

The authors have also been performing SPS for several diseases and have reported their experiences.<sup>10,11</sup> In this study, we introduced a modified laparoscopic technique for adrenal diseases, dual-incision laparoscopic adrenalectomy (DILA), using a newly designed multichannel trocar. Furthermore, we analyzed the operative outcomes between DILA and conventional laparoscopic adrenalectomy (CLA) and verified the cost effectiveness of DILA compared with CLA.

## 2. Patients and methods

### 2.1. Patients

From October 2007 to September 2014, we collected data prospectively and retrospectively from the medical records of 133 patients who underwent a laparoscopic adrenalectomy at Seoul St. Mary's Hospital, Seoul, Korea. Two types of surgical approaches were used: conventional laparoscopic surgery with four trocars and dual incision laparoscopic surgery using a multichannel trocar. We excluded six patients from the present study who underwent concomitant laparoscopic surgeries, such as laparoscopic cholecystectomy or colon surgery, which inevitably required additional trocars and operative time. This study was approved by the Institutional Review Board of the ethics committee of our hospital.

The three surgeons who were enrolled in this study had performed CLA surgeries for at least 5 years. DILA was initially introduced in May 2012 and, since then, it has been performed consistently by one surgeon after patients provide their consent.

### 2.2. Clinical outcomes

Demographic data, including age, sex, body mass index, American Society of Anesthesiologists score, and size of the adrenal gland on computed tomography (CT) scans, were

compared between the DILA and CLA groups. The confirmative pathology after surgery was also verified. The operative parameters, such as intraoperative blood loss volume, transfusion rate, conversion rate to open surgery, operative time and operative costs, and the postoperative parameters, which included the number of postoperative days spent in the hospital, the surgical complications and the visual analog scale (VAS) pain scores, were recorded for each procedure. The VAS pain score was routinely assessed 12 hours after surgery.<sup>12</sup>

The operative time consisted of the duration of the entire procedure from skin incision to wound closure. The operative costs were calculated by summing the cost of the disposable surgical supplies and items. This value was abstracted from the operating room resource utilization reports. The surgical fee, anesthesia fees, and all of the postsurgery costs, including hospital room costs, were not included in the operative costs. All costs are presented in Korean won (KRW).

All of the patients underwent routine preoperative CT to determine the location and size of the adrenal gland. In some patients, an endocrine function test, such as high dose or low dose dexamethasone suppression tests and plasma rennin activity, was performed in the Department of Endocrinology, Seoul St. Mary's Hospital prior to surgery if the patients had diabetes mellitus, hypertension, or Cushing's syndrome.

### 2.3. Surgical procedures

Generally, there were few differences between the operative methods performed during the DILA and CLA procedures, except for the difference in trocar use.

The patients were placed in right or left lateral decubitus in the reverse Trendelenburg position at approximately 60°. The table was flexed at the waist area of the patient to increase the space between the subcostal margin and the iliac crest.

For the DILA procedure, an incision at least 20 mm in length was made at the right or left upper abdominal quadrant, depending on the location of the adrenal gland that was scheduled for surgery, and then the multiport device was inserted. The precise incision size for the multichannel trocar was determined by the size of the tumor on CT scans, and the size was generally approximately 20% smaller than the length of the short axis of the tumor. An additional 5-mm trocar was inserted at the sub-xiphoid area. We used a specially designed multichannel trocar (Glove Port; Nelis, Seoul, Republic of Korea) consisting of two rings and four trocar channels with gas insufflation and exsufflation lines (Fig. 1). The finished product is similar to the homemade glove port commonly used for other SPS or dual incision surgeries. The trocar consists of transparent material and allows for smooth and safe introduction of the instruments. It also enables intracorporeal crossing and rearrangement of the instruments. Therefore, the interference between instruments is reduced. Furthermore, the trocar can introduce a 10-mm scope, an additional liver retractor (Snake Liver Retractor, Artisan medical, Medford, NJ, USA) and a grasper during right adrenalectomy, as well as, in the case of left

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