Single-port laparoscopic adrenalectomy: initial experience

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Abstract

**Background:** Recent reports have suggested that single-port laparoscopic surgery is technically feasible. The aim of this study was to describe our initial experience with single-port laparoscopic adrenalectomy (SPLA) for benign adrenal tumors.

**Methods:** Medical records of consecutive patients undergoing SPLA were analyzed. All procedures were performed through a single multichannel port. Demographic and operative data were assessed. A visual analog scale (VAS) was used with a 10-point scale for an objective assessment of incisional pain and incisional cosmesis.

**Results:** Between January 2010 and July 2012, 14 consecutive patients with benign adrenal tumors underwent SPLAs. Of the planned SPLAs, 12 (86%) were completed with a single-port, whereas two required an additional port placement. Mean operating time was 128.1 ± 31.5 min and mean blood loss 10.5 ± 12.1 ml. Mean pain scores using the VAS on postoperative days 1, 3, and 14 were 2.3, 1.0, and 0.3 points, respectively. The rate of analgesic use was also lower within 12 hours after surgery (14%). The patient was highly satisfied with the single small wound procedure, and mean cosmesis scores
of postoperative days 3 and 14 were 9.4 and 9.8 points, respectively. The postoperative course was uneventful with no morbidity within one month of follow-up.

**Conclusions:** SPLA is a safe and technically feasible procedure for patients with benign adrenal tumors, and offers a cosmetic benefit, as well. However, further studies are necessary to clearly identify the risks and benefits of this new approach to the adrenalectomy.

**Key words**  Single-port surgery ・ Single-incision surgery ・ Laparoendoscopic single site ・ Laparoscopy ・ Adrenalectomy

**Background**

A conventional multiport laparoscopic adrenalectomy (MPLA) using three or four ports is the gold standard operative treatment for benign adrenal tumors [1–3]. The advantages of MPLA include decreased pain, shorter hospital stay, and an earlier return to normal activity. Recently, a single-port surgery (SPS) was developed as an extension of the standard laparoscopic minimally invasive procedures. SPS has the potential to
provide patients with improved cosmesis and decreased pain; as such, it satisfies a growing demand for less invasive surgical procedures [4,5]. Since the initial report of laparoscopic adrenalectomy (LA) using a single-incision [6], several investigators have demonstrated the technical feasibility of a variety of SPS procedures for adrenal tumors [7,8]. SPS obviates the need to externally space ports for triangulation, thus allowing for the creation of a small, solitary portal of entry into the abdomen. However, we have previously reported our initial developmental experiences with select SPS procedures [9–13]. In this report, we describe our initial experience with single-port laparoscopic adrenalectomy (SPLA) for benign adrenal tumors.

Methods

Patients

Data were prospectively entered in an SPLA database and retrospectively reviewed. Between January 2010 and July 2012, 14 consecutive patients (7 men and 7 women) with benign adrenal tumors underwent SPLAs at the Iwate Medical University Hospital. All procedures were performed by a
A visual analog scale (VAS) was used as an objective assessment of incisional pain on postoperative days 1, 3, and 14, and for incisional cosmesis on postoperative days 3 and 14. The VAS was used to score incisional pain on a 10-point scale with a range from 0 (no pain) to 10 (worst possible pain). The VAS was also used to score cosmesis on a 10-point scale with a range from 0 (worst) to 10 (best). Data are expressed as mean ± standard deviations (SD).

**Surgical technique**

The patient was placed in the semilateral position. All procedures were performed through a single multichannel port. A 2.5 cm incision was made through the umbilical skin and fascia. The wound protector/sleeve of the GelPOINT (Applied Medical, CA, USA) was placed. Three 5-mm cannulas were placed through the GelPOINT and then attached to the wound protector. A 5-mm flexible laparoscope (Olympus Medical Systems, Tokyo, Japan), a
SILS dissector (Covidien), and a tissue sealing device (EnSeal, Ethicon, Cincinnati, OH, USA) were the primary tools used in the operation. An anterior approach, with no mobilization of the right lobe, was used for the right-sided tumors, while a lateral approach was used for left-sided tumors. Only the central adrenal vein was clipped and the small adrenal vessels were divided using an EnSeal device. For the right-sided adrenal tumor, the right liver lobe was evaluated using a 2.3 mm percutaneous instrument (MiniLap, Stryker, Kalamazoo, MI, USA) and a small gauze, which provided good visualization of the operative field surrounding the right adrenal gland (Fig. 1). Although MiniLap insertion appears to be scar-less, a needle instrument can be traumatic for the liver. To avoid a traumatic procedure, we used small gauze as cushioning to evaluate the liver. The overall procedure was similar to the procedure performed in a conventional anterior approach using a four-port technique. The adrenal gland was extracted without a retrieval bag. The umbilical fascia was closed with a 2-0 Vicryl suture and 4-0 Monocryl interrupted subcuticular sutures were used. DERMABOND ADVANCED™ (Ethicon, Somerville, NJ, USA) skin adhesive was applied to all ports. No drains were inserted.
Results

Patient demographics are summarized in Table 1. Mean age was 51.7 ± 11.6 years. Indications for SPLA were 11 aldosterone-producing adenomas, 2 non-functioning tumors, and 1 patient with Cushing’s syndrome. Operative outcomes are detailed in Table 2. Of the planned SPLAs, 12 (86%) were completed with a single-port, whereas two required an additional port placement for patients with body mass indexes greater than 27 kg/m². Mean operating time was 128.1 ± 31.5 min and mean blood loss was 10.5 ± 12.1 ml. There was no difference between the initial 7 cases and the last 7 cases in mean operating time (134.4 min versus 121.9 min, p=0.477). There were also no other significant differences between the preoperative characteristics of the patients. No blood transfusions were required. Mean tumor size was 21.2 ± 7.0 mm. No patients demonstrated a delay in initiating oral intake or a regular diet. Mean hospital stay after surgery was 3.9 ± 1.0 days, and convalescence was complete at two weeks. The postoperative course was uneventful with no morbidity within one month of follow-up.
Mean scores for postoperative incisional pain on postoperative days 1, 3, and 14 were 2.3 ± 1.6, 1.0 ± 1.1, and 0.3 ± 0.7 points, respectively (Table 3). The rate of analgesic use (diclofenac sodium suppository; 50 mg) was also lower within 12 hours after surgery (14%). The patients were highly satisfied with the single small wound procedure. According to their self-assessments, mean cosmesis scores on postoperative days 3 and 14 were 9.4 ± 0.7 and 9.8 ± 0.3 points, respectively (Table 4). The rates of best cosmetic satisfaction (VAS score of 10) at 3 and 14 days were 57% and 79%, respectively.

A limited cost analysis was performed on the series of patients undergoing SPLA. SPLA was associated with 18% lower mean operative charges compared with the standard MPLA (¥147,000 vs ¥180,000).

Discussion

Conventional multiport laparoscopic surgery is the gold standard operative treatment for a variety of diseases. Generally, the goal has been to minimize the invasiveness of this procedure by reducing the number or size of the operating ports. Recently, SPS was developed as an extension of standard
laparoscopic minimally invasive procedures. The potential for decreased
pain, faster recovery, and improved cosmesis has surgeons, their patients,
and the industry interested in pushing the technique forward. In 2008,
Castellucci et al. [6] reported the first SPLA in a 63-year-old female patient
with a 4.5-cm left adrenal incidentaloma. They used a 3-port technique,
introduced through a 2-cm supraumbilical incision and successfully
removed a pheochromocytoma. However, SPLA is still limited by the
surgical team’s adrenal and laparoscopic experience [6–8,12].

Since March 2009, we have been using single-port laparoscopic
cholecystectomies in selected patients with benign gallbladder diseases.
Additionally, our team has recently performed successful advanced SPSs,
such as gastrectomy, colectomy, splenectomy, Heller-Dor procedure, and
Nissen fundoplication [9–13]. At our institution, SPLA was introduced after
more than 100 MPLAs were conducted. Since our first description in 2010
[12], we have performed SPLAs on consecutive patients with benign adrenal
tumors. In a left-side SPLA, as in conventional MPLA, the spleen is
mobilized which provides a good operative field surrounding the left
adrenal gland. The applicability of a right SPLA has not resulted in its
widespread use, however, due to its technical challenges. The most important technical challenge for right SPLA is providing a good operative field surrounding the right-sided tumors. However, an elevation of the right liver lobe using a percutaneous instrument provided good visualization of the operative field, which reproduced a result similar to that observed in MPLA. The assistance of the needlescopic instrument does not compromise the cosmetic outcomes; this fact is considered to be one of the main advantages of SPLA over MPLA. An additional 5-mm port was required in two patients with body mass indexes greater than 27 kg/m$^2$. Good laparoscopic skills and careful patient selection are essential; additional ports should be considered to help with liver retraction. The inclusion criteria for SPLA are still controversial. A large tumor of more than 7 cm in size, or an invasive tumor, should be approached by MPLA; however, we have not had any experience with such patients. Patients with severe adhesions around the target organ, or unpredictable hemorrhaging, may require additional port placement.

Two matched-control studies have reported that patients undergoing SPLA had significantly lower pain scores or required significantly less
analgesia [7,14]. Jeong et al. [7] reported the first matched case-control study to demonstrate the technical feasibility of laparoendoscopic single site (LESS) adrenalectomy, compared with conventional MPLA, in the removal of a benign adenoma. Nine patients undergoing LESS adrenalectomies were compared with 17 patients undergoing conventional MPLA. No significant differences were found between the groups in terms of mean operating time, blood loss, or postoperative hospitalization. However, the degree of postoperative pain was significantly lower in the SPLA group than in the MPLA group. Our study also demonstrates that the postoperative VAS scores for incisional pain were lower. However, evaluation of postoperative cosmetic outcomes is a challenge, due to the absence of a reliable objective scale. The combination of multiple contributing factors, potential observer bias, and variations in patients’ expectations contributes to difficulties in assessing cosmetic outcomes [15]. In our series, we observed that patients scored the single-wound technique significantly better with regard to cosmetic appearance. However, operating surgeons should consider carefully which patients would be ideal candidates for initial SPLAs.
Conclusions

SPLA is a safe and technically feasible procedure for patients with benign adrenal tumors, and offers a cosmetic benefit, as well. However, further studies are necessary to clearly identify the risks and benefits of this new approach to the adrenalectomy.

Abbreviations


Competing interest

The authors declare that they have no competing interests

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Consent

Written informed consent was obtained from the patient for publication of this report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Author’s contributions

AS conceived the experimental plan, analyzed the data, and drafted the manuscript. NH, OK, KK, MM, and GW helped to draft the manuscript. SB and AU cared for the patients. All authors read and approved the final manuscript.

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Figure legend

Figure 1 Intraoperative view of single-port laparoscopic right
adrenalectomy
Figure 1  Intraoperative view of single-port laparoscopic right adrenalectomy.
Additional files provided with this submission:

Additional file 1: Table 1.doc, 36K
http://www.biomedcentral.com/imedia/1263319691890828/supp1.doc
Additional file 2: Table 2.doc, 35K
http://www.biomedcentral.com/imedia/1926345051890828/supp2.doc
Additional file 3: Table 3.doc, 35K
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Additional file 4: Table 4.doc, 35K
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