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Original Article

Comparison of Standard and Hand-Assisted Laparoscopic Radical Nephrectomy for Renal Cell Carcinoma

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Abstract A laparoscopic radical nephrectomy (LRN) for renal cancer can be performed using two methods, hand-assisted laparoscopic surgery (HALS) and standard laparoscopic surgery (SLS). This institute initially used HALS to perform all radical nephrectomy, but gradually shifted to SLS. This study compared the two methods of radical nephrectomy: HALS vs. SLS, which were performed at a single institute. From March 1999 to November 2006, a total 129 patients with pathologically confirmed renal cell carcinoma underwent LRN, including 73 patients with the HALS and 56 patients with SLS. The median operative time was 264 minutes, and median estimated blood loss was 200ml in the HALS group, respectively. The median operative time and median estimated blood loss in the SLS were 215 minutes and 100 ml, respectively. There was no significant difference in either the operative time or estimated blood loss between HALS and SLS. The median time to both postoperative oral intake and ambulation in the SLS were 1 day. Neither of these events after SLS was significantly shorter than that after HALS. The 4-year disease-free and overall survival rates in the HALS patients were 97.5% and 98.2%, respectively. Both the 4-year disease-free and overall survival rates in the SLS patients were 100%. Since no significant differences were observed between the two operative methods (SLS and HALS) regarding the operative data, postoperative course and oncological outcome, the surgical method for LRN can be selected according to characteristics of each surgical method.

Key words : laparoscopic radical nephrectomy, hand-assist, standard procedure

Introduction

The laparoscopic approach has been used to perform a wide variety of urological procedures^{1)~7)}. A laparoscopic radical nephrectomy (LRN) for renal cancer usually consists of 2 methods, hand-assisted laparoscopic surgery (HALS) and standard laparoscopic surgery (SLS). Both methods have

their own advantages and disadvantages. For example, HALS can be performed easily, even if a surgeon has a little experience in laparoscopic surgery. On the other hand, although it is necessary to be extremely careful in the early period of SLS, it may be easier to perform close dissection with SLS than that with HALS. The ongoing incorporation of the advantages of both HALS and the SLS appears to be useful⁸⁾. To identify any advantages of the HALS technique over the SLS technique in performing a radical nephrectomy the results of

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Table 1 Patient characteristics in the two groups who underwent a laparoscopic radical nephrectomy

	HALS-Nx ¹⁾	SLS-Nx ²⁾	p-value
Period :	1999.3~2005.9	2002.2~2006.11	
No. patients :	73	56	
Gender (Male/Female)	51/22	47/9	NS ³⁾
Age :	62±11.5	62.5±9.7	NS
No. rt/lt tumor :	37/36	27/29	NS
Median tumor size :	4±2.1	3.9±2.3	NS
No. pathological stage			
pT1aN0M0	37	26	
pT1bN0M0	27	19	NS
pT2N0M0	6	6	
pT1-2N1M1	3	5	

¹⁾ HALS-Nx, Hand-assisted laparoscopic radical nephrectomy

²⁾ SLS-Nx, Standard laparoscopic radical nephrectomy

³⁾ NS, not significant

several LRN performed with HALS were therefore compared with those using SLS at a single institute.

Patients and Methods

Between March 1999 and November 2006, 73 and 56 patients with renal cell carcinoma received LRN using HALS and SLS, respectively (Table 1). At this institute we initially performed all of LRN using HALS, and then, gradually shifted to the SLS. Specifically, HALS was used from 1999–2005 and SLS from 2002–2006. During this study, 6 surgeons performed both types of procedures.

The devices and our procedures for LRN using HALS has been described previously⁵⁾. In the HALS methods, the Lap Disc[®] (Hakko Shoji, Tokyo, Japan) was used as the abdominal wall-sealing device, which allowed the surgeon to adjust the iris valve by rotating its ring. The major operative techniques in LRN with SLS were same as for the HALS methods. The renal artery was clipped with either vascular clips or the Hem-o-lok[®] (WECK, USA), and then the renal vein was then divided using either the ENDOGIA[®] (Auto Suture, USA) or Hem-o-lok[®]. The ureter was dissected, secured with the Hem-o-rok[®], and transected.

The kidney, adrenal gland, and Gerota's fascia were freed en bloc, and a mini-incision of approximately 6 cm was made at the camera port in cases using SLS. The resected kidney was inserted into the ENDOCATCH[®] (Auto Suture, USA), and then pulled out in the final step.

The parameters evaluated in the present study include operative time, estimated blood loss (EBL), tumor size, time to oral intake, time to ambulation, hospital stay and complications. The overall survival and disease free survival were also evaluated in the both groups.

The patients were examined every 3 months for up to 5 years postoperatively. All patients underwent a physical examination every 3 months, and a chest-to-abdominal CT scan every 6 months. The disease-free and the overall survival were evaluated by the Kaplan-Meier analysis. Statistical analyses were performed using the Mann-Whitney's U test. Statistical differences were considered significant where $p < 0.05$.

Results

Of the 129 patients investigated, 73 received a radical nephrectomy with HALS. The median operating time was 264 min and the median EBL was 200ml (Table 2). A

total conversion to open surgery was required in three cases with the HALS. The HALS procedure failed because of uncontrollable bleeding from the renal vein in two patients. In one patient, a tumor thrombus was discovered in the renal vein intraoperatively, resulting in conversion to an open surgery. In contrast, a radical nephrectomy using the SLS was performed in 56 patients. The median operative time was 215min, and the median EBL was 100ml (Table 2). There was no significant difference in either the operative time or EBL between the HALS and SLS groups. The median time to both postoperative oral intake and ambulation in the HALS group were 2 days. Neither of these events after HALS was significantly earlier than that after SLS (Table 2). The median hospital stay after HALS was 8 days, which was not significantly shorter than that after SLS. The SLS procedure failed because uncontrollable bleeding from renal vein in one patient.

There were 4 intraoperative complications (5.4%), including the two vascular injuries, a colon injury and a diaphragm injury occurring in the HALS group (Table 3). In addition, 3 patients (4.1%) demonstrated postoperative complications: a paralytic ileus, a port hernia, and an atelectasis (Table 3). In contrast, in the SLS group, there were only 2 intraoperative complica-

tions (3.6%), including a renal artery injury, and a duodenum injury. In addition, 3 patients (5.4%) demonstrated postoperative complications, including liver dysfunction, atelectasis, and pneumonia.

Sixty two patients with HALS were followed up for 11 to 99 months (median 48.5 months). Eleven patients were lost during the follow-up after the operation. Lung metastasis developed in 4 patients at 13, 18, 42, and 43 months postoperatively. Lymph node metastasis developed in a patient at 24 months postoperatively, and adrenal metastasis developed in a patient at 54 months, and two patients died of cancer. No patients demonstrated either local or port site recurrence. The 4-year disease-free and overall survival rates for the patients who underwent HALS were 97.5% and 98.2%, respectively (Figs 1 and 2). On the other hand, 46 patients who underwent SLS were followed up for 3 to 58 months (median 12.8 months). Ten patients were lost during the follow-up after the operation. No patients demonstrated either local or port site recurrence or distant metastasis. Both the 4-year disease-free and overall survival rates with SLS were 100% (Figs 1 and 2). There was no statistically significant difference in either the disease-free or the overall survival rate between the HALS and SLS groups.

Table 2 Operative and postoperative data in the two groups undergoing a laparoscopic radical nephrectomy

	HALS-Nx ¹⁾ (n=73)	SLS-Nx ²⁾ (n=56)	p-value
Median operative time (min.)	264±84	215±79	NS ³⁾
Median estimated blood loss (ml.)	200±268	100±460	NS
Median time to oral intake (days)	2.0±1.2	1.0±0.8	NS
Median time to ambulation (days)	2.0±1.2	1.0±0.6	NS
Median hospital stay (days)	8.0±3.9	8.0±4.7	NS
No. conversions (cases)	3	1	
No. complications (cases)	7	5	

¹⁾ HALS-Nx, Hand-assisted laparoscopic radical nephrectomy

²⁾ SLS-Nx, Standard laparoscopic radical nephrectomy

³⁾ NS, not significant

Table 3 Complications related to a laparoscopic radical nephrectomy

HALS-Nx	SLS-Nx
<i>Intraoperative</i>	<i>Intraoperative</i>
splenic vein injury	renal artery injury
renal vein injury	duodenum injury
colon injury	
<i>Postoperative</i>	<i>Postoperative</i>
ileus	liver dysfunction
atelectasis	atelectasis
port hernia	pneumonia

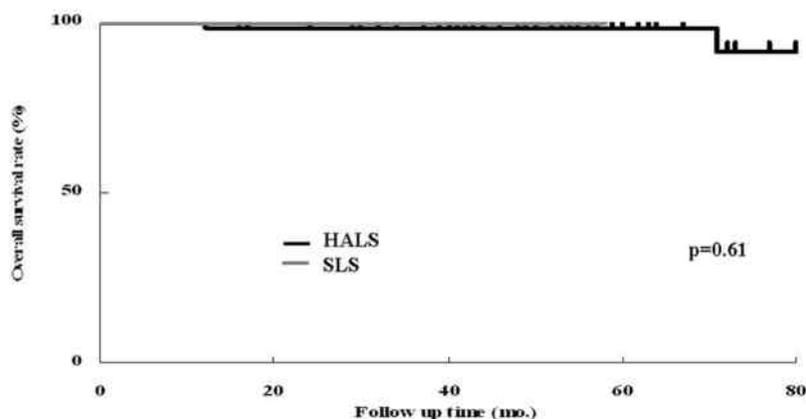
Discussion

The final purpose of LRN is the oncological outcome and the safety which are equivalent to the conventional open radical nephrectomy. There are no reported differences in the oncological outcome between an open and laparoscopic radical nephrectomy^{9)~13)}. There are a few characteristic complications that have been observed with LRN. However, there are many reports that conclude that the frequency of complications is the same with either an open and laparoscopic nephrectomy. Therefore, LRN for renal cancer is now considered to be the standard treatment modality.

The options for performing LRN include the both hand-assisted and the standard methods. A hand-assisted method is considered helpful in selected cases of laparoscopic nephrectomy because it improves the manipulative ability and tactile sense. It

makes the objective detection of the organs easy, and results in a shortened operation time¹⁴⁾. It may make a laparoscopic nephrectomy more appealing to urologists who have no advanced laparoscopic experience. In addition, even if the patients demonstrate uncontrolled hemorrhaging after the renovascular dissection, the surgeon can easily put pressure on the hemorrhage and convert to open surgery⁵⁾.

In some cases, however, it is somewhat difficult to perform such complicated procedures as the dissection of renovascular vessels using HALS. In fact, SLS may have an advantage over HALS in performing such detailed procedures because the surgeon can use the laparoscopic instruments with both hands while performing SLS. In addition, in the retroperitoneal approach with a narrow working space, the SLS methods seems to be more useful than the HALS methods, because the operators hands tend to disturb the operation field in cases undergoing

**Fig. 1** Overall survival with Kaplan-Meier survival analysis

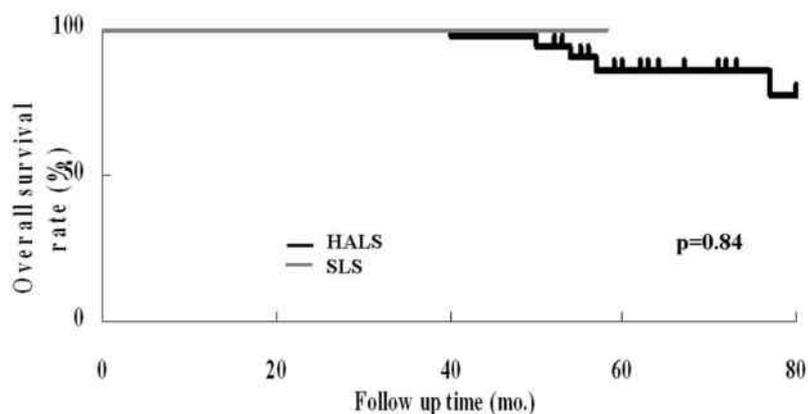


Fig. 2 Disease-free survival with Kaplan-Meier survival analysis

HALS.

Some authors have reported the invasiveness of HALS to be acceptable and almost equivalent to that of SLS^{14)~17)}. The results presented in this study demonstrate that there was no significant difference between the HALS and the SLS regarding the time to oral intake, the time to ambulation and hospital stay. Although there was some concern that the longer incision required for the HALS might diminish the advantages of minimally invasive surgery, however, no statistically significant differences were observed between the two operative methods in the present study. There are many reports demonstrating the operative time in HALS to be shorter than that in the SLS¹⁴⁾¹⁶⁾¹⁷⁾. In the present series, however, there were no significant differences between the operative time for a HALS or a SLS. In this institute, the surgeons tended to begin performing a laparoscopic nephrectomy using the HALS. After acquiring sufficient experience with this procedure, the surgeons switched to SLS. Therefore, the operative time with HALS might have been longer than that described in other reports¹⁴⁾¹⁶⁾¹⁷⁾. Recently, due to the advantages of SLS for performing detailed procedures during LRN this procedure is now the preferred surgical method. A

LRN with HALS is now limited to only cases with large tumors and surgeons lacking laparoscopic experience.

There are several reports detailing the long-term outcome of LRN^{11)~13)}. Cededdu et al. reported the outcome of 157 patients with localized renal cell carcinoma who underwent LRN¹¹⁾. The 5-year disease free rate was 91%. Barrett et al. also reported the outcome in 72 patients. No patients demonstrated progressive disease¹²⁾. Chan et al. also demonstrated the outcome in 67 patients. The 5-year disease-free and overall survival rates were 86% and 95%, respectively¹³⁾. Regarding the hand-assisted laparoscopic radical nephrectomy, the 4-year disease-free and overall survival rates were 88% and 100%, respectively, whereas the 4-year disease-free and overall survival rates using an open radical nephrectomy were 93% and 100%, respectively⁹⁾. These rates were compatible with those in a similar cohort of patients who underwent an open radical nephrectomy^{3)18)~20)}. In cases with HALS, the operator sometimes tends to manipulate the kidney or the tumor. Therefore, the oncological outcome of the HALS group with that of the SLS group was compared. The data indicated there was no significant difference regarding the oncological outcome between HALS and

SLS (Fig 1 and 2).

No significant differences were observed regarding the length of the operative time, the estimated blood loss or the postoperative course between HALS and SLS when performing LRN. These results suggest that the surgical method should be chosen based on the characteristics of each surgical procedure and the operators' skill in performing LRN.

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(和文抄録)

腎癌に対する鏡視下根治的腎摘除術 —standard 法と hand-assist 法の比較—

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【目的】腎癌に対する鏡視下根治的腎摘除術には, ハンドアシスト (hand-assisted laparoscopic surgery : HALS) 法とスタンダード (standard laparoscopic surgery : SLS) 法がある. 鏡視下根治的腎摘除術における HALS 法と SLS 法について比較した. 【方法】99年3月から06年11月までに計129例 (HALS : 73例, SLS : 53例) の鏡視下根治的腎摘除術を行った. 手術成績・術後経過・合併症・非再発率・生存率について比較検討した. 【結果】HALS と SLS の手術時間/出血量は, それぞれ264・215分, および200・100mlであった. 経口摂取・歩行開始までの期間および術後入院期間について差はなかった. HALS における4年非再発率は97.5%, 4年生存率は98.2%であり, SLS の4年非再発率・生存率はともに100%であった. 【結語】手術時間・出血量・術後経過について, HALS と SLS で有意差はなく, それぞれの手術の特徴を考慮し術式を選択すべきと思われた.