

Hand-Assisted Laparoscopy Confers Equal Efficacy in Simple and Radical Nephrectomy

Sutchin R. Patel, MD, Daniel M. Kaplon, MD, Timothy D. Moon, MD,
Sean P. Hedican, MD, Stephen Y. Nakada, MD

ABSTRACT

Background and Objectives: To evaluate outcomes for simple hand-assisted laparoscopic nephrectomy (HALSN).

Methods: A retrospective chart review was performed at our institution for all patients who had undergone HALSN from January 2002 to January 2009. Thirty-three patients underwent HALSN during this time period and were matched with 33 patients who underwent radical hand-assisted laparoscopic nephrectomy (HALRN).

Results: Operative times were similar between both groups (301 vs 286 min for HALSN vs HALRN; $P=.54$). There were no intraoperative or postoperative transfusions in either group. There was one conversion to open nephrectomy in the HALSN group in a patient with xanthogranulomatous pyelonephritis and no conversions in the HALRN group. The mean opioid equivalence requirement was not statistically different between both groups (110 vs 120 for HALSN vs HALRN, $P=.70$). Mean hospital stay was similar for patients undergoing HALSN and HALRN (5.0 ± 3.8 days vs 4.0 ± 1.2 days, $P=.63$). There was 1 major complication in the HALSN group (pulmonary embolus) and no major complications in the HALRN group. Rates of minor complications were comparable between the 2 groups (18% vs 24% for HALSN vs HALRN).

Conclusions: HALSN may be associated with similar operative times and length of postoperative hospital stay as well as comparable complication rates compared to HALRN.

Key Words: Simple hand-assisted laparoscopic nephrectomy, Complications.

INTRODUCTION

Since the first report of laparoscopic nephrectomy by Clayman et al in 1991,¹ laparoscopy has emerged as the standard of care for benign renal disease requiring surgical intervention. Laparoscopic simple nephrectomy has been used to remove the kidney in nonmalignant situations, such as poor renal function in the setting of refractory pain, renovascular disease, congenital UPJ obstruction, and chronic calculus disease with poor renal function, malignant hypertension, chronic pyelonephritis, autosomal dominant polycystic kidney disease, xanthogranulomatous pyelonephritis (XGP), and reflux nephropathy.² However, laparoscopic simple nephrectomy has been regarded as a technically difficult operation in some of these conditions due to the scarring and inflammation that can accompany these nonmalignant conditions. Some have advocated the use of the open approach in these cases feeling that a laparoscopic approach would take longer and be more difficult for these indications. The first reported urologic case of hand-assisted laparoscopic surgery using a sleeve in the United States by Nakada et al³ in 1997 has proven to be an important addition to laparoscopic renal surgery. The tactile feedback and the ability for gentle retraction, dissection, and the compressive abilities of the intraperitoneal hand can further aid the surgeon in more technically challenging cases.^{2,4} Moreover, minimally invasive simple nephrectomy and the tedious dissection required in cases where there is more inflammation and fibrosis due to a history of infection or in cases where the patient has a previous history of abdominal surgery can be simplified with the more tactile approach. Despite the fact that the hand-assisted approach has been available since 1997, there is a dearth of outcome data regarding laparoscopic hand-assisted simple nephrectomy. We present the largest series of simple hand-assisted laparoscopic nephrectomies in the literature to evaluate the feasibility of the procedure with regard to surgical outcomes.

MATERIALS AND METHODS

After institutional review board approval, a retrospective chart review was performed at our institution for all patients who had undergone HALSN from January 2002 to

Department of Urology, University of Wisconsin School of Medicine and Public Health, Madison WI, USA (all authors).

Address correspondence to: Stephen Y. Nakada, MD, Department of Urology, University of Wisconsin School of Medicine and Public Health, G5/348 Clinical Science Center, 600 Highland Drive, Madison, Wisconsin 53792-7375, USA. Telephone: (608) 262-8136, Fax: (608) 262-6453, E-mail: nakada@urology.wisc.edu

DOI: 10.4293/108680811X13071180406556

© 2011 by JSLs, *Journal of the Society of Laparoendoscopic Surgeons*. Published by the Society of Laparoendoscopic Surgeons, Inc.

January 2009. Thirty-three patients underwent HALSN during this time period at our institution by 3 surgeons (TDM, SPH, SYN) and were matched with 33 patients who underwent HALRN during the same time period and by the same surgeons. Even though patients undergoing HALSN and HALRN underwent surgery for different pathologies (benign versus malignant pathology), the purpose of matching HALSN patients to patients undergoing HALRN was to control for the use of the handport.

Patients undergoing HALSN and HALRN underwent the same preoperative regimen. On the day of surgery, they received a dose of preoperative antibiotics, and sequential compression devices were placed on their lower extremities. All patients underwent endotracheal intubation with placement of an orogastric tube to decompress the stomach as well as Foley catheter placement. Hand-assisted laparoscopic nephrectomy was performed via the standard approach.⁵ Veress needle entry was used to establish pneumoperitoneum and to allow more exact placement of the handport. In cases of prior abdominal surgery or where intraabdominal adhesions may be present, the handport incision was created first and pneumoperitoneum established through the GelPort device (Applied Medical, Rancho Santa Margarita, CA). All cases were performed via a transperitoneal approach.

The handport incision with two 12-mm ports was placed, depending on the affected side and the dominant hand of the surgeon. The GelPort device was utilized as the hand-assist device for all of our procedures. Intraabdominal adhesions, when present, were taken down sharply with laparoscopic shears. For HALSN, Gerota's fascia was incised and entered, and the plane between Gerota's fascia and the renal capsule was dissected using the Harmonic scalpel (Ethicon Endosurgery, Cincinnati, OH). In cases where this plane was obliterated by inflammation, the kidney was mobilized outside of Gerota's fascia similar to the approach used for HALRN.

Demographic information, intraoperative parameters, postoperative course and final pathology were all extracted from patient charts. Institutional review board approval was attained for the study. The Student *t* test and Fisher's test were used for statistical analysis, and the level of significance was set at $P < .05$.

RESULTS

Of the 33 patients in each group, there was a statistically significant difference in the mean age of patients and the American Society of Anesthesiologists (ASA) score but not in patient body mass index (BMI) between the 2 groups (**Table 1**). The main indications for surgery in patients who underwent HALSN included flank pain, chronic urinary tract infections, and urolithiasis (**Table 2**).

Thirty-six percent of the patients undergoing HALSN had a previous history of urolithiasis, and all of them had undergone treatment including ureteral stent placement, ureteroscopy, or percutaneous nephrolithotomy (**Table 2**). Twelve patients in the HALSN group had undergone previous abdominal surgery (3 hysterectomies, 2 renal transplants, 1 exploratory laparotomy, 3 appendectomies, 1 radical cystectomy, 2 pyeloplasties) compared to 5 patients in the HALRN group (3 appendectomies, 2 hysterectomies). Incisions for the handport included 16 midline, 8 right lower quadrant (Gibson), 7 left lower quadrant (Gibson), and 2 right upper quadrant (for right HALSN by a left-handed surgeon). The mean renal function of the affected side in patients undergoing HALSN by nuclear renal scan was 9.0%. The mean tumor size for patients undergoing HALRN was 5.0 ± 2.3 cm.

HALSN had similar operative times compared to HALRN (**Table 3**). Despite a statistically significant difference in the operative blood loss between the groups, no transfusions were required. There was one conversion to open surgery in a patient with xanthogranulomatous pyelone-

Table 1.
Demographics

	Simple Hand-assisted Laparoscopic Nephrectomy	Radical Hand-assisted Laparoscopic Nephrectomy	P Value
Male:Female	10:23	17:16	—
Right:Left	20:13	21:12	—
Mean Age	51	63	<.01
Mean ASA	3.1	2.7	<.01
Body Mass Index (kg/cm ²)	34.8	35.8	.42

Table 2.

Indications and Comorbidities for Hand-assisted Laparoscopic Nephrectomy

Indications	No. (%)
Flank Pain	18 (55)
Chronic urinary tract infection	14 (42)
Urolithiasis	9 (27)
UPJ Obstruction	4 (12)
Renal Artery Stenosis	1 (3)
Comorbidities	
Hypertension	14 (42)
Diabetes	3 (9)
History of Urolithiasis	12 (36)
Past Surgical History	
Ureterscopy	5 (15)
Ureteral Stent Placement	11 (33)
Percutaneous Nephrostomy Placement	3 (9)
PCNL	1 (3)
Abdominal Surgery	12 (36)

Table 3.

Intraoperative and Postoperative Comparison of Simple Hand-assisted Laparoscopic Nephrectomy (HALSN) and Radical Hand-assisted Laparoscopic Nephrectomy (HALRN)

	HALSN	HALRN	P Value
Operative			
Operative time (min)	301	286	.54
Estimated blood loss (mL)	123	54	<.01
Conversion to open (n)	1	0	—
Postoperative			
Mean opioid equivalence Requirement	110	120	.70
Mean hospital stay (Days±SD)	5.0±3.8	4.0±1.2	.63
Major complications	1 (3%)	0	—
Minor complications	6 (18%)	8 (24%)	—

phritis due to failure to progress, because of extensive adhesions and fibrosis. The postoperative mean opioid equivalence usage per patient was not different between the 2 groups (110 vs. 120, P=.70). The mean hospital stay

was longer for the HALSN group (5.0±3.8 days vs 4.0±1.2 days) but not significantly different. One patient in the HALSN had a major complication (postoperative pulmonary embolus) compared to no major complications in the HALRN group. Both groups had a comparable minor complication rate (18% and 24% for the HALSN and HALRN groups, respectively). The minor complications in the HALSN included 4 patients with postoperative ileus, 1 patient with new postoperative atrial fibrillation requiring medical conversion to normal sinus rhythm, and 1 patient with postoperative fever and atelectasis. The 8 minor complications in the HALRN group included 2 patients with postoperative ileus, 1 patient with postoperative atrial fibrillation requiring medical conversion to normal sinus rhythm, 1 patient with urinary retention, 3 patients with postoperative fever and atelectasis, and 1 superficial wound infection treated with oral antibiotics. Pathology specimens for the HALSN patients revealed no evidence of malignancy in all of the specimens with 67% (n=22) of the patients having evidence of chronic pyelonephritis and 3% with XGP (n=1).

DISCUSSION

The presence of inflammation and fibrosis in benign renal conditions can make laparoscopic simple nephrectomy a technically challenging procedure. The operative times and the conversion rates to open surgery in these cases have been reported to be higher compared to those with noninflammatory renal conditions.⁶ Duarte et al⁷ retrospectively compared 50 laparoscopic simple nephrectomies for inflammatory causes (based on pathology) with 29 simple nephrectomies in noninflammatory kidneys. They found a significantly higher conversion rate to open surgery in the inflammatory kidneys (28% vs 3%) as well as a higher transfusion rate (12% vs 0%). The length of hospital stay for patients undergoing simple laparoscopic nephrectomy in patients with inflammatory conditions was longer than that with noninflammatory conditions (8.3 vs 3.2 days).

Wolf et al⁸ were the first to compare patients undergoing hand-assisted versus standard laparoscopic nephrectomy. In patients with inflammatory renal conditions, they found that the mean operative times for hand-assisted laparoscopic nephrectomy were significantly shorter than with standard laparoscopic nephrectomy (229 vs 348 minutes).

They also found no significant difference in the time to resumption of oral intake, length of hospital stay, analgesic requirements, and pain score between the standard and hand-assisted laparoscopic nephrectomy groups.

Tan et al⁹ present the only other HALSN series in the literature. Their series compared 22 cases of HALSN of

inflammatory renal causes to 24 patients who underwent HALRN for renal tumor. Patients undergoing HALSN for inflammatory renal conditions had a 45% complication rate (15% major complications, 30% minor complications). The major complications consisted of conversion to open surgery for bleeding, an intraoperative diaphragm injury that was recognized and fixed laparoscopically, and a death due to postoperative gastrointestinal bleeding in a patient with gastroduodenal ulcers in a setting of Zollinger-Ellison syndrome. The minor complications included ileus, pneumonia, mild pancreatitis, temporary renal impairment, and venous thrombosis of an upper extremity. In comparison, patients undergoing HALRN had a 21% complication rate (13% major, 8% minor). The mean length of hospital stay was 7.2 days vs 4.7 days for the inflammatory versus renal tumor group.

Our study showed that HALSN for inflammatory renal conditions has comparable outcomes to those with hand-assisted laparoscopic nephrectomy for renal tumors. Both the HALSN and HALRN had similar complication rates (both major and minor complications), only one patient undergoing HALSN underwent conversion to open surgery compared to no conversions to open in the HALRN group, and no patients in either group required a transfusion. The analgesic requirements for both groups were similar. The combination of a higher number of patients in the HALSN group with previous abdominal surgery (12 vs 5 patients) and the inflammatory renal cause may account for the larger number of patients with postoperative ileus in the HALSN group (4 vs 2 patients) and the longer length of hospital stay in these patients. The rate of conversion to open in our

study is slightly better and our complication rates are comparable to those of other contemporary laparoscopic simple nephrectomy series. (Table 4).^{7,9,10-16} Despite our comparable complication rates to rates of other series, it is important to recognize that our HALSN series was performed by 3 experienced laparoscopic surgeons. We urge caution in proceeding with more challenging cases in those with less laparoscopic experience.

Other studies have shown significantly higher operative times in patients undergoing simple nephrectomy for inflammatory renal conditions compared to standard nephrectomy. The overall operative times for patients in our study undergoing HALSN was longer than that for HALRN, though the difference was not statistically significant (301 vs 286 min; $P=.54$). The operative time for both groups in our series may be due to a number of different factors. The measurement of overall operative time in the medical records included both anesthesia and operative times. The operating room setting for the cases performed were in a training institution, so both the anesthesia time and operative times may be increased due to teaching residents throughout these cases. There was variability between the overall operative times in this study. The average overall operative time for one surgeon in the study was 384 minutes (15 cases), while the average overall operating room time for the remaining 2 surgeons (18 cases) was 232 minutes. The overall estimated blood loss was relatively low, and this may be due to more meticulous dissection in some cases. Finally, it should be noted that though there was no difference in the BMI between groups, both patient populations were obese ($BMI > 30\text{kg/}$

Table 4.
Comparison of Different Techniques for Laparoscopic Simple Nephrectomy

Study	Year	Technique ^a	No. Cases	Conversion (%)	Complications (%)
Kim et al ¹⁰	2009	TP	80	2 (3) Open	8 (10)
Hsiao et al ¹¹	2008	RP, TP	25 RP 17 TP	3 (7) Open 3 (7) RP→TP	14 (33) [21% Major, 12% Minor]
Duarte et al ⁷	2008	Lap	50	14 (28) Open	2 (10)
Kapoor et al ¹²	2006	TP	10	2 (20) Open	1 (10)
Tan et al ⁹	2004	HALN	22	1 (5) Open	9 (45) [15% Major, 30% Minor]
Xu et al ¹³	2004	RP	12	0	0
Gupta et al ¹⁴	2004	RP	351	22 (6) Open	47 (13) [1% Major, 12% Minor]
Shekarriz et al ¹⁵	2001	TP	12	2 (17) Open	0
Gaur et al ¹⁶	2000	RP	38	6 (16) Open	17 (45)

^aHALN=Hand-Assisted Laparoscopic Nephrectomy; RP=Laparoscopic Retroperitoneal Nephrectomy; TP=Laparoscopic Transperitoneal Nephrectomy; Lap=Laparoscopic Nephrectomy (number of RP and TP cases in series not reported).

m²), which may increase anesthesia time (difficult intubation), time for positioning, as well as operative time (increased time for dissection) in both groups.

CONCLUSIONS

HALSN may be associated with similar operative times and length of postoperative hospital stay as well as comparable complication rates compared to HALRN. HALSN presents a practical approach in cases of inflammatory renal conditions (XGP, pyonephrosis, chronic pyelonephritis) or in patients with previous abdominal surgery. Tactile feedback can further aid the surgeon when tissue planes are obscured due to inflammation and multiple adhesions. Hand assistance may be the minimally invasive approach of choice in simple nephrectomy when significant scarring or surgical complexity is expected.

References:

1. Clayman RV, Kavoussi LR, Soper NJ, et al. Laparoscopic nephrectomy: initial case report. *J Urol*. 1991;146:278–282.
2. Liao JC, Breda A, Schulam PG. Laparoscopic renal surgery for benign disease. *Curr Urol Rep*. 2007;8:12–18.
3. Nakada SY, Moon TD, Gist M, et al. Use of the Pneumo Sleeve as an adjunct in laparoscopic nephrectomy. *Urology*. 1997;49:612–613.
4. Hedican SP. Complications of hand-assisted laparoscopic urologic surgery. *J Endourol*. 2004;18:387–396.
5. Auge BK, Albala DM. Hand-assisted laparoscopic approach to simple nephrectomy. *J Endourol*. 2004;18:333–336.
6. Richstone L, Seideman C, Baldinger L, et al. Conversion during laparoscopic surgery: frequency, indications and risk factors. *J Urol*. 2008;180:855–859.
7. Duarte RJ, Mitre AI, Chambo JL, Arap MA, Srougi M. Laparoscopic nephrectomy outside Gerota fascia for management of inflammatory kidney. *J Endourol*. 2008;22:681–685.
8. Wolf JS, Moon TD, Nakada SY. Hand assisted laparoscopic nephrectomy: comparison to standard laparoscopic nephrectomy. *J Urol*. 1998;160:22–27.
9. Tan YH, Siddiqui K, Preminger GM, Albala DM. Hand-assisted laparoscopic nephrectomy for inflammatory renal conditions. *J Endourol*. 2004;18:770–774.
10. Kim BS, Yoo ES, Kwon TG. Complications of transperitoneal laparoscopic nephrectomy: A single-center experience. *Urology*. 2009;73:1283–1287.
11. Hsiao W, Pattaras JG. Not so “simple” laparoscopic nephrectomy: Outcomes and complications of a 7-year experience. *J Endourol*. 2008;10:2285–2290.
12. Kapoor R, Vijjan V, Singh K, et al. Is laparoscopic nephrectomy the preferred approach in xanthogranulomatous pyelonephritis? *Urology*. 2006;68:952–955.
13. Xu Z, Xin M, Hong-Zhao L, Zhong C, Li LC, Ye ZQ. Retroperitoneoscopic subcapsular nephrectomy for infective non-functioning kidney with dense perinephric adhesions. *BJU Int*. 2004;94:1329–1331.
14. Gupta NP, Goel R, Hemal AK, et al. Should retroperitoneoscopic nephrectomy be the standard of care for benign nonfunctioning kidneys? An outcome analysis based on experience with 449 cases in a 5-year period. *J Urol*. 2004;172:1411–1413.
15. Shekarriz B, Meng MV, Lu H, Yamada H, Duh Q, Stoller ML. Laparoscopic nephrectomy for inflammatory renal conditions. *J Urol*. 2001;166:2091–2094.
16. Gaur DD. Simple nephrectomy: Retroperitoneal approach. *J Endourol*. 2000;14:787–790.