

Renal Pedicle Vessel Control During Transperitoneal Laparoscopic Nephrectomy Using Hem-o-lok Clips With and Without LigaSure Sealing

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ABSTRACT

INTRODUCTION: The technique used to control and divide the renal vessels during laparoscopic nephrectomy is critical to successful surgical outcomes. The aim of this study was to compare renal pedicle vessel control using (1) Hem-o-lok clips with a LigaSure vessel sealing system, and (2) Hem-o-lok clips without LigaSure.

METHODS: A total of 20 patients underwent unilateral transperitoneal laparoscopic nephrectomy between February 2007 and February 2008. They were divided nonrandomly into 2 groups. Group 1 (n = 10) underwent laparoscopic nephrectomy using Hem-o-lok clips and the Valleylab LigaSure™ vessel sealing system; group 2 (n = 10) underwent laparoscopic nephrectomy using Hem-o-lok clips without LigaSure. Outcome variables were compared across groups using Mann-Whitney tests.

RESULTS: The mean operative time was significantly shorter for patients in group 1 ($P < .0001$). Clip time was significantly shorter for patients in group 1 ($P < .0001$). Transection time was significantly shorter for patients in group 2 ($P < .0001$). There were no significant group differences in total pedicle dissection time ($P > .05$). Subcutaneous emphysema and intraabdominal adherence were the only complications recorded, and there were no significant group differences in their occurrence. There was no conversion to open surgery in either group. There was no significant group difference in mean length of hospitalization.

CONCLUSION: Results of the present study showed that using the LigaSure vessel sealing system for laparoscopic nephrectomy can decrease operative time. The shorter operative time is attributed to easier control of bleeding and a reduced number of instrument exchanges when using the LigaSure device.

INTRODUCTION

Laparoscopic nephrectomy has become a valid option for both benign and malignant diseases of the kidney [1]. The first clinical report was recorded by Clayman and colleagues in 1991 [2]. However, several major problems with this procedure have been reported, including longer operative time than open surgery and the need for a sufficiently experienced surgeon [1,3,4].

The technique used to control and divide the renal vessels is

critical to successful surgical outcomes. The options for control of bleeding during laparoscopic nephrectomy are more limited than they are during the open surgery approach [1].

Exclusive use of Hem-o-lok clips for both the renal artery and vein is uncommon. Most surgeons rely on automated titanium clips for the artery and a vascular stapling device for the veins [5]. A 1.7% device malfunction rate for both the stapler and Hem-o-lok clip has been reported [1,5]. Although this is not a high rate, malfunction can lead to serious complications

KEYWORDS: LigaSure; Laparoscopic nephrectomy; Renal pedicle control; Hem-o-lok clip

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resulting in conversion to open surgery or sometimes death [1,6,7].

An ideal approach for management of bleeding during laparoscopic nephrectomy is not yet defined. The purpose of the present study was to compare renal pedicle vessel control during laparoscopic nephrectomy using (1) Hem-o-lok clips with a LigaSure vessel sealing system, and (2) Hem-o-lok clips without LigaSure.

METHODS

Participants

The participants were 20 patients who underwent unilateral transperitoneal laparoscopic nephrectomy between February 2007 and February 2008. The patients were nonrandomly assigned to 2 groups. Group 1 (n = 10) underwent laparoscopic nephrectomy using Hem-o-lok clips and the Valleylab LigaSure™ vessel sealing system (Valleylab; Tyco Healthcare Group LP, Boulder, CO, USA); group 2 (n = 10) underwent laparoscopic nephrectomy using Hem-o-lok clips without LigaSure.

The mean (standard deviation) ages were 47.1 (16.8) years and 34.2 (15.5) years for patients in group 1 and group 2, respectively. There were 3 males and 7 females in group 1; there were 4 males and 6 females in group 2. The unilateral nephrectomy was on the right side for 7 of the patients in group 1 and 6 of the patients in group 2. The mean intraabdominal pressure was 16 mmHg and 15 mmHg for patients in group 1 and group 2, respectively. There were no significant group differences in age, sex distribution, nephrectomy side, or intraabdominal pressure ($P > .05$).

Surgical Procedures

All patients had placement of a nasogastric tube and urethral catheter. General anesthesia was used. The surgeons performed the nephrectomy with a transperitoneal approach. They used 10 mm trocars (quantity = 2) and 5 mm trocars (quantity = 1 or 2) in both groups. After entrance to the abdomen along the Told line, colon mobilization was performed. The surgeons then found the ureter, used it as handle, and dissected to the lower renal pole. They initially exposed the vein and then exposed the artery; both were dissected.

Laparoscopic nephrectomy using Hem-o-lok clips and the LigaSure vessel sealing system. The proximal part of the ureter and adrenal, spermatic, and lumbar veins were ligated and transected with the LigaSure device. The renal pedicle was ligated and transected with the LigaSure after using 2 Hem-o-lok clips for the artery and 2 Hem-o-lok clips for the vein. The surgeons used the LigaSure tip for dissection of the ureter,

lower renal pole, pedicle, upper renal pole, and both sides of the kidney. They did not place any clips in the distal part of the arteries and veins. Figure 1 shows the Hem-o-lok clip ligation of the proximal portion of the renal artery and vein. The LigaSure helped to seal the distal part of both vessels. The primary renal lymphoma and xanthogranulomatous pyelonephritis were placed in an EndoCatch™ bag (Auto Suture, Norwalk, Connecticut, USA) and removed through a 5 cm incision in the lower abdomen.

Laparoscopic nephrectomy using Hem-o-lok clips without LigaSure vessel sealing. Three Hem-o-lok clips were used for ligation of the renal artery and vein. The ureter and adrenal, spermatic, and lumbar veins were clamped with Hem-o-lok clips (1 on the proximal part; 1 on the distal part). The surgeons placed clips on the distal part of the arteries and veins and did not use LigaSure. All parts of the kidney were removed through a 4-6 cm incision in the lower abdomen. Hydronephrotic kidneys were removed through a 10 mm port.

Data Analysis

Clip time was defined as the time between placing the clip in the clip applicator and locking it on the vessel. *Transection time* was defined as the time between placement of the instrument and transection of the vessel. *Pedicle dissection time* was defined as the time between visualizing and separating the vessels.

Figure 1. Hem-o-lok Clip Ligation of the Proximal Portion of the Renal Artery and Vein, With LigaSure Helping to Seal the Distal Part of Both Vessels.

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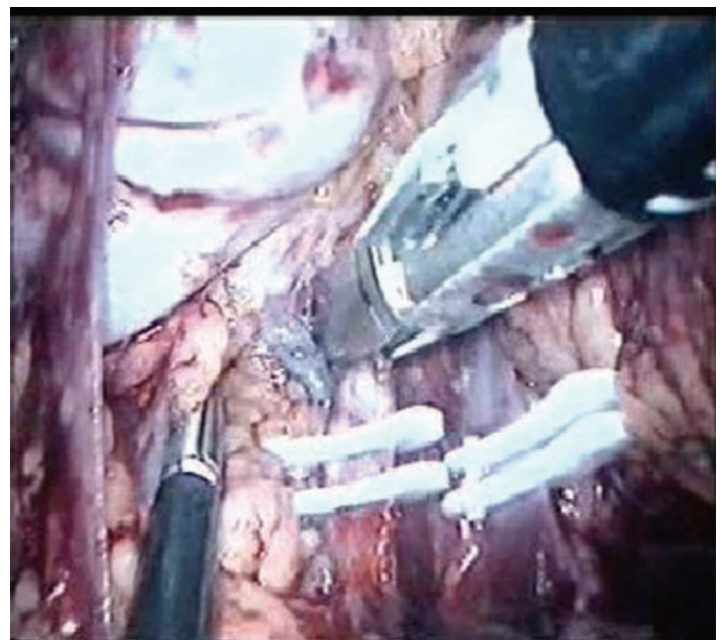


Table 1. Intraoperative, Clip, Transection, and Pedicle Dissection Times for Patients Receiving Laparoscopic Nephrectomy With and Without LigaSure Vessel Sealing (N = 20).

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Outcome Measure	Laparoscopic Nephrectomy With LigaSure (n = 10)			Laparoscopic Nephrectomy Without LigaSure (n = 10)			p ^b
	Mean	SD	Mean Rank	Mean	SD	Mean Rank	
Total operative time (min)	108.5	2.8	5.5	124.2	2.7	15.5	<.0001
Clip time (sec)	71.1	8.2	5.5	320.1	12.1	15.5	<.0001
Transection time ^a (sec)	18.3	1.3	15.5	13.3	1.7	5.5	<.0001
Total pedicle dissection time (min)	15.8	4.0	7.0	22.4	4.6	14.0	>.05

Abbreviation: SD, standard deviation.

^aLigation and transection time in group with LigaSure; transection time in group without LigaSure.

^bProbability values for group comparisons based on Mann-Whitney tests.

Clip time, transection time, pedicle dissection time, operative time, conversion rate, intraoperative complications, and postoperative discharge time were calculated. The 2 groups were compared on these variables using Mann-Whitney tests. Group differences with $P < .05$ were considered significant.

RESULTS

Table 1 contains the results of the intraoperative time, clip time, transection time, and pedicle dissection time. The mean intraoperative time was significantly shorter for patients in group 1, receiving laparoscopic nephrectomy with LigaSure, when compared with patients in group 2 ($P < .0001$). Clip time was significantly shorter for patients in group 1 ($P < .0001$). Transection time was significantly shorter for patients in group 2 ($P < .0001$). There were no significant group differences in total pedicle dissection time ($P > .05$).

The mean (standard deviation) postoperative hospital stay was 3.4 (2.3) days and 2 (0.8) days for patients in group 1 and group 2, respectively. There was no significant group difference ($P > .05$).

Table 2 contains the number of patients with perioperative complications in each group. Subcutaneous emphysema and intraabdominal adherence were the only complications recorded, and there were no significant group differences in their occurrence ($P > .05$). There were no cases of organ injury, nerve injury, or wound infection. There was no conversion to open surgery in either group.

DISCUSSION

Nephrectomy has become the most common laparoscopic urologic procedure, achieving results similar to those of open nephrectomy in safety, efficacy, and economy. Although the laparoscopic approach hastens recovery and decreases

patient discomfort, it requires longer operative times than open surgery [3]. The extent of the surgeon's experience and use of various devices during laparoscopy can decrease the intraoperative time. However, the advent of laparoscopic surgery has created new technical challenges and problems [3]. Controlled dissection and ligation of the renal pedicle is the most challenging procedure and an important step during laparoscopic nephrectomy.

Recently, authors reported the use of clips in securing the renal artery [1]. Venous control can be achieved by using an endostapler, or by locking the vessel using clips or a combination of sutures and clips [1]. Although traditional methods such as monopolar electrocautery and titanium clips are sufficient for smaller vessels and nonvascular tissues, alternative techniques typically are necessary for the renal artery and vein. Suture ligation with either extracorporeal or intracorporeal knot formation is feasible but cumbersome [8]. Concomitant use of Hem-o-lok clips and a knot pusher for extracorporeal ligation was suggested by Janetscheck et al [9]. Baldwin and colleagues [10] described the reliability of Hem-o-lok clips during hand-assisted laparoscopic donor nephrectomy, with attention on the control of both the artery and the vein with nonabsorbable polymer ligating (NPL) clips. Each of these methods has some problems. A well known shortcoming is the risk of titanium clip dislodgement or endostapler failure in different phases [6,7]. Stapling devices have a potential for misfire [10]. Zafar and Dunn [5] reported that in 1 case (1.7% of N) a Hem-o-lok clip slipped from a branch of the renal vein with no serious sequelae.

Although laparoscopic management is possible when failure is recognized, delayed failure and bleeding is more common and may necessitate urgent exploration with a potential for significant morbidity [8]. The LigaSure vessel sealing system

Table 2. Perioperative Complications for Patients Receiving Laparoscopic Nephrectomy With and Without LigaSure Vessel Sealing (N = 20). doi: 10.3834/uij.1944-5784.2010.04.10ft2

Complication	Laparoscopic Nephrectomy With LigaSure (n = 10)	Laparoscopic Nephrectomy Without LigaSure (n = 10)
	n	n
Intraabdominal adherence	2	3
Subcutaneous emphysema	0	1
Perforation of gastrointestinal tract	0	0
Vascular trauma	0	0
Conversion to open surgery	0	0

seems to provide a consistent, reliable, permanent seal of veins, arteries, and tissue bundles by fusing the collagen in vessel walls. It is a microprocessor-based bipolar generator that is applied under pressure.

In the present study, the mean operative time was 108.5 minutes for the group receiving laparoscopic nephrectomy with LigaSure, and 124.2 minutes for the group without LigaSure. The group difference was statistically significant. In a similar study, mean operative time in groups with and without Ligasure was 68 minutes and 164 minutes, respectively, which also reflected a significant group difference [3]. In both the present and previous studies, the group differences in mean hospital stay were not significant. The LigaSure decreases operating time and blood loss by reducing the number of sutures and the number of instrument exchanges in the operating theater [3].

Izaki et al [11] found that renal pedicle ligation time with Hem-o-lok clips (mean 3 clips) was 167 seconds. In the present study, the mean clip and mean transection times were 71.1 and 18.3 seconds, respectively, for the group receiving LigaSure, and 320.1 and 13.3 seconds, respectively, when LigaSure was not used. The group differences were significant. In summary, the present study showed that using the LigaSure device significantly decreased operative time and clip times, but transection times were significantly shorter when the LigaSure device was not used. There were no significant group differences in total pedicle dissection time.

In laparoscopic nephrectomy, dissection of the ureter, kidney, pedicle, gonadal vessel, lumbar vein, and adrenal vein can be performed with the LigaSure tip. The LigaSure device can help dissect the pedicle and is similar in use to a finger tip. The present authors used 2 Hem-o-lok clips for the artery and 2 Hem-o-lok clips for the vein. They then used LigaSure for renal

vessel ligation and transection. Using this method decreased vessel ligation time and resulted in no venous backflow. The LigaSure can ligate vessels up to 7 mm, so the urologist can easily control minor vessel bleeding during the nephrectomy. In the present study, 2 accessory renal veins were only ligated with the LigaSure device.

Knowledge of the complications resulting from laparoscopic renal surgery aids in providing patients with true informed consent and realistic surgical expectations [12]. Complications from urological laparoscopic procedures were assessed in one study that was performed at a single high-volume center during a 12-year period [13]. The authors found that vascular injuries were the most common intraoperative complications. These may occur in laparoscopic nephrectomy [14]. In the present study, the most common complication was intraabdominal adherence. No vascular complications were found, and there was no significant blood loss or need for transfusion.

Conversion to open surgery may be due to bleeding from a splenic laceration, poor visualization of the renal hilum, or other complications. Kanno et al [14] reported a conversion from laparoscopic to open surgery in 2.6% of their cases; Poulsen et al [15] reported a conversion rate of 7%. In the present study, none of the patients required conversion to open surgery. These results may be due to the small number of patients in the present study. The authors acknowledge limitations of the present study in the small number of patients treated and the nonrandomization of patients into groups.

CONCLUSION

Results of the present study showed that using the LigaSure vessel sealing system for laparoscopic nephrectomy can decrease operative time. The shorter operative time is attributed to easier control of bleeding and a reduced number of instrument

exchanges. Although the LigaSure device may be expensive, it appears to be a useful tool for any laparoscopy department.

Conflict of Interest: none declared

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