

Renal pedicle control in laparoscopic donor nephrectomy: Evaluation of a single-center experience

Moayid Fallatah, Abdullah W Aldughiman¹, Abdulrahman S Binjawhar¹, Bader A Melaibary¹, Hossam S El-Tholoth¹, Abdullah S Al-Gadheeb¹, Ahmad Y Alzahrani¹, Tarek M Zahrani¹, Hamad S Alakrash¹

Department of Urology, King Faisal Specialist Hospital and Research Center, ¹Department of Urology, Prince Sultan Military Medical City, Riyadh, Saudi Arabia

Abstract

Introduction and Study Purpose: Renal pedicle control is a crucial period in laparoscopic donor nephrectomy (LDN). Till now, there is no standardized technique for renal pedicle control. Proper evaluation and investigation of the different ways of renal vessel control have to be done to avoid any calamitous event. We aim to prove the safety and reliability of the Hem-o-Lok clips for the renal vascular control in transperitoneal LDN.

Methods: All LDNs or hand-assisted LDNs done between January 2016 and December 2018 were collected. The primary outcome was the safety of the Hem-o-Lok clips. The secondary outcomes were blood loss, ischemia time, hospital stay, cost, and operative time. The data were analyzed using SPSS 20, and a statistical package was conducted.

Results: The data showed that 238 laparoscopic donor nephrectomies were done. The renal pedicle control during the 1st year was done using a vascular stapler for the artery (63 cases) and two polymer self-locking clips extra-large (XL) for the vein. Two events were reported in the form of mechanical failure. In the following 2 years, the artery was controlled using polymer self-locking clips large (L) few millimeters distal to the aorta and two metallic clips distal to it to increase the safety and stability of the vascular stump (175 cases). However, the vein was controlled by the two polymer self-locking clips XL. There was no reported intraoperative complications or events related to this way of pedicle control; there was no open conversion or blood transfusion required. There was no postoperative complication or collection in ultrasound.

Conclusion: Using a combined polymer self-locking clip few millimeters distal to the aorta and two metallic clips distal to it for renal artery control in laparoscopic donor nephrectomies is cost-effective and safe. However, further and broader evidenced base studies are still needed to establish a standard technique for renal pedicle control.

Keywords: Nephrectomy, laparoscopy, renal pedicle, staplers, clips

Address for correspondence: Dr. Moayid Fallatah, Department of Urology, King Faisal Specialist Hospital and Research Center, MBC 83 P.O. Box 3354, Riyadh 11211, Saudi Arabia.

E-mail: moayidomar@gmail.com

Received: 28.03.2020, **Accepted:** 16.08.2020, **Published:** 15.02.2022.

INTRODUCTION

In Saudi Arabia, the estimated number of patients with end-stage renal disease (ESRD) is around 17,687.^[1] As

renal transplant is the definitive management of ESRD, minimally invasive living donor nephrectomy has

| Access this article online | |
|---|-----------------------------------|
| Quick Response Code: | Website: www.urologyannals.com |
|  | DOI: 10.4103/UA.UA_34_20 |

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Fallatah M, Aldughiman AW, Binjawhar AS, Melaibary BA, El-Tholoth HS, Al-Gadheeb AS, *et al*. Renal pedicle control in laparoscopic donor nephrectomy: Evaluation of a single-center experience. *Urol Ann* 2022;14:152-5.

become one of the most performed major operations in Saudi Arabia. According to the Saudi Center for Organ Transplantation, the number of kidney transplants that were done from living donors is 776 in 2017. The first laparoscopic living donor nephrectomy was performed by Ratner *et al.* in 1995.^[2] Since then, minimally invasive living donor nephrectomy has continued to introduce multiple approaches and multiple techniques. Renal pedicle control is a crucial step in laparoscopic donor nephrectomy (LDN). Although stapler's use is a US Food and Drug Administration (FDA)-approved method for renal pedicle control,^[3] many surgeons still elect to control the renal pedicle with surgical clips for various reasons. Until now, there is no standardized technique for renal pedicle control; we aim to prove the safety and reliability of the Hem-o-Lok clips for renal vascular control in LDN.^[4-8]

METHODS

Via single-center retrospective approach, and after taking the approval of the research ethics committee (No: 987-09/2017), all LDNs or hand-assisted LDNs which were done in Prince Sultan Military Medical City between January 2016 and December 2018 were collected. Demographic data, intraoperative way of pedicle control, blood loss, transfusion requirement, ischemia time, intraoperative events, and postoperative complications were reported. A total of 238 patients were included. 63 cases of LDN were done in the 1st year where the renal artery was controlled using the vascular stapler, and the renal vein was controlled by two polymer self-locking clips XL. In the following 2 years, 175 cases of LDN were done. We adopted to control the renal artery using polymer self-locking clips L few millimeters distal to the aorta and two metallic clips distal to it to increase the safety and stability of the vascular stump. However, the renal vein still was controlled by two polymer self-locking clips XL. In both techniques, the renal vessels were dissected till their origin in the aorta and vena cava. The primary outcome was the safety of the Hem-o-Lok clips. The secondary outcomes were blood loss, ischemia time, hospital stay, cost, and operative time. The data were analyzed using SPSS 20, and a statistical package was conducted including categorical variables that were assessed by frequencies and percentages. Medians and standard deviation were used for descriptive statistics. The analysis of the perioperative variables was performed using Pearson's Chi-square test for categorical variables and the Mann-Whitney nonparametric test for numerical variables.

RESULTS

238 LDNs were done in this period between January

2016 and December 2018. 183 males and 55 females were included in the study with an age range between 18 and 54 years (mean 32.2) and an average body mass index of 30.8. With regard to laterality, left-sided nephrectomy was done in the vast majority (233 patients), while the right-sided nephrectomy was done only in 5 patients [Table 1]. The renal artery control during the 1st year was done using a vascular stapler (63 cases). Among these 63 cases, we encountered two technical issues. They were inform of staplers' jaws refused to open. Fortunately, in both cases, the surgeon's hand was inside and the jaws were opened manually. In the following 2 years (from February 2017 to December 2018), the artery was controlled using polymer self-locking clips large (L) few millimeters distal to the aorta and two metallic clips distal to it (175 cases). However, the vein was controlled by the two polymer self-locking clips extra-large (XL) all over the study period. Using the latter technique, there was no reported intraoperative complications, no open conversion was done, and no blood transfusion was required. When comparing the difference between the two techniques, the only

Table 1: demographics and Intraoperative findings

| Parameters | Value |
|--|-------------|
| Gender | |
| Male | 183 |
| Female | 55 |
| Age (Mean) | 32.2 |
| Body Mass Index (mean) | 30.8 |
| Total | 238 cases |
| Left Nephrectomy | 233 cases |
| Right Nephrectomy | 5 cases |
| Technique | |
| Hand assisted Laparoscopic Nephrectomy | 78 cases |
| Laparoscopic Nephrectomy | 160 cases |
| Renal artery control with stapler | 63 cases |
| Renal artery control with clips | 175 cases |
| Renal vein control with XL clips | 238 cases |
| Warm Ischemia Time (mean) | 192 seconds |
| Operative time range | 142 min |
| Blood Loss (mean) | 75 ml |

Table 2: Comparison between stapler control and clipping control

| Parameters | Clip control (n=175) | Stapler control (n=63) | P |
|------------------------------------|----------------------|------------------------|--------|
| Age (years) | 30.5±6.9 | 31.6±6.7 | 0.28 |
| Side | | | |
| Left | 172 | 61 | 0.92 |
| Right | 3 | 2 | 0.49 |
| Body mass index | 29.7±3.7 | 29.8±3.8 | 0.86 |
| Warm ischemia time (s) | 188±39 | 198±38 | 0.08 |
| Operative time (min) | 138±36 | 145±38 | 0.19 |
| Blood loss (ml) | 74±34 | 73±35 | 0.69 |
| Conversion to open | 0 | 0 | - |
| Average pedicle control cost (USD) | 44±15 | 780±20 | <0.001 |
| Hospital stay (days) | 3.3±1.3 | 3.4±1.2 | 0.59 |
| Death | 0 | 0 | - |

significance was the cost-effectiveness in favor of the clipping technique [Table 2]. From the recipient side data, there were no difficulties or complications related to the artery length because of the efforts done to dissect as much as possible to provide the maximum vessel length.

DISCUSSION

Renal pedicle control is the most critical step in minimally invasive renal surgery and it is considered as the determinant factor for the procedure success. From patient safety and graft quality perspectives, renal pedicle control with staplers versus Hem-o-Lok clips has been a topic of debate over the past couple of years in LDN.

After reviewing the FDA database from January 1992 to May 2007, Hsi *et al.* reported the estimated overall failure rate of 3.0% for staplers and 1.7% only for locking clips.^[9] In addition, other studies reported that the malfunction rate of staplers ranged from 0.2% to 1.1%.^[10,11] Nevertheless, the FDA considered the staples as a gold standard for pedicle control in LDN since hem-o-Lok clips use was associated with more morbidity and mortality secondary to slippage and dislodgment.^[3,9,12-16] Despite that, many surgeons nowadays are still adopting controlling the renal pedicle with Hem-o-Lok clips.

Ping *et al.* evaluated 116 laparoscopic nephrectomies using Hem-o-Lok clips for renal pedicle control from January 2004 to May 2009.^[4] No vascular complications or other clip-related complications occurred.

In Iran, Simforoosh *et al.* developed their own way to control the pedicle for 241 patients from July 2005 to January 2007.^[5] One 10-mm Hem-o-Lok clip was applied on the renal artery a few millimeters distal to the root from the aorta, and a medium-large titanium clip was applied distal to the Hem-o-Lok clip using a nonautomatic firing applicator. The renal vein was controlled with one 12-mm and one 10-mm Hem-o-Lok clip. Of note, they encountered no vascular or clip-related complications. In addition, Simforoosh *et al.* included 1834 nephrectomies in their study where they controlled the renal pedicle with one Hem-o-Lok clip and a medium-large titanium clip distal to it. With this technique, only one vascular complication occurred consisting of a delayed presentation of postoperative hematoma secondary to minimal abrasion on the root of the renal artery. They attributed this complication to the Hem-o-Lok clip being placed very close to the aorta. Consequently, they adopted to place the Hem-o-Lok clip a few millimeters distal to the aorta and a titanium clip

distal to it. After this modification, 938 cases were done without any reported vascular complication. Eventually, they concluded that Hem-o-Lok and titanium clips for vascular control in laparoscopic nephrectomy are safe when applied by trained surgeons and according to published safety guidelines.^[8]

One additional study was done by Baumert *et al.* in France from June 2002 to July 2005 where 130 consecutive laparoscopic nephrectomies were done using the Hem-o-Lok clip to control the renal pedicle. No vascular complication was reported nor clips failure.^[6]

A multi-institutional retrospective review of all laparoscopic nephrectomies in which Hem-o-Lok clips were used to control the renal vasculature was done by Ponsky *et al.* between October 2001 and June 2006.^[7] 1695 cases were included from 9 different centers and no clips have failed. They concluded that Hem-o-Lok clips are safe, effective, and reliable for use in all types of laparoscopic nephrectomies when applied correctly by laparoscopically trained urologists.

In our study, apart from the clips' cost-effectiveness, no statistical significance was noted when comparing the two modalities. Hence, we support using polymer self-locking clips as no adverse events have happened with their use in our experience. On the contrary, the only two technical problems we encountered were associated with staplers' use. They were informed of staplers' jaws refused to open. However both cases were managed without complications. From a technical standpoint, Simforoosh *et al.* put only one titanium clip distal to the Hem-o-Lok clip on the renal artery.^[5,8] We adopted to add two metallic clips on the renal artery distal to the polymer self-locking clips to increase the safety and stability of the vascular stump and for medicolegal purpose. Of note, no vascular complication was reported on the recipient's side nor any complaint with regard to the length of the renal pedicle from the recipient side surgeons.

From our point of view, we are in favor of controlling the renal pedicle with clips as it is SAFE, easier to handle, more cost-effective than the staplers and it provides a cut under vision in contrast to the stapler which is considered as a blind cutter.

On the other hand, when it comes to staplers' use, Brown and Woo reported 112 deaths and 2180 injuries associated with staplers' malfunction.^[3] Furthermore, staplers' use has been associated with major adverse events in urological practice including massive hemorrhage and deaths as

reported by the U. S. FDA Manufacturer and User Facility Device Experience database.^[11] Overall, most minimally invasive surgeons have experienced laparoscopic linear stapler malfunction and 25% have had to significantly alter the planned operative procedure due to the malfunction.^[17]

Recently, Liu *et al.* performed a systematic review and meta-analysis of all studies in the literature which compared staplers and clips used in LDN, and the studies provided main outcome data evaluating the safety and reliability of the staples vs clips. Based on their inclusion criteria, only 8 studies were eligible for the meta-analysis. They concluded that Hem-o-Lok clips and staplers have a similar function in LDN renal ligation, regarding the device failure rate, death rate, and severe hemorrhage rate. Moreover, the clips are more cost-effective and give more flexibility for the surgeons in dealing with various anatomical variation of the renal pedicle.^[18]

CONCLUSION

Upon a glimpse of the literature, it can be easily realized that either of the aforementioned modalities has its own advantages and drawbacks in renal pedicle control. In addition, the FDA data did not describe the amount of surgeon experience or the technical difficulty present in each case which both could have contributed to the failure.^[9] Given the fact that still there are no randomized control trials comparing both techniques performed by surgeons equally experienced, the safety of one technique over another will be a point of debate. We believe that there is still no guaranteed technique for renal pedicle control. The surgeon can select the modality that he is comfortable with based on the intraoperative finding and fits the patient condition.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Shaheen F, Al-Attar B, Santiago D, Follero P, Zakaria H, Kamal M. Health indicators for renal replacement therapy in Saudi Arabia.

2. Ratner LE, Ciseck LJ, Moore RG, Cigarroa FG, Kaufman HS, Kavoussi LR. Laparoscopic live donor nephrectomy. *Transplantation* 1995;60:1047-9.
3. Brown SL, Woo EK. Surgical stapler-associated fatalities and adverse events reported to the Food and Drug Administration. *J Am Coll Surg* 2004;199:374-81.
4. Ping H, Xing NZ, Zhang JH, Yan Y, Kang N, Niu YN. Application of the Hem-o-lok ligation system in laparoscopic nephrectomy. *Surg Endosc* 2010;24:1494-7.
5. Simforoosh N, Aminsharifi A, Zand S, Javaherforooshzadeh A. How to improve the safety of polymer clips for vascular control during laparoscopic donor nephrectomy. *J Endourol* 2007;21:1319-22.
6. Baumert H, Ballaro A, Arroyo C, Kaisary AV, Mulders PF, Knipscheer BC. The use of polymer (Hem-o-lok) clips for management of the renal hilum during laparoscopic nephrectomy. *Eur Urol* 2006;49:816-9.
7. Ponsky L, Cherullo E, Moinzadeh A, Desai M, Kaouk J, Haber GP, *et al.* The Hem-o-lok clip is safe for laparoscopic nephrectomy: A multi-institutional review. *Urology* 2008;71:593-6.
8. Simforoosh N, Sarhangnejad R, Basiri A, Ziaee SA, Sharifaghdas F, Tabibi A, *et al.* Vascular clips are safe and a great cost-effective technique for arterial and venous control in laparoscopic nephrectomy: Single-center experience with 1834 laparoscopic nephrectomies. *J Endourol* 2012;26:1009-12.
9. Hsi RS, Ojogho ON, Baldwin DD. Analysis of techniques to secure the renal hilum during laparoscopic donor nephrectomy: Review of the FDA database. *Urology* 2009;74:142-7.
10. Breda A, Veale J, Liao J, Schulam PG. Complications of laparoscopic living donor nephrectomy and their management: The UCLA experience. *Urology* 2007;69:49-52.
11. Deng DY, Meng MV, Nguyen HT, Bellman GC, Stoller ML. Laparoscopic linear cutting stapler failure. *Urology* 2002;60:415-9.
12. Friedman AL, Peters TG, Jones KW, Boulware LE, Ratner LE. Fatal and non fatal hemorrhagic complications of living kidney donation. *Ann Surg* 2006;243:126-30.
13. Janki S, Verver D, Klop KW, Friedman AL, Peters TG, Ratner LE, *et al.* Vascular management during live donor nephrectomy: An online survey among transplant surgeons. *Am J Transplant* 2015;15:1701-7.
14. Dekel Y, Mor E. Hem-o-lok clip dislodgment causing death of the donor after laparoscopic living donor nephrectomy. *Transplantation* 2008;86:887.
15. Meng MV. Reported failures of the polymer self-locking (Hem-o-lok) clip: Review of data from the Food and Drug Administration. *J Endourol* 2006;20:1054-7.
16. Goh YS, Cheong PS, Lata R, Goh A, Vathsala A, Li MK, *et al.* A necessary step toward kidney donor safety: The transition from locking polymer clips to transfexion techniques in laparoscopic donor nephrectomy. *Transplant Proc* 2014;46:310-3.
17. Kwazneski D 2nd, Six C, Stahlfeld K. The unacknowledged incidence of laparoscopic stapler malfunction. *Surg Endosc* 2013;27:86-9.
18. Liu Y, Huang Z, Chen Y, Liao B, Luo D, Gao X, *et al.* Staplers or clips?: A systematic review and meta-analysis of vessel controlling devices for renal pedicle ligation in laparoscopic live donor nephrectomy. *Medicine (Baltimore)* 2018;97:e13116.