

Ureteral Clipping Simplifies Hand-Assisted Laparoscopic Donor Nephrectomy

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ABSTRACT

Objectives: We describe a technique of doubly clipping the distal ureter during hand-assisted laparoscopic donor nephrectomy (HALDN) to prevent urine accumulation, thereby simplifying renal hilar division and potentially decreasing the graft warm ischemic time.

Methods: A technique of placing polymer-locking clips across the distal ureter prior to division was developed to prevent urine accumulation and the need for suctioning during critical hilar vessel division.

Results: We found that ureteral clipping and the elimination of urine accumulation simplified renal hilar division. Retrospective assessment of a series of 27 sequential HALDNs (15 without and 12 with clipping) demonstrated similar estimated blood loss, total operative and warm ischemic times ($P=0.13$ to 0.18). No adverse impact on graft viability or recipient outcome was observed.

Conclusion: Distal ureter clipping to prevent urine accumulation around the renal hilum during HALDN is safe and helpful.

Key Words: Nephrectomy, Donor, Laparoscopy, Ureter.

INTRODUCTION

Laparoscopic donor nephrectomy has become the standard of care for performing left living-related renal transplant surgery at many medical centers.¹ It is standard practice to provide ample intravenous (IV) crystalloid replacement to generate and maintain high urine output throughout the procedure. Additionally, the use of mannitol and dopamine infusions during laparoscopic donor nephrectomy has been reported to provide superior intraoperative urine production.² Also, periarterial application of papaverine during laparoscopic donor nephrectomy has been shown to improve early graft function after kidney transplantation in pigs.³ The proximal ureter has traditionally been left open after division to confirm brisk diuresis and a well-perfused kidney prior to hilar division.²

However, some investigators have questioned the dogma of the need to provide high-volume IV fluid replacement. Bergman and colleagues⁴ reported that renal donors receiving fluid-load ($>10\text{mL/kg/hr}$) and fluid-restriction ($<10\text{mL/kg/hr}$) did equally well in terms of postoperative creatinine levels and complications. Furthermore, there were no differences in recipient postoperative creatinine levels (to 12 months), delayed graft function, or acute rejection. They concluded that lower volume fluid management strategies did not appear to worsen donor or recipient outcomes. Thus, high-volume fluid replacement and its intraoperative monitoring may be less important than previously believed.

One potential downside to a brisk diuresis and leaving the ureter open after division is accumulation of urine around the hilar vessels necessitating suctioning. This may make the hilar vessel transection more challenging and possibly add to the warm ischemic time and negatively impact the graft function. In this article, we report a novel technique of doubly clipping the ureter prior to division (between the clips) to prevent urine accumulation around the hilum. We also evaluate our initial cohort of patients to address whether this technique modification, which inhibits intraoperative urine output monitoring, has a negative effect on outcomes.

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MATERIALS AND METHODS

We initiated a hand-assisted laparoscopic donor nephrectomy (HALDN) program at our center in November 2003. We found that leaving the ureter open upon division allowed for urine spillage into the operative field. This negatively affected operative field visibility during the critical next operative step, division of the renal hilar vessels. This is particularly problematic in that during laparoscopic hilar division, the lower pole and tail of Gerota's fascia is elevated (with a laparoscopic Kitner instrument or surgeon's hand). Because the patient is positioned in the lateral decubitus position, the ureter folds upon itself and drains immediately onto the renal hilum. This creates the need to suction the urine to maintain visibility during ligation and division of the hilar vessels, adding to the warm ischemic time and surgical challenge.

Technique

We initiated the technique of doubly clipping the distal ureter before transection between clips in September 2005. We accomplished this by using 2 Hem-o-Lok clips (Weck Closure Systems, Research Triangle Park, NC) placed across the ureter just below the iliac artery. This eliminated the problem of urine accumulation around the renal hilar vessels and facilitated the ease of dividing the renal vessels. Importantly, renal hilar irrigation with papaverine followed by peritoneum desufflation and placing the kidney at rest for at least 15 minutes before ureteral clipping and division is routinely performed.³ Renal artery perfusion is confirmed by palpating a tense renal capsule, rather than directly assessing urine output from the transected ureter.

DISCUSSION

Although it has been held as dogma that intravenous fluid load, leading to a brisk diuresis, is beneficial during laparoscopic donor nephrectomy, there is evidence that patients, and the donor kidneys from them, receiving more conservative fluid replacement do equally well.⁴ This raises the question of how beneficial and necessary fluid replacement and confirmation of a brisk diuresis from the transected ureter is during laparoscopic donor nephrectomy.

One downside to leaving the ureter open after division to confirm a brisk diuresis is the potential need to deal with accumulated urine around the renal hilar vessels while trying to set them up for division. We have found this urine accumulation routinely required suctioning, often repetitive, during our effort to staple and divide vessels.

Our technique modification, which eliminates this urine accumulation problem, raises 2 concerns. One, is it harmful to the kidney to obstruct the ureter for a few minutes prior to hilar division? Two, does inability to monitor urine output from the divided ureter negatively impact subsequent graft viability? We hypothesized that neither would be the case, because the obstruction would be a brief few minutes and because rarely, in our experience, did monitoring urine production from the kidney alter the next step of proceeding with hilar division.

To provide an initial assessment of the feasibility and impact of this surgical modification, 27 sequential cases performed by a single surgeon were evaluated (**Table 1**). The operative technique was otherwise identical, including renal hilar irrigation with papaverine prior to placing

Table 1.
Comparison of Outcomes of Hand-assisted Laparoscopic Donor Nephrectomy Cohorts with and without Ureteral Clipping

	Ureter Not Clipped	Ureter Clipped	P ^b
	n=15	n=12	
	Mean (Range)	Mean (Range)	
EBL (mL)	190 (0–500)	115 (30–325)	0.15
Total OR time (minutes)	281 (185–333)	262 (211–323)	0.18
Warm ischemic time (minutes)	3.8 (2–6)	3.1 (1–5)	0.13
Recipient Initial UOP (liters/24 hours)	4.0 (1.2–10)	3.6 (1.6–5.3)	0.67
Recipient SCr decrease (%/24 hours)	40 (13–80)	51 (25–78)	0.14
Recipient SCr at follow-up (mg/dL)	1.6 (0.9–3.5)	1.5 (0.9–2.0)	0.18

^aEBL=estimated blood loss; OR=operating room; UOP=urine output; SCr=serum creatinine

^bStudent *t* test.

the kidney at rest (peritoneum desufflated) for at least 15 minutes before hilar division.

Donor and recipient outcomes before and after making this surgical technique change are compared in **Table 1**. We realize that there are significant limitations to this comparison. These include the small number of patients in each cohort from a single surgeon experience in a medium-sized state university renal transplant program. The fact that our patient cohorts are sequential and not randomized also significantly impacts our ability to truly judge whether differences observed between the cohorts are statistically significant and whether our findings are reliable and support our conclusions. This is an initial feasibility study of a novel surgical modification and that additional study is warranted to provide a clear answer as to its risk and benefit.

We observed no urologic complications. Two acute recipient rejection episodes occurred, both in the initial HALDN cohort having the proximal ureter left open. Operative ($P=0.18$) and warm ischemic ($P=0.13$) times were mathematically, but not statistically significantly, shorter in the clipped ureter cohort. A lower estimated blood loss was also seen in this cohort ($P=0.15$), likely reflecting the elimination of urine suctioned from the field.

CONCLUSION

We observed that ureteral clipping improves visibility during division of the renal hilar vessels during HALDN. We

believe that this surgical modification simplifies the procedure by eliminating urine accumulation around the renal hilum and the subsequent frequent need to suction. Renal perfusion and viability is confirmed by palpation of a tense capsule rather than direct observation of diuresis from the kidney. We believe the warm ischemic time might be slightly reduced ($P=0.13$) due to the elimination of the need to suction urine accumulation. We found no evidence that ureteral clipping adversely affects graft viability or recipient outcome, and it appears to be a safe and helpful operative technique modification.

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