Lighted ureteral stents in laparoscopic colorectal surgery; a five-year experience

William P. Boyan Jr[1], Daniel Lavy[1], Anthony Dinallo[1], Javier Otero[1], Annelie Roding[2], Dustin Hanos[1], Roy Dressner[1], Michael Arvanitis[1]

[1]Monmouth Medical Center, Long Branch, NJ, USA; [2]Seton Hall University, South Orange, NJ, USA

Contributions: (I) Conception and design: WP Boyan Jr, D Lavy, A Dinallo, J Otero, R Dressner, M Arvanitis; (II) Administrative support: None; (III) Provision of study materials or patients: WP Boyan Jr, D Lavy, A Dinallo; (IV) Collection and assembly of data: WP Boyan Jr, D Lavy, A Dinallo, J Otero, A Roding, D Hanos; (V) Data analysis and interpretation: All authors; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Correspondence to: William P. Boyan Jr, MD. Surgical Resident, Monmouth Medical Center, 110 Robinson Place Shrewsbury, Long Branch, NJ 07702, USA. Email: wpboyanj@gmail.com.

Background: Ureteral injuries during colorectal surgery are a rare event, ranging in the literature from 0.28–7.6%. Debate surrounds the use of prophylactic lighted ureteral stents to help protect the ureter during laparoscopic surgery. It has been suggested that they help to identify injuries but do not prevent them. The authors look to challenge this.

Methods: Over 66 months, every laparoscopic or colectomy involving ureteral stents was recorded. Researchers documented any injury to the ureter intraoperatively. The chart was also reviewed for the complications of urinary tract infection (UTI) and urinary retention post-operatively.

Results: During the 66 months, 402 laparoscopic colon resections were done. There were no ureteral injuries. The lighted ureteral stent was identified during every case in the effort to prevent injury during dissection and resection. No catheter associated UTIs were identified, while 14 (3.5%) suffered from post-operative urinary retention.

Conclusions: The authors of this study present a large series of colon resections with no intraoperative ureteral injuries. In addition, these catheters were not associated with any UTIs and a rate of urinary retention similar to that of the at large data. This series provides compelling data to use lighted ureteral stents during laparoscopic colon surgery.

Keywords: Laparoscopic colorectal surgery; colon cancer; minimally invasive surgery; ureteral injury; ureteral stents

Submitted Dec 18, 2016. Accepted for publication Jan 10, 2017.
doi: 10.21037/atm.2017.02.01
View this article at: http://dx.doi.org/10.21037/atm.2017.02.01

Introduction

Identifying the ureter during colorectal surgery is one of the most critical steps of the operation. Ureteral injuries are often discussed, albeit rarely encountered, ranging in the literature from 0.28–7.6% (1). However rare, a ureteral jury has the potential to be a devastating complication and prevention is a top priority for the surgeon. Prophylactic ureteral stent placement has been utilized in pelvic surgery to facilitate intraoperative ureter identification and allow for immediate recognition of injury (2). Similarly, in laparoscopic colorectal surgery (CRS), lighted stents have been introduced to enhance visualization of the ureter with the goal to overcome the limitations of tactile feedback (3).

Despite their apparent theoretical advantages, much debate still surrounds the use of prophylactic stent placement, including lighted stents, and their effectiveness in preventing injury (4). Although there have been no randomized control trials to determine the utility of stents in preventing injury, several studies have suggested that they

Table 1 nature of operation, number of ureteral injuries, incidence of urinary retention and UTIs

Operation	Cases	Ureteral injury	Urinary retention	UTI
Right	42	0	1	0
Extended right	4	0	0	0
Transverse	3	0	0	0
Left	115	0	2	0
Extended left	4	0	0	0
Sigmoid	12	0	1	0
LAR	228	0	12	0
Total abdominal colectomy	23	0	1	0
Subtotal colectomy	5	0	0	0
Reversal	18	0	0	0
APR	5	0	1	0
Rectopexy	6	0	1	0

UTI, urinary tract infection; LAR, low anterior resection; APR, abdominal perineal resection.

help to identify injuries at time of surgery. Nevertheless, complications secondary to stent placement have been documented in the literature and include urinary tract infections (UTIs), oliguria, hydronephrosis and hematuria. However, these complications are largely self-limited and rates of UTIs with stent placement have been comparable to published rates of nosocomial UTIs after colorectal surgery (1). This study reports a single institution's experience utilizing prophylactic lighted ureteral stents in laparoscopic CRS and documents any ureteral injuries along with any complications from their placement.

Methods

The study was a retrospective review of the case logs of two board certified colorectal surgeons at Monmouth Medical Center in Long Branch, New Jersey. Cases reviewed were from January 2010 through June 2015 and include all laparoscopic or robotic-assisted colectomies in which prophylactic ureteral stents were inserted. All ureteral stents, size five French, were placed utilizing cystoscopy by one of four urologists. Catheters were placed after induction of general endotracheal anesthesia prior to starting the colorectal procedure. Stents were removed at the conclusion of the laparoscopic procedure prior to extubation. All patients had Foley catheters inserted by the urologist at the time of the ureteral stent insertion. Foley catheters remained in place for all patients postoperatively. A review of the incidence of ureteral injuries, UTIs, and urinary retention was done. Urinary retention was documented when the Foley catheter was reinserted post operatively.

Results

A total of 465 laparoscopic colorectal resections with prophylactic lighted ureteral stents were performed between January 2010 and June 2015 (66 months). Average age of patients was 60.9 years old. The series included 214 (46%) male and 251 (54%) female patients. Of the 465 cases, 160 (34%) were performed for malignant disease, while 305 (66%) were performed for benign disease. Diverticular disease (n=264) and ulcerative colitis (n=15) were the most common benign indications for operative intervention. Rectal cancer comprised 76 out of the 160 malignant cases (47.5%). The remainder were performed for colon cancer (n=84, 52.5%). Laparoscopic low anterior resection (n=228) and laparoscopic left colectomies (n=115) were the most commonly performed procedures. There were no ureteral injuries or urinary tract infections identified postoperatively. Nineteen patients (4.1%) suffered from postoperative urinary retention. All patients (n=465) had transient postoperative hematuria, which resolved prior to discharge. Expanded in *Table 1*.

Discussion

Iatrogenic injury is a major concern during any surgery. Low dissection during colorectal surgery requires constant

awareness of ureteral location. In the past surgeons had to rely on their knowledge of anatomy to identify the ureters and prevent injury during surgery. According to Bieniek *et al*., the incidence of ureteral injuries during CRS has been cited as high as 7.6%. Alternatively, 5–15% of all ureteral injuries occur during CRS (5,6). Pokala *et al*. suggests ureteral catheters might increase risk of injury during open colorectal procedures by making ureters less pliable, which may predispose to intraoperative ureteral injury, and also propose that stents do not reduce injury but may aid in early recognition (2).

Laparoscopic CRS sparked a new challenge to surgeons, giving them less tactile feedback and more dependence on visual identification to avoid iatrogenic injury. In an effort to enhance visualization of ureters, lighted ureteral stents were devised to improve visual identification of ureters throughout the dissection. Although these catheters also helped to identify injuries intraoperatively, their use did not change the overall incidence of ureteral injuries (2).

The series done at this institution revealed no ureteral injuries from either catheter insertion or during the surgery in 465 laparoscopic colorectal resections in a time period spanning 66 months. The practice of bilateral stent placement for all colon resections has shifted to only placing left sided stents during left colon resections. The authors propose that stents are more helpful during left colon resections secondary to proximity of the ureter during a low pelvic dissection. The careful identification of the LED illuminated ureter is a major step in preventing ureteral injuries during these cases.

Catheter associated urinary tract infections (CAUTIs) are a known complication of ureteral stent insertion (1). However, in this series out of 465 cases with ureteral stent placement, no CAUTIs occurred. Beraldo *et al*. also showed a UTI occurrence as low as 2.2% in their 89 patients who underwent prophylactic ureteral stents (7). One study showed UTI rates lower (2% *vs*. 4.3%) in cases that used catheters (8). All of the catheters inserted in this review were done by one of four experienced urologists in a sterile environment. Furthermore, every patient received preoperative antibiotics prior to the start of the case. A final contributing factor is that this institution utilizes an enhanced recovery pathway, which standardizes removing all Foley catheters on postoperative day one.

Transient hematuria is a known effect of instrumentation to the ureter. This was seen in all 465 cases which ureteral stents were used. However, the hematuria resolved in all cases. Ureteral edema and subsequent urinary retention has been reported as a complication of ureteral stent placement (9). Nineteen patients (4%) required Foley reinsertion during the postoperative period prior to discharge. Changchien *et al*. reviewed 2,355 who underwent surgery without the aid of ureteral stents for CRS and reports 5.5% incidence of urinary retention after colorectal resection. The authors conclude that the addition of ureteral stents poses no additional risk of urinary retention than a traditional laparoscopic colon resection without stents.

Prophylactic ureteral stent placement has been associated with increased operative time (2). The average time for stent insertion prior to CRS was eight minutes. The average total additional time including set up, draping, procedure, and re-prep for the colorectal procedure was 28 minutes. Other studies which emphasize a coordinated approach to prophylactic stent placement and predefined protocols have demonstrated much shorter amount of additional time under general anesthesia to 11 minutes (6). With additional coordination involving the entire treatment team, extra time spent in the operating room could potentially be decreased significantly.

The illuminated catheter used at the author's institution costs $167.01 and therefore adds 1.76% to the standard elective laparoscopic colon operation totaling a median cost of $9,476. The exact cost of a ureteral injury is difficult to calculate as it could result in a variety of different treatments whether it was found at time of original operation versus delayed. Inevitably the increased length of stay and necessity of another procedure will increase costs more than $167.01. For these reasons and the overall benefit to the patient, the authors surmise that 1.76% increase in cost is worth considering the lack of complications both intraoperatively and from the stent insertion itself.

It has become increasing evident that the benefits of universal ureteral catheter placement for colorectal surgery far exceeds the risk. While attempts in the literature have been made to identify certain cases which may benefit most from lighted ureteral stents, such as obese patients, those with extensive inflammation, or those with history of surgery, it is not always possible to accurately make these judgments preoperatively.

Certain protocols regarding the use of ureteral catheters have helped to mitigate risk from cystoscopy and catheter placement. For example, patients undergoing segmental resection with an undisrupted retroperitoneum receive unilateral catheters while those with a history of previous retroperitoneal dissections now receive bilateral catheters. We have found that such protocols add minimal time, cost,

and risk to the overall case while providing added security from injury to a vital structure. While it may be conceded that number needed to treat to prevent a ureteral injury with catheter placement is relatively high, the complications of such an injury are all too morbid emotionally, physically, and financially to undergo such risk.

The data presented in this series demonstrates no ureteral injuries over the course of 465 laparoscopic colorectal surgeries in which prophylactic lighted ureteral stents were used. This supports the notion that identification of the ureter via lighted stents can help prevent injury in colorectal resections without a large amount of additional risk. Standardization of operating room logistics may help to reduce additional operative time. Randomized studies are needed to prove definitive correlation between ureteral stent insertion and reduction of intraoperative ureteral injury during CRS.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. da Silva G, Boutros M, Wexner SD. Role of prophylactic ureteric stents in colorectal surgery. Asian J Endosc Surg 2012;5:105-10.
2. Pokala N, Delaney CP, Kiran RP, et al. A randomized controlled trial comparing simultaneous intra-operative vs sequential prophylactic ureteric catheter insertion in re-operative and complicated colorectal surgery. Int J Colorectal Dis 2007;22:683-7.
3. Senagore AJ, Luchtefeld M. An initial experience with lighted ureteral catheters during laparoscopic colectomy. J Laparoendosc Surg 1994;4:399-403.
4. Chahin F, Dwivedi AJ, Paramesh A, et al. The implications of lighted ureteral stenting in laparoscopic colectomy. JSLS 2002;6:49-52.
5. Bieniek JM, Meade PG. Reflux anuria after prophylactic ureteral catheter removal: a case description and review of the literature. J Endourol 2012;26:294-6.
6. Speicher PJ, Goldsmith ZG, Nussbaum DP, et al. Ureteral stenting in laparoscopic colorectal surgery. J Surg Res 2014;190:98-103.
7. Beraldo S, Neubeck K, Von Friderici E, et al. The prophylactic use of a ureteral stent in laparoscopic colorectal surgery. Scand J Surg 2013;102:87-9.
8. Tsujinaka S, Wexner SD, DaSilva G, et al. Prophylactic ureteric catheters in laparoscopic colorectal surgery. Tech Coloproctol 2008;12:45-50.
9. Changchien CR, Yeh CY, Huang ST, et al. Postoperative urinary retention after primary colorectal cancer resection via laparotomy: a prospective study of 2,355 consecutive patients. Dis Colon Rectum 2007;50:1688-96.

Cite this article as: Boyan WP Jr, Lavy D, Dinallo A, Otero J, Roding A, Hanos D, Dressner R, Arvanitis M. Lighted ureteral stents in laparoscopic colorectal surgery; a five-year experience. Ann Transl Med 2017;5(3):44. doi: 10.21037/atm.2017.02.01

