Outcomes with delayed dorsal vein complex ligation during robotic assisted laparoscopic prostatectomy

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Introduction: *There are many concerns expressed by urologists performed robotic assisted laparoscopic prostatectomy (RALP) regarding management of the dorsal vein complex (DVC). We sought to examine the influence of delayed DVC ligation versus standard DVC ligation on the apical surgical margin status and other key surgical parameters following RALP.*

Materials and methods: *The Columbia University Urologic Oncology Database was retrospectively reviewed to identify patients who underwent RALP between 2008-2011. Operative records were analyzed to determine whether the DVC was ligated in the 'standard' or 'delayed' manner. The standard group had the DVC ligated prior to the apical dissection; in the delayed group, the DVC was initially transected and subsequently oversewn after completion of the apical dissection. Clinical and pathologic*

data was retrospectively evaluated and stratified by the type of DVC ligation to compare positive apical margin rates based on DVC-control technique.

Results: *A total of 244 patients were identified, including 118 in the standard group and 126 in the delayed group. Estimated blood loss (112 mL versus 122 mL), operative time (132 min versus 126 min), and postoperative continence rates (81% versus 84% at 3 months) were similar between the standard and delayed DVC groups (p = NS). Apical margin status was also similar in the two groups, with 3.4% having a positive surgical margin in the standard DVC ligation arm, and 1.6% having a positive margin in the delayed DVC ligation arm (p = 0.43).*

Conclusions: *Delayed DVC ligation after apical dissection is a safe approach with comparable surgical outcomes during RALP. From a technical standpoint, we feel it allows for improved visualization of the apical dissection and therefore has become standard practice at our institution.*

Key Words: robotics, prostate, cancer, laparoscopy, malignant disease

Introduction

In his seminal work, Walsh described the anatomic approach to a radical retropubic prostatectomy which has become the model for most current prostatectomies. In this description, he advocated for the placement

of a suture through the dorsal vein complex (DVC) prior to transection to allow for adequate hemostasis during the remainder of the procedure.[1-3] However, with the advent of laparoscopic and robotically assisted laparoscopic prostatectomies, many have attempted to modify this technique by forgoing the initial DVC ligation prior to transection and apical margin dissection.[2] This is largely due to the ability of pneumoperitoneum that is present during these laparoscopic cases, and the ability of this increased intra-abdominal pressure to tamponade the venous bleeding from the DVC.

Currently there are two major approaches to DVC ligation during robotic assisted laparoscopic prostatectomy (RALP): standard or delayed. With the standard approach, the DVC is ligated prior to the apical dissection; in the delayed approach, the apical dissection is carried out first without DVC ligation, and then the DVC is subsequently oversewn to control venous bleeding. While the delayed approach theoretically prevents tethering of the prostatic apex, which may result in a positive surgical margin, it can theoretically result in poorer surgical outcomes due to impaired visibility due to bleeding, increase in operative times, poorer surgical outcomes, blood loss and the resultant need for transfusion. The goal of our study was to compare the operative outcomes using these two surgical strategies.

Materials and Methods

With institutional review board approval, we performed a retrospective review of the Columbia University Urologic Oncology Database from 2008-2011 of a single surgeon. All patients had tissue confirmed prostatic adenocarcinoma and underwent robotic assisted laparoscopic prostatectomy (RALP) using either one of two approaches to DVC ligation (standard versus delayed). The decision to perform either standard versus delayed DVC ligation was made largely based on the time the operation was performed. Initially, most RALPs were performed with standard (early) DVC ligation, however about mid-way through the study period our approach changed to a delayed approach for DVC ligation.

Our RALP technique is similar to what has been previously described.[4] With the standard technique, the DVC is ligated prior to the apical dissection. The endopelvic fascia is incised laterally and the levator muscles are swept laterally. This process is continued medially toward the apex until reaching the DVC and puboprostatic ligaments in the midline. The same process is replicated on the contralateral side until there is adequate exposure of the DVC. The puboprostatic ligament can be excised for more precise placement of the suture to ligate the DVC. Inadvertent entry into the DVC during dissection is usually not problematic due to pneumoperitoneum. Our technique to the DVC ligation is to precisely place to a size zero unidirectional barbed absorbable "V-loc" suture (Covidien, Mansfield, MA, USA) above the urethra to encompass the entire dorsal vein in a figure of eight pattern. The foley catheter is manipulated to ensure that the suture has not inadvertently been placed through the urethra and foley. Finally the suture is placed through the puboprostatic ligaments in order to anchor the suture anteriorly so that it will not slip down at the time of transection.

The other option is delayed DVC ligation, in which the DVC is transected without a prior ligating suture. The pneumoperitoneum is increased from the standard 15 mmHg to 20 mmHg to minimize venous back-bleeding. The anterior dissection or the prostate is carefully performed until the urethra has been circumferentially exposed. At this point, a 2-0 vicryl suture is used to oversow the DVC, with a preference of a running suture, vertically from one side to the other. The bedside assistant intermittently applies perineal pressure in order to demonstrate the location of the venous complex as the increase in pneumoperitoneum is sometimes be so effective that there is no venous bleeding that can be used to identify the transected DVC. Final histopathologic sections are taken at the urethral margin and were reported in our results as the "apical margin."

Patients are left with a foley catheter for 7-9 days. Their continence rates were calculated using number of pads per day used at 3 weeks and 6 months postoperatively. Continence was defined as having used zero pads during the course of a day.

Statistical analysis was performed using SPSS Statistics Version 21.0 (Armonk, NY, USA). Student's T-tests were used for comparison of numerical means, while Chi-square tests and Fisher Exact testing was used for comparison of categorical and proportional means.

Results

There were a total of 244 patients included in the analysis, Table 1. A total of 118 cases were performed with the standard early DVC ligation technique, while 126 cases were performed with the delayed DVC ligation technique. There were no differences in baseline demographics, symptoms scores, Gleason score sums, pathologic T-staging or node status between the two groups, Table 1.

With regards to operative outcomes, the mean estimated blood loss was 112 mL in patients undergoing standard DVC ligation versus 122 mL in patients with delayed DVC ligation (p = 0.78). Only one patient required a postoperative transfusion; this patient was in the standard group. With respect to operative time there was also no statistical difference between the standard and delayed groups, 132 min versus 126 min, respectively (p = 0.82).

There was also no statistically significant difference in positive apical margin rates on final histopathologic analysis; four patients (3.4%) of those who underwent the standard (early) DVC ligation ended up having a

TABLE 1. **Baseline characteristics and staging**

	Standard DVC ligation	Delayed DVC ligation	p value
Number of patients	118	126	-
Race (no. of Caucasian)	81	89	0.74
Age (years)	61.8	60.2	0.86
BMI	27	29	0.82
Preoperative IPSS	9	8	0.81
Preoperative IPSS bother score	3	3	0.75
Gleason sum			0.84
6	53	52	
7	42	47	
8-10	23	27	
T-stage (pathologic)			0.78
pT2	76	78	
pT3	42	48	
Node status			0.34
Positive	1	3	
Negative	117	123	

DVC = dorsal vein complex; BMI = body mass index; IPSS = International Prostate Symptom Score

positive apical margin, while just two patients (1.2%) of those who underwent a delayed DVC ligation had a positive surgical margin (p = 0.43), Table 2.

Continence rates at 6 weeks (58% versus 56%) and 3 months (81% versus 84%) postoperatively were similar between the standard and delayed DVC ligation groups (p > 0.05). No other postoperative complications were noted, Table 2.

Anecdotally, we felt that there were no detrimental effects of DVC ligation after transection and apical margin dissection. Additionally, we perceived that the this approach allowed for improved visibility during the apical margin dissection and facilitated better preservation of the urethral sphincter and improved visibility and delineation of the prostatic apex, which is a known source of positive surgical margins.

TABLE 2. **Operative results**

	Standard DVC ligation	Delayed DVC ligation	p value
EBL (mL)	112	122	0.78
Operative time (min)	132	126	0.82
Nerve sparring technique (no. of patients)	92	102	0.86
Positive apical margin rate (%)	4 (3.4%)	2 (1.6%)	0.43
Continence (%)	58% at 6 weeks	56% at 6 weeks	0.79
	81% at 3 months	84% at 3 months	0.73
Postoperative transfusion (no. of patients)	1	0	0.48

DVC = dorsal vein complex; EBL = estimated blood loss

Discussion

Robotic assisted laparoscopic prostatectomy (RALP) has become the method of choice amongst many urologists in the United States for performing a prostatectomy for organ-confined disease, and many have reported on continuous refinements in operative technique which aide in improving the standard operative outcomes of duration of surgery, blood loss, and in the case of prostatectomies, the specific outcomes of urinary continence, potency, and margin status. We sought to contribute to this on-going discussion and refinement of the surgical technique by presenting our surgical outcomes when comparing a delayed versus standard dorsal venous complex (DVC) during RALP.

Our data suggests that there are no detrimental effects in terms of blood loss and operative time for a delayed approach to the DVC ligation during RALP. Furthermore, postoperative outcomes of continence are similar between our two approaches. These results are consistent with other reports of a delayed approach to DVC ligation during standard laparoscopic prostatectomies in which delayed DVC ligation after transection did compromise surgical outcomes.[5,6]

One area of specific interest to us was the status of the apical margin. Numerous studies have demonstrated that the finding of a positive surgical margin after radical prostatectomy is an altogether too common event, even in the case of what is otherwise pathologically localized disease. Furthermore, it appears that the prostatic apex is the most commonly affected site of positive surgical margins in cases of localized disease.[7-10] Several authors have suggested possible technical reasons for the increased incidence of positive surgical margins at the prostatic apex, including the absence of significant periprostatic tissue in the confines of the bony pelvis, the close proximity of adjacent structures, the lack of a true anatomical capsule, the lack of the normal condensation of fibromuscular tissue present in the posterolateral margins, and the importance of the apex as it relates to potency and urinary continence.[3,11,12] Additionally, a concern specific to RALP is that due to magnification afforded by the robotic camera system, there may be an attempt to preserve urethral length at the expense of incomplete resection of the cancer.[7] Furthermore, Walsh suggests that the release of the DVC may further contribute to the increased positive surgical margins noted at the apex.[13]

In our hands, the apical margin was fortunately rarely positive (just six cases out of the 244 patients), however because of this low incidence, our study was underpowered to detect a statistically significant difference in apical margin status after standard versus delayed DVC ligation during RALP. That said, there were only two patients who had a positive surgical margin in the delayed arm and four patients with a positive surgical margin in the standard arm. Anecdotally we felt very confident about the apical anatomy of the prostate during our dissection when we did not place a suture through the DVC before transecting it and doing the dissection. And we postulate that this difference was due to "tethering" and "tissue bunching" at the prostatic apex that results from an early DVC ligation suture. Given our improved surgical margin status, ease of dissection, and no concomitant increase in operative difficulty, time, or complications, this delayed DVC ligation strategy has become the standard for RALP in our team.

There are several limitations to our study that should be acknowledged. This was a retrospective study and patients were chosen to undergo standard versus delayed DVC ligation in a non-randomized fashion, which was largely, but not entirely, based on the date the operation was performed (later operations were overwhelmingly performed with a delayed DVC ligation). This clearly has the risk of introducing bias. The results of the study are from a single-surgeon's experience, and while this provides for reproducibility, it is also conceivable that another surgeon would find an apical dissection easier and would have improved results with the standard as opposed to the delayed DVC ligation strategy. Our results are encouraging and we feel warrant a randomized study.

Conclusion

Delayed DVC ligation after apical dissection does not appear to have a negative affect on operative times, continence rate, or blood loss during the case at the prostatic apex during RALP. While not a statistically significant difference in apical margin status, we feel a delayed approach to DVC ligation after apical dissection allows for a more confident delineation of apical margins due to increased visualization and lack of tethering at the apex and avoidance of tissue "bunching" when the DVC is ligated prior to the apical dissection. As such, the delayed approach to DVC ligation has become standard practice during RALP for our team. □

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