Illustrated Surgical Technique/Robotics/Laparoscopy

Impact of a Retrotrigonal Layer Backup Stitch on Post-Prostatectomy Incontinence

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Purpose: To evaluate the impact of a retrotrigonal layer backup stitch (RTBS) during robot-assisted laparoscopic radical prostatectomy (RALP) on post-prostatectomy incontinence.

Materials and Methods: We compared the difference in continence recovery between 94 patients (group 1, as historical controls) and 57 patients (group 2). The only technical difference between our two groups was the incorporation of the retrotrigonal layer into the posterior aspect of the vesicourethral anastomosis (group 1: without RTBS; group 2: with RTBS). Postoperative continence recovery was defined as the use of no absorbent pads.

Results: In group 1, the continence rate at 3, 6, and 12 months postoperatively was 40.4%, 70.2%, and 90.4%, respectively; in group 2, the continence rate was 42.1%, 70.1%, and 89.7%, respectively. The median (95% confidence interval) time to continence recovery was four months (range, 1 to 12 months) in group 1 and four months (range, 1 to 9 months) in group 2. Kaplan-Meier curves showed no significant difference in the recovery of continence between the two groups (log rank test, p=0.629).

Conclusions: A RTBS does not appear to improve urinary incontinence after RALP. Further anatomical study and prospective randomized studies will be needed to confirm this.

**Key Words:** *Prostatectomy; Prostatic neoplasms; Urinary incontinence*

INTRODUCTION

With the evolution of radical prostatectomy from an open technique to a laparoscopic or robotic approach, several discussions have ensued regarding the anatomy around the posterior bladder neck (BN), because the antegrade dissection proceeds differently in the new approaches from that used in the open approach [1-4].

Since 2000, the anterior layer of Denonvilliers' fascia (DNF) or a posterior layer of the detrusor apron have been reported as the structure at the posterior aspect of the BN [1,5], which needed to be incised horizontally during posterior BN dissection. More recently, Tewari et al reported this structure as the *retrotrigonal layer* and emphasized that this tissue may serve as a key surgical anatomical landmark to orient the location of the vasa and seminal vesicles,

which are located just beneath this layer [3] (Fig. 1). Since their report, we have used this structure to identify the vas deferens and seminal vesicles in the midline at the posterior aspect of the prostato-vesical junction.

However, aside from the presence and position of the layer, it seems that there have been no reports about the natural function of the layer. The aim of our study, therefore, was to discover a possible role of this structure. Considering this layer's positioning around the BN, we postulated that it might have some role in the control of urinary continence. To verify this, we assessed whether there was difference in the recovery of postprostatectomy incontinence (PPI) according to whether the retrotrigonal layer (which was incised during posterior dissection of RALP) was reconstructed or not.
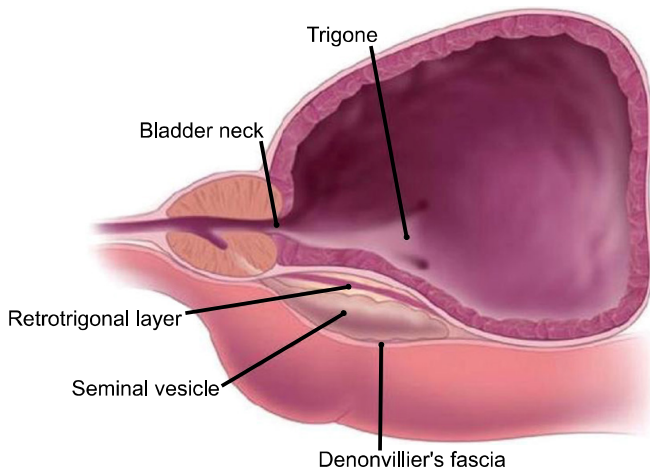
FIG. 1. The anatomical relationships of the retrotrigonal layer. This layer extends from the posterior aspect of the trigone to the base of the prostate (Reproduced with permission from Wiley Interscience [3]).

TABLE 1. Patient baseline characteristics

Characteristic	Group 1 (n=94)	Group 2 (n=57)	p-value
Mean (SD)			
Age (yr)	63.2 (6.7)	63.9 (6.9)	0.482
BMI (kg/m^2)	24.4 (2.4)	23.9 (2.8)	0.206
Prostate volume (cc)	36.9 (30.5)	35.2 (27.1)	0.692
Preoperative PSA (ng/ml)	11.7 (14.4)	9.6 (12.8)	0.319
Preoperative IPSS (obstructive score)	6.9 (4.5)	7.1 (4.3)	0.883
Preoperative IPSS (irritative score)	4.6 (3.0)	4.8 (2.9)	0.909
Length of membranous urethra (cm)	1.3 (0.5)	1.4 (0.5)	0.721

SD: standard deviation, BMI: body mass index, PSA: prostate-specific antigen, IPSS: International Prostate Symptom Score

MATERIALS AND METHODS

From May 2007 to September 2010, a total of 181 consecutive patients underwent RALP by a single surgeon (BHC) at our institution. All of the preoperative, perioperative, and postoperative data were collected through a retrospective review of the patients' charts. All men were continent for urine before surgery (no involuntary urine loss of any kind) and had neither undergone transurethral resection of the prostate nor had a history of neurological disease. To control the learning curve, the initial 30 cases were excluded from our study. We divided our patients into two groups depending on whether a retrotrigonal layer backup stitch (RTBS, as described below) was performed. These stitches were not used in group 1 (cases 31 to 124) but were used for the patients in group 2 (cases 125 to 181). The characteristics of our patients are summarized in Table 1.

All cases were carried out by use of the transperitoneal, six-port technique. After the endopelvic fascia was opened and the dorsal vein complex (DVC) ligated, the anterior BN was divided. The posterior BN was then divided at the midline of the prostate-vesical junction. At this stage, the retrotrigonal layer was identified (Fig. 2A). After division of the retrotrigonal layer, both the vasa and seminal vesicles were found just beneath the retrotrigonal layer (Fig. 2B). The vasa were ligated and transected. The seminal vesicles were then completely dissected as the transected distal ends of the vasa were pulled anteriorly by using the fourth robotic arm. Subsequently, posterior dissection was continued as far distally as possible, and the posterior aspect of the prostate was nearly freed from the rectum. Then the nerve sparing (interfascial) was performed from the apex to the base, if deemed indicated according to the patient's preoperative potency and tumor characteristics (Table 2). After the prostatic pedicles were ligated, apical dissection

and urethral transection were performed. Vesicourethral anastomosis was performed with a continuous running suture (double-armed). Posterior anastomosis was performed in a clockwise direction starting at the 5 o'clock position and ending at the 10 o'clock position. Anterior anastomosis was performed with the second arm of the suture in a counterclockwise direction, and both sutures were tied together. Here, the only technical difference between our two groups was an incorporation of the retrotrigonal layer into the posterior aspect of the vesicourethral anastomosis in group 2. In group 2, when we made conventional, continuous running sutures on the posterior bladder wall, the needle was inserted into the retrotrigonal layer first (Fig. 2C) and then into the posterior bladder wall. This suture was anastomosed with the urethra (Fig. 2D and 2E). This stitch was performed at a minimum of four points on the posterior bladder wall. After completing the anastomosis, a leak test was performed. If a leak was found, extra sutures were placed. A Jackson Pratt drain was placed around the anastomosis before closure.

Routine postoperative care was administered, and the urethral catheter was removed 5 to 7 days after surgery. Follow-up for all patients was conducted at 1 week, 1 month, 3 months, and then every 3 months for up to 2 years. We defined the continence recovery of patients as the use of no absorbent pads. Continence recovery was determined by direct interview with the patients at each visit to our outpatient clinic.

The two groups were statistically compared for patient age, body mass index (BMI), prostate volume, pre-RALP prostate-specific antigen (PSA) level and International Prostate Symptom Score (IPSS), length of membranous urethra, number of nerve-sparing procedures, pathologic Gleason score, pathologic stage, margin-positive rates, biochemical recurrence, rates of adjuvant radiation therapy, overall operative time, robotic console time, and postoperative continence rate. The student's t-test or the
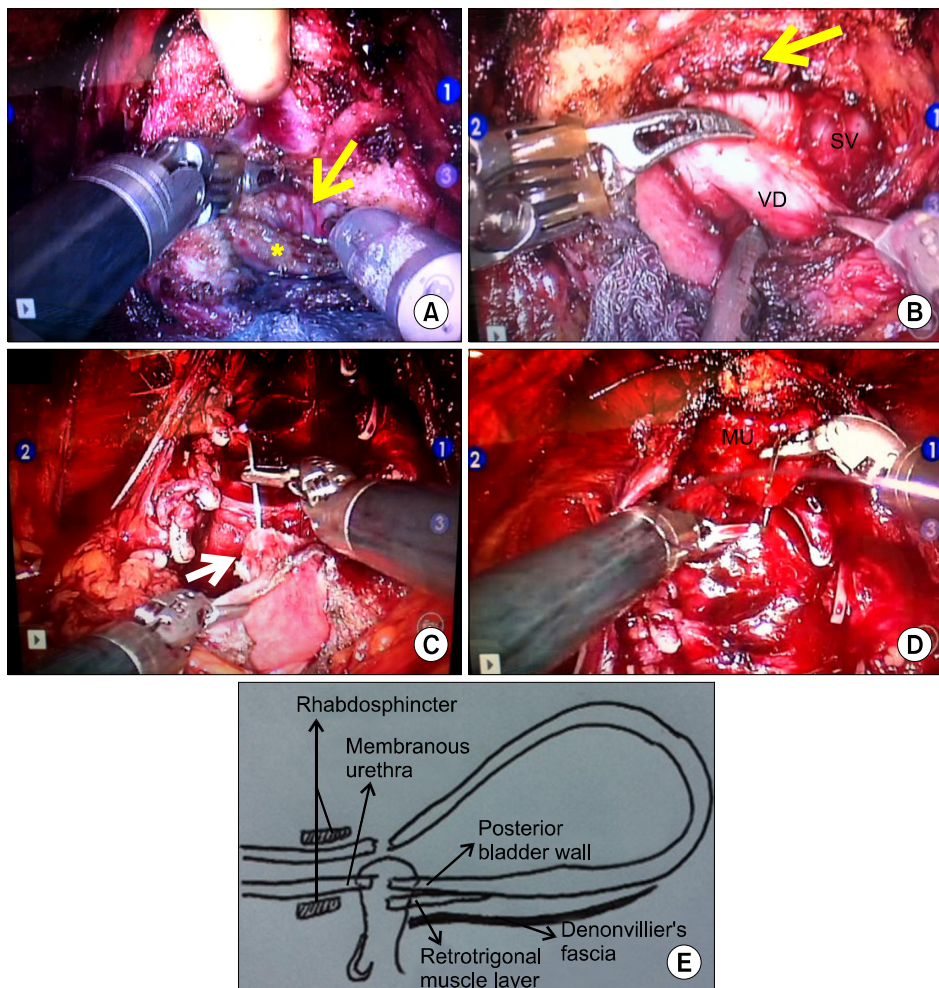
FIG. 2. The retrotrigonal layer and backup stitch of this layer during vesicourethral anastomosis. (A) The intraoperative appearance of the retrotrigonal layer (arrow). During dissection of posterior bladder neck, this layer was found in the midline at the prostato-vesical junction (*indicates the posterior bladder wall). It appears as a pinkish white midline strip with vertically orientated fibers. (B) After this layer was divided, the vasa and seminal vesicles were found just beneath the retrotrigonal layer (arrow indicates the transected retrotrigonal layer). (C) The appearance during vesicourethral anastomosis. The retrotrigonal layer (arrow) was sutured together with the posterior bladder wall. (D) This suture was anastomosed with the membranous urethra. (E) Schematic figure of RTBS technique. SV: seminal vesicle, VD: vas deference, MU: membranous urethra.

Mann-Whitney test was used to analyze numerical variables, and the chi-square test or the Fisher's exact test was used to analyze categorical variables. To compare the interval before the return of urinary continence between the two groups, we used the Kaplan-Meier method with the log-rank test to analyze the differences between the curves. To minimize and control for selection bias, we constructed a Cox proportional hazards model for the interval to continence. Statistical analysis was performed with Prism ver. 5.00 (GraphPad Software, San Diago, CA, USA). Results were considered significant at $p < 0.05$.

RESULTS

There were no significant differences between the groups with respect to patient age, BMI, prostate volume, preoperative PSA level, or preoperative obstructive and irritative IPSS ($p > 0.05$) (Table 1). There were also no significant differences between the groups in the number of nerve-sparing procedures, pathologic Gleason score, pathologic stage, positive surgical margin, biochemical recurrence, or rates of adjuvant radiation therapy ($p > 0.05$) (Table 2). For overall operative time and robotic console time, times were considerably shorter in group 2 (cases 125 to 181) than in

TABLE 2. Perioperative and postoperative data

Characteristic	Group 1 (n=94)	Group 2 (n=57)	p-value
Mean (SD)			
Operative time (min)	282.2 (82.7)	219.3 (77.4)	<0.0001
Console time (min)	222.2 (82.7)	143.7 (80.1)	<0.0001
%			
Nerve sparing (bilateral, unilateral, none)	77, 5, 18	74, 10, 16	0.885
Pathologic Gleason score (≤ 6, 7, ≥ 8)	33, 50, 17	37, 47, 16	0.832
pT2, pT3	47, 53	49, 51	0.566
Margin-positive rates			
pT2	19.5	18.2	0.498
pT3	51.0	49.5	0.675
Biochemical recurrence (3-yr)			
pT2	88.7	87.7	0.598
pT3	57.4	57.0	0.820
Adjuvant radiation therapy[a]	13.7	14.6	0.638

SD: standard deviation, [a]: Immediate postoperative-postoperative 12 months
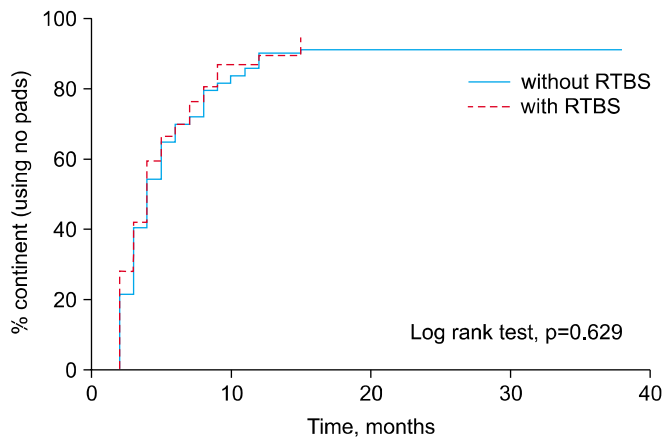
FIG. 3. Kaplan-Meier curves showing the urinary continence probability after robot-assisted laparoscopic radical prostatectomy without (group 1) and with (group 2) the placement of the retrotrigonal layer back up stitch (RTBS).

TABLE 3. Association of various factors with early recovery of continence following RALP in the multivariate analysis

	Hazard ratio (95% CI)	p-value
Age	1.28 (0.72-2.25)	0. 398
BMI	1.02 (0.81-1.45)	0.502
Prostate volume	2.67 (0.75-6.52)	0.142
Serum PSA	1.02 (0.97-1.08)	0.402
Preoperative total IPSS	1.00 (0.62-1.58)	0.876
Pathologic Gleason score	0.99 (0.88-1.10)	0.609
Length of membranous urethra	2.78 (0.92-7.93)	0.163
RTBS (no/yes)	1.19 (0.90-1.28)	0.278

RALP: robot-assisted laparoscopic radical prostatectomy, CI: confidence interval, BMI: body mass index, PSA: prostate-specific antigen, IPSS: International Prostate Symptom Score, RTBS: retrotrigonal muscle backup stitch

group 1 (p < 0.0001) (Table 2). There were no intraoperative complications during RALP in either group of patients.

According to our definition, group 1 showed continence rates of 40.4%, 70.2%, and 90.4% at 3, 6, and 12 months, respectively; in group 2, the continence rates were 42.1%, 70.1%, and 89.7%, respectively. The median (95% confidence interval) time to continence recovery was four months (range, 1 to 12 months) in group 1 and four months (range, 1 to 9 months) in group 2. Kaplan-Meier curves showed no significant difference in the recovery of continence between the two groups (log rank test, p=0.629) (Fig. 3). In the multivariate analysis, age, BMI, prostate volume, serum PSA, preoperative total IPSS, pathologic Gleason score, length of membranous urethra, and RTBS technique were not significant risk factors for the recovery of continence after RALP (p > 0.05) (Table 3).

In patients with no preoperative erectile dysfunction (International Index of Erectile Function-5 score > 21), intercourse was reported in 72.5% and 76.2% of the patients undergoing bilateral nerve-sparing surgery at 12 and 24 months of follow-up, respectively.

DISCUSSION

Various intraoperative techniques for improving PPI have been introduced for use in open radical prostatectomy [6-14], LRP [15], and RALP series [16-18]. Although many of these techniques showed continence outcomes that were superior to those of procedures performed without the techniques, some controversies regarding the efficacy or limitations of these techniques persist [19-24]. Besides, we had found that our initial experiences with RALP (cases 1 to 124) showed acceptable continence outcomes without the use of such techniques. For these reasons, we did not fully trust the efficacy of the current and past intraoperative techniques for improving PPI until now.

For techniques focusing on the BN, which is regarded as

an internal sphincter, several conflicting reports on efficacy and safety have raised concern. A BN preservation technique was introduced to theoretically improve PPI on the basis of the idea that sparing as much BN as possible during RP might result in a sphincter mechanism more closely resembling that of the preoperative state [7,10]. However, Srougi et al found that the technique did not improve PPI and in fact might compromise cancer control because of the marginal positivity of the BN [19]. Intussusception of the BN, a technique introduced by Walsh and Marschke, was another modification intended to result in earlier return of urinary control [9]. This, too, is associated with conflicting reports [21].

Concerning the anatomy around the BN, there are some newly visited aspects (especially posterior to the BN) in addition to the well-known anatomy that was described by Myers [25,26]. Such trends have resulted from the evolution of RP from an open technique to LRP or RALP. That is to say, the anatomy around the posterior BN has been examined under the enhanced and magnified vision of laparoscopic surgery and, more importantly, as a result of the different (antegrade) dissection of LRP/RALP. For example, in 2001 and 2002, Myers described the extension of the longitudinal detrusor muscle of the bladder anteriorly, in front of the anterior commissure of the prostate [25,26]. He termed this the detrusor apron and explained that this structure had generally been unappreciated during RP by many urologists. In another example, in 2006, Secin et al described some longitudinal muscle fibers extending from the BN to the base of the prostate during the dissection of the posterior BN in LRP [2]. They proposed that these fibers actually correspond to the posterior longitudinal fascia of the detrusor muscle. An earlier report regarding this structure could be found. When describing the 'Montsouri' technique of LRP, Guillonneau and Vallancien described the presence of a fascial structure with cephalocaudal striations that needed to be incised horizontally during the posterior BN dissection [1]. Those authors termed this tissue the anterior layer of the *DNF*. However, this terminology

was challenged by several authors [5,27], because, according to our current anatomical knowledge, the DNF does not extend anterior to the seminal vesicle [5,27,28]. Instead, the term posterior layer of the detrusor apron was suggested [5], in view of the similarity between this structure and the detrusor apron that Myers had described [25,26]. More recently, Tewari et al used cadaveric dissections and real-time videos from RALPs to describe a tissue layer posterior to the BN that extended from the posterior aspect of the trigone to the base of the prostate, which is consistently encountered after division of the posterior BN [3]. They referred to this tissue as the retrotrigonal layer. In their report, they emphasized that this tissue may serve as a key surgical anatomical landmark to locate the vasa and seminal vesicles, which are located just beneath this layer.

Aside from its presence or accurate termination, however, it seems that the natural role or function of the layer is not clearly known. Therefore, we postulated that this layer might have some role in the control of urinary continence, considering its position around the BN. To verify this, we analyzed the outcomes in continence recovery after dividing our RALP cases into two groups (with or without RTBS). Accordingly, we started to perform RTBS techniques from the 125th case of our RALP series. We compared the data of the patients with RTBS (cases 125 to 181) with those of our initial RALP cases (without RTBS, cases 31 to 124), in which the retrotrigonal layer had been used only as a landmark for posterior dissection of the BN.

Our RALP technique in all 151 cases did not include any of the current or past techniques for improving PPI, including puboprostatic ligament (PPL) preservation [6,8], additional anterior support of the PPL/DVC [14,18], BN preservation [7,10], membranous urethral lengthening [11], or posterior reconstruction of Denonvilliers' musculofascial plate (such as the Rocco stitch) [13,15]. Moreover, there was no significant difference in the number of nerve-sparing procedures between our two groups. Accordingly, we think that our comparison of the two groups was quite reliable in terms of both surgical aspects and baseline patient characteristics.

During posterior dissection of the BN, the retrotrigonal layer was clearly identified in all but four of our patients, although the thickness varied from one case to another. From our experience, we fully agree with Tewari et al that this tissue may be a key landmark for use in the dissection of the posterior BN [3]. Although some authors have reported the use of an "ultradissection technique" or modified ultradissecction (in Asians with relatively small body sizes) during BN dissection [29,30], we felt that the approach via the retrotrigonal layer was easier. Also, incorporating the retrotrigonal layer into the posterior aspect of the vesicourethral anastomosis presented no difficulty.

However, upon analysis of our results, our RTBS technique did not show any role in the improvement of PPI. We think that this conclusion is bolstered by the fact that the surgeries in group 2 (with RTBS) were performed when our

procedures for RALP were far more stabilized in every other step that might affect the continence outcome (e.g., nerve sparing, etc), and yet there was no significant difference in continence recovery between the two groups. The finding of significant differences in operative time and console time between the groups (Table 2) also supports this conclusion.

Our study would have more power if verified knowledge existed of the innate, accurate point at which the retrotrigonal layer has its distal insertion. Such knowledge will be essential to put our conclusions in context, because the residual retrotrigonal layer was sutured to the membranous urethra (Fig. 2D) in our RTBS technique. Further anatomical study with more patients will be needed to confirm our result.

The limitations of the present study include the retrospective comparison with a historical cohort and the lack of randomization. Unrecognized variables might account for our findings because the study was retrospective. As such, the results should be considered exploratory or observational, not definitive. To address this concern, we are planning a prospective randomized trial with validated continence measures to more rigorously assess the effectiveness of RTBS.

CONCLUSIONS

In this study, the RTBS did not appear to improve urinary incontinence after RALP. A verified description of the innate, accurate point at which the retrotrigonal layer has its distal insertion and prospective randomized studies with larger numbers of patients will be essential to confirm our results.

Conflicts of Interest
The authors have nothing to disclose.

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