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Surgery in Motion

Periurethral Suspension Stitch During Robot-Assisted Laparoscopic Radical Prostatectomy: Description of the Technique and Continence Outcomes

Vipul R. Patel[a,b,*], *Rafael F. Coelho*[a,b,c], *Kenneth J. Palmer*[a,b], *Bernardo Rocco*[a,b,d]

[a] *Global Robotics Institute, Florida Hospital Celebration Health, Celebration, FL 34747, USA*
[b] *University of Central Florida School of Medicine, Orlando, FL 32826-0116, USA*
[c] *Hospital das Clinicas da Faculdade de Medicina da Universidade de São Paulo, Divisão de Urologia, São Paulo, Brazil*
[d] *Divisione di Urologia Istituto Europeo di Oncologia, Milano, Italy*

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Abstract

Background: Several studies have shown that robot-assisted laparoscopic radical prostatectomy (RALP) is feasible, with favorable complication rates and short hospital times. However, the early recovery of urinary continence remains a challenge to be overcome.
Objective: We describe our technique of periurethral retropubic suspension stitch during RALP and report its impact on early recovery of urinary continence.
Design, setting, and participants: We analyze prospectively 331 consecutive patients who underwent RALP, 94 without the placement of suspension stitch (group 1) and 237 with the application of the suspension stitch (group 2).
Surgical procedure: The only difference between the groups was the placement of the puboperiurethral stitch after the ligation of the dorsal venous complex (DVC). The periurethral retropubic stitch was placed using a 12-in monofilament polyglytone suture on a CT-1 needle. The stitch was passed from right to left between the urethra and DVC, and then through the periostium on the pubic bone. The stitch was passed again through the DVC, and then through the pubic bone in a figure eight, and then tied.
Measurements: Continence rates were assessed with a self-administered validated questionnaire (Expanded Prostate Cancer Index Composite [EPIC]) at 1, 3, 6, and 12 mo after the procedure. *Continence* was defined as the use of no absorbent pads or no leakage of urine.
Results and limitations: In group 1, the continence rate at 1, 3, 6, and 12 mo postoperatively was 33%, 83%, 94.7%, and 95.7%, respectively; in group 2, the continence rate was 40%, 92.8%, 97.9%, and 97.9%, respectively. The suspension technique resulted in significantly greater continence rates at 3 mo after RALP ($p = 0.013$). The median/mean interval to recovery of continence was also statistically significantly shorter in the suspension group (median: 6 wk; mean: 7.338 wk; 95% confidence interval [CI]: 6.387–8.288) compared to the non-suspension group (median: 7 wk; mean: 9.585 wk; 95% CI: 7.558–11.612; log rank test, $p = 0.02$).
Conclusions: The suspension stitch during RALP resulted in a statistically significantly shorter interval to recovery of continence and higher continence rates at 3 mo after the procedure.

* Corresponding author. Global Robotics Institute, Florida Hospital Celebration Health, 410 Celebration Place, Suite 200, Celebration, FL 34747, USA. Tel. +1 407 303 4673.
E-mail address: Vipul.patel.md@flhosp.org (V.R. Patel).

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1. Introduction

The robot-assisted laparoscopic radical prostatectomy (RALP) is a widespread and rapidly expanding procedure around the world. Several studies have shown that RALP is feasible with limited blood loss, favorable complication rates, and short hospital times [1]. Also, the continence rates 1 yr after RALP reaches >90% in most of the large, single-center prospective studies—results at least comparable to the open radical retropubic prostatectomy (RRP) [2–5]. However, the early recovery of urinary continence remains a challenge to be overcome. The functional outcomes in the first 3 mo after radical prostatectomy (RP) are still variable, which has been attributed to differences in the surgical technique and variations in the definition and assessment of continence [6,7].

Based on this information, some technical variations have been described to improve the early urinary continence rates after RRP, such as the use of pubourethral suspension stitches [7] or the application of sutures anchoring the vesicourethral anastomosis to the ligated dorsal venous complex (DVC) [6]. Walsh [8,9] also previously described a technical refinement to divide the DVC with minimal blood loss while avoiding excision or damage to striated sphincter. The maneuver consists of passing a suture through the DVC, then through the perichondrium of the pubic symphysis in a reverse direction. The suture is tied, suspending the DVC. According to the author, this maneuver can help control the venous bleeding and can provide a recapitulation of the puboprostatic ligaments, supporting the striated sphincter. Some of these technical variations, although not widely adopted, showed a significant effect on the earlier recovery of urinary continence without compromising the oncologic outcomes [6,7].

The use of these suspension techniques and their outcomes in RALP, however, has not been described. Based on the previous clinical experience with open RRP and on the technical refinements reported by Walsh [8,9], we describe the placement of a periurethral retropubic suspension stitch during RALP. In this paper, we report the application of this technique and its impact on early recovery of urinary continence.

2. Methods

We analyzed 331 consecutive patients who underwent RALP, 94 without the placement of a suspension stitch (group 1) and 237 with the application of a suspension stitch (group 2), as described below. The data were prospectively collected in a customized database and retrospectively analyzed. All of the procedures were performed by a single surgeon (VRP) after his initial 1000 procedures. Our ethics committee approved the prospective collection of the data, and all patients provided written informed consent.

Patients with prostate cancer (PCa) of clinical stage T2 or less with no evidence of metastasis were considered candidates for RALP. Before RALP, all the patients underwent a standard evaluation, including digital rectal examination, transrectal biopsy, serum prostate-specific antigen (PSA) levels, and a radioisotope bone scan when necessary. The characteristics of patients included in the study are shown in Table 1.

Continence rates were assessed with a self-administrated validated questionnaire (Expanded Prostate Cancer Index Composite [EPIC]) [10] at 1, 3, 6, and 12 mo after the procedure. The definition of continence was based on patient responses to two questionnaire items selected to reflect the range of incontinence severity: "Over the past 4 weeks, how often have you leaked urine" and "How many pads or adult diapers per day did you usually use to control leakage during the last 4 weeks." Continence was defined as the use of "no pads" and "no leakage of urine," based on the patient responses to these two EPIC questions. The week on which continence was recovered was also assessed and recorded.

2.1. Surgical technique

All cases were carried out using the transperitoneal, six-port technique described by the authors previously [11]. The anterior peritoneum was incised to enter the retropubic space of Retzius. The endopelvic fascia was opened immediately lateral to the reflection of the puboprostatic ligaments bilaterally, and the elevator muscle fibers were pushed off the prostate until the DVC and urethra were visualized. The DVC was ligated using 12-in monofilament polyglytone suture on a CT-1 needle. The only difference between the groups with and without suspension was the placement of the puboperiurethral stitch after the ligation of the DVC.

In the suspension group, a periurethral retropubic stitch was placed using another 12-in monofilament polyglytone suture on a CT-1 needle. The stitch was placed holding the needle two-thirds of the way back in a 90° position and passed from right to left between the urethra and DVC (Fig. 1b), and then through the periostium on the pubic bone (Fig. 2a). The stitch was passed again trough the DVC (Fig. 2b), and then through the pubic bone (Fig. 3a) in a figure eight, and then tied with a mild amount of tension (Fig. 3b). The DVC was typically divided later during

Table 1 – Preoperative patient characteristics.

Characteristic	Without suspension	With suspension	*p* value
Age, yr, median/mean ± SD (range)	60/60, 1 ± 6.79 (45–73)	60/59, 8 ± 7.48 (42–79)	0.699
BMI, kg/m^2 (range)	28.75 ± 3.59 (20–38)	28.19 ± 3.61 (20–370)	0.243
PSA level before RALP, ng/ml, mean ± SD (range)	6.03 ± 5.03 (0.6–16.3)	5.52 ± 3.46 (0.5–13.3)	0.502
Prostate weight, g, mean ± SD (range)	51.84 ± 22.9 (15.3–96.6)	52.18 ± 23.4 (23–155)	0.610
AUASS, mean ± SD (range)	7.61 ± 7.55 (0–35)	8.21 ± 7.24 (0–32)	0.410
Biopsy Gleason score, no. (%)			
≤6	48/94 (51)	142/237 (60)	0.192
7	40/94 (42.6)	78/237 (33)	0.127
≥8	6/94 (6.4)	17/237 (7)	0.988

SD = standard deviation; BMI = body mass index; PSA = prostate-specific antigen; RALP = robot-assisted laparoscopic radical prostatectomy; AUASS = American Urological Association Symptom Score.

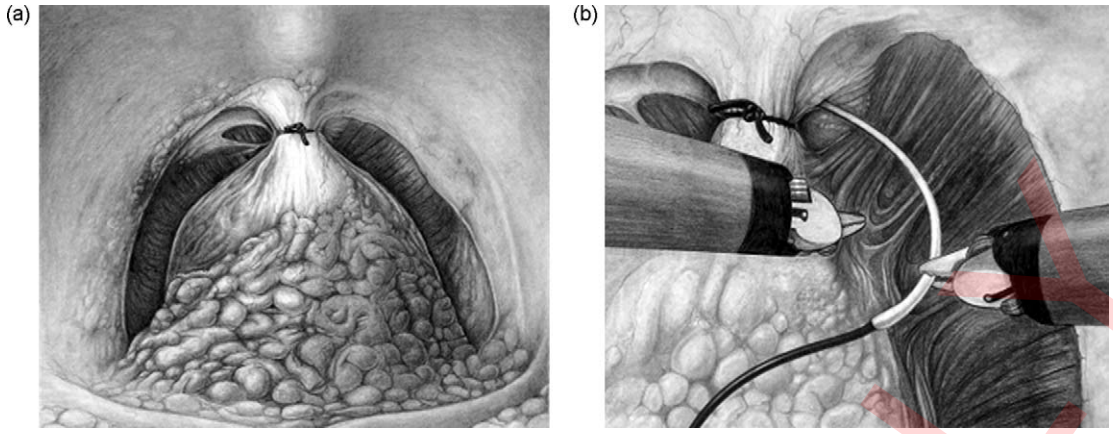

Fig. 1 – (a) Vision after the endopelvic fascia has been opened and the dorsal venous complex ligated; (b) CT-1 needle held at a 90° angle passed from right to left between the urethra and dorsal venous complex.

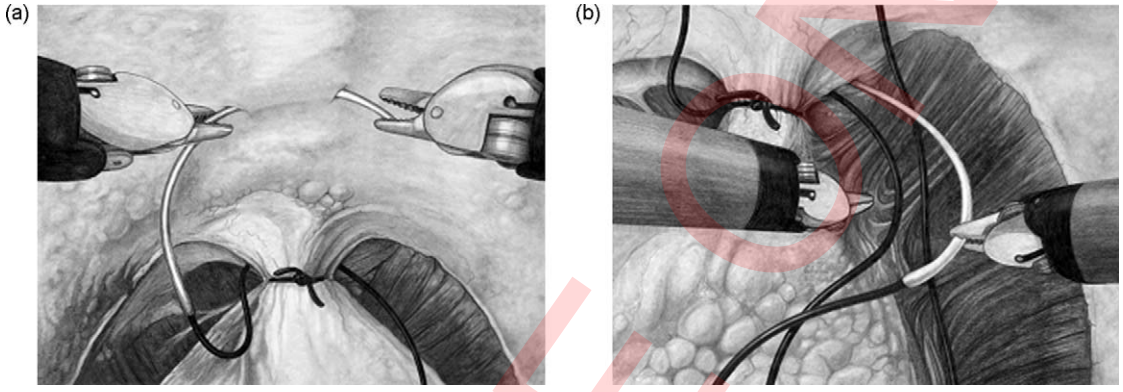

Fig. 2 – (a) Stitch placed through the periostium on the retropubis; (b) second pass through the dorsal venous complex.

the operation, prior to the apical dissection of the prostate and division of the urethra.

The suspension stitch was followed by the bladder neck dissection and mobilization of the seminal vesicles prior to ligation of the prostatic pedicles. The nerve sparing was performed athermally with an early retrograde release of the bundles from apex to base prior to ligation of the pedicles. The anastomosis was performed with continuous running suture using two 20-cm 3-0 monocryl sutures of different colors tied together. The posterior aspect of the anastomosis was performed in a clockwise direction starting at the 5 o'clock position and ending at 10 o'clock. The anterior aspect of the anastomosis was then performed with the second arm of the suture in a counterclockwise direction, and both sutures were tied together at the 10 o'clock position. A JP drain was placed around the anastomosis. All patients underwent cystogram on fourth postoperative day to exclude urinary leakage. The urethral catheter was removed 4–7 d after the procedure.

2.2. Statistical analysis

The two groups were statistically compared for patient age, body mass index (BMI), PSA levels before RALP, prostate weight, American Urological Association Symptom Score (AUASS), biopsy Gleason score,

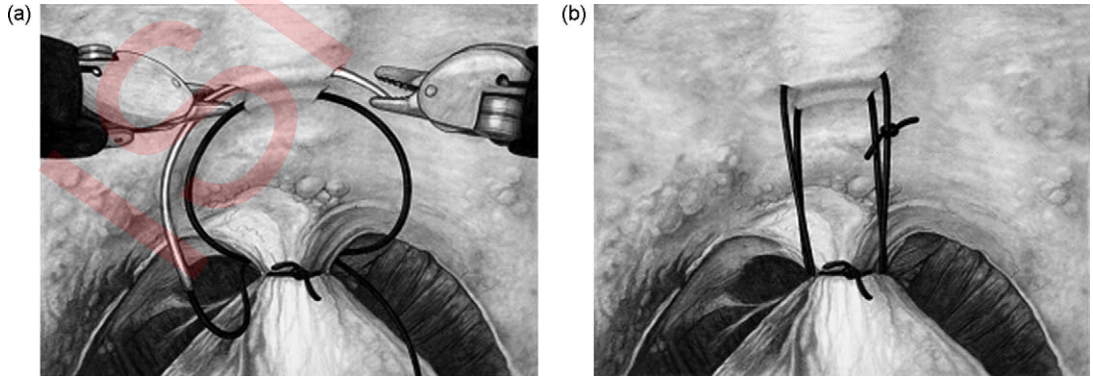

Fig. 3 – (a) Second pass through the dorsal venous complex and the periostium on the retropubis; (b) the final stitch is tied.

Table 2 – Perioperative parameters.

Parameter	Without suspension	With suspension	*p* value
Operative time, min (range)	77.34 ± 11.81 (55–100)	76.28 ± 9.54 (45–100)	0.804
Estimated blood loss, ml (range)	121.86 ± 54.82 (75–500)	114.02 ± 32.31 (50–400)	0.265
Transfusion rate (%)	0	0	–
Catheterization time, d (range)	5.33 ± 0.72 (4–8)	5.37 ± 1.3 (4–12)	0.110
Nerve-sparing procedure, no. (%)			
Bilateral nerve sparing	58 (61.7)	150 (63.3)	0.886
Unilateral nerve sparing	20 (21.3)	45 (19)	0.749
Non–nerve sparing	16 (17)	42 (17.7)	0.895

Table 3 – Pathologic stage and positive surgical margins.

	Without suspension	With suspension	*p* value
Pathologic stage (%)			
pT2	68/94 (72.3)	184/237 (77.6)	0.381
pT3	26/94 (27.6)	53/237 (22.3)	0.381
PSM rates (%)	9/94 (9.5)	29/237 (12.2)	0.621
pT2	3/68 (5.3)	12/184 (6.5)	0.743
pT3	6/26 (23)	11/53 (20)	0.989
PSM at the apex	4/94 (4.2)	15/237(6.3)	0.639
Gleason score—surgical specimen (%)			
≤6	40/94 (42.6)	105/237 (44.3)	0.868
7	43/94 (45.7)	106/237 (44.7)	0.372
≥8	11/94 (11.7)	26/237 (11)	0.998

PSM = positive surgical margins.

Table 4 – Continence rates at <1, 3, 6, and 12 months of follow-up with and without the suspension stitch.

Follow-up time, mo	Without suspension stitch (*n* = 94)	With suspension stitch (*n* = 237)	*p* value
1 (%)	31 (33.0)	95 (40.0)	0.282
3 (%)	78 (83.0)	220 (92.8)	0.013
6 (%)	89 (94.7)	232 (97.9)	0.237
12 (%)	90 (95.7)	232 (97.9)	0.479

pathologic stage, positive surgical margins (PSMs), estimated blood loss, operative time, blood transfusion rates, catheterization time, number of nerve-sparing procedures, and continence rates. To compare the numerical variables, we used the student *t* test or the Mann-Whitney test. To compare categorical variables, we used the χ^2 test or the Fisher exact test. To compare the interval before the return of urinary continence between the two groups, we used the Kaplan-Meier method and the log-rank test to analyze the differences between the curves. The information was processed with SigmaStat v.3.5 software (Systat Software, San Jose, CA, USA), and statistical significance was defined as $p < 0.05$.

3. Results

There was no significant difference between the groups with respect to patient age, BMI, PSA levels before RALP, prostate weight, AUASS, and biopsy Gleason score (Table 1). There was also no significant difference with respect to estimated blood loss, operative time, blood transfusion rates, and catheterization time (Table 2).

In group 1, 58 (61.7%) patients underwent a bilateral nerve-sparing procedure, 20 (21.3%) underwent a unilateral nerve-sparing procedure, and 16 (17%) underwent a non–nerve-sparing procedure. In group 2, 150 (63.3%) patients underwent a bilateral nerve-sparing procedure, 45 (19%) underwent a unilateral nerve-sparing procedure, and 42 (17.7%) underwent a non–nerve-sparing procedure. There was no statistically significant difference between the groups with respect to the number of nerve-sparing procedures (Table 2).

There were no intraoperative complications during RALP in either group of patients. No significant postoperative morbidity related to the placement of the suspension stitch, such as pubic osteitis, was reported. No patients presented with acute urinary retention after catheter removal.

The two groups had no significant differences in their pathologic stage, in the frequency of PSM, and in the Gleason score of the surgical specimen (Table 3). In the suspension group (group 2), the overall PSM rate was 12.2% (29 of 237), and the PSM rates in patients with pT2 and pT3 tumors were 6.5% (12 of 184) and 20% (11 of 53), respectively. In the nonsuspension group (group 1), the overall PSM rate was 9.5% (9 of 94), and the PSM rates in patients with pT2 and pT3 tumors were 5.3% (3 of 68) and 23% (6 of 26), respectively. The incidence of PSM at the apex was also similar between the groups (4.2% vs 6.3%; $p = 0.639$).

We received the questionnaires (EPIC) from all the 94 patients evaluated in group 1 and all the 237 patients in group 2. In group 1, the continence rate at 1, 3, 6, and 12 mo postoperatively was 33%, 83%, 94.7%, and 95.7%, respectively. In group 2, the continence rate at 1, 3, 6, and 12 mo postoperatively was 40%, 92.8%, 97.9%, and 97.9%, respectively. The suspension technique resulted in significantly greater continence rates at 3 mo after RALP ($p = 0.013$), although the rates at 6 and 12 mo were not significantly affected (Table 4).

The median/mean interval to recovery of continence was statistically significantly shorter in the suspension group (median: 6 wk; mean: 7.338 wk; 95% confidence interval [CI]: 6.387–8.288) compared to the nonsuspension group (median: 7 wk; mean: 9.585 wk; 95% CI: 7.558–11.612; log-rank test, $p = 0.02$; Fig. 4).

4. Discussion

Urinary incontinence following RRP is still a major source of morbidity and significant concern for patients with prostate-confined cancer [6,7]. Questionnaires of health-related quality of life and continence administered to patients who underwent RP showed that urinary incontinence has the greatest impact on patient quality of life

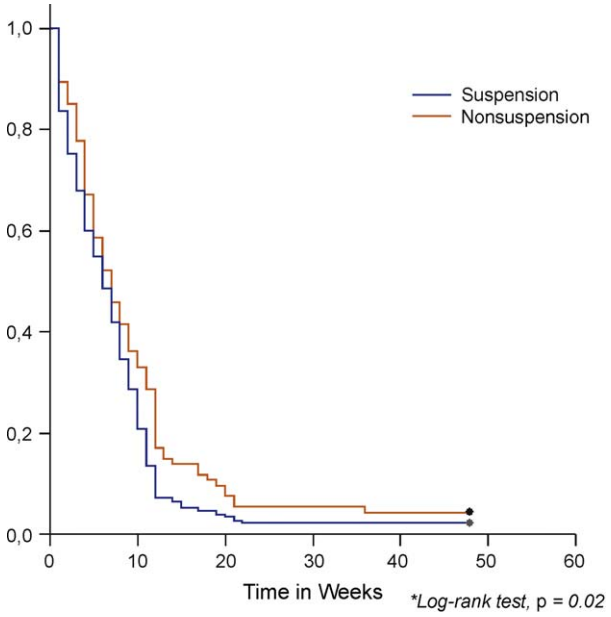

Fig. 4 – Kaplan-Meier curves showing the urinary incontinence probability after robot-assisted laparoscopic radical prostatectomy with and without the placement of the suspension stitch.

[12,13]. As a result, a variety of surgical techniques has been used in an attempt to improve the early return of continence after RRP, including bladder neck preservation [14,15], intussusception of the bladder neck [16], puboprostatic ligament sparing [17], incorporation of the striate urethral sphincter to the anastomosis [18], and tubularization of the bladder neck [19]. However, the results are controversial.

Srougi et al. [20] concluded that bladder neck preservation during RRP does not improve urinary continence and causes a higher incidence of PSMs (10% vs 0%; $p = 0.08$). Contrarily, Selli et al. [15] and Deliveliotis et al. [14] found that preserving the bladder neck contributes substantially to early recovery of continence. In his turn, Walsh and Marschke [16] described the technique of intussusception of the bladder neck using two sutures placed lateral and posterior to the reconstructed bladder neck. Three months after the procedure, 82% of the patients who underwent intussusception of the bladder neck were continent, compared to 54% of the patients who had RRP without intussusceptions. Finally, Lowe [17] reported that preserving the anterior urethral ligamentous attachments results in improved urinary continence and lower operative blood flow, without an increase in PSMs. This author compared patients undergoing RRP with preservation of the anterior urethral attachments to three other groups of patients: patients undergoing RRP with resection of the bladder neck, patients with preservation of the bladder neck, and patients undergoing dorsal vein gathering. The continence rate 3 mo after the procedure was significantly higher with preservation of the urethral attachments (80.4%, 41.4%, 50.9%, and 50%, respectively).

Technical modifications during RALP were also proposed, aiming to improve the continence rates. Menon et al. [21] described their RALP technique with preservation of the lateral prostatic fascia (veil of Aphrodite). These authors advocate early transection of the bladder neck (without opening endopelvic fascia or ligating the DVC), preservation of the prostatic fascia, and control of the DVC after dissection of the prostatic apex. They analyzed 2625 patients who underwent RALP for treatment of clinical localized PCa and found that 95.2% of patients were socially dry (use of one pad or less per day) 12 mo after surgery. Of patients who were totally dry, 25% were dry within 24 h of catheter removal, 50% were dry within 4 wk (median duration of incontinence), and 90% within 3 mo.

Other intraoperative attempts to improve early continence have included the sling suspension of the vesicourethral anastomosis. Jorion [22] described a sling suspension of the vesicourethral anastomosis with a strip harvested from the fascia of the rectus muscle at the time of the RRP. Complete continence rates 3 mo after the procedure were significantly higher in the patients who underwent the fascial sling suspension (93% vs 70%; $p = 0.042$). The disadvantages of this procedure include additional operative time, the additional morbidity of harvesting the fascia, and the risk of urinary retention [22]. Campenni et al. [7] described the placement of two pubourethral suspension stitches during open RRP in an attempt to simplify the suspension of the vesicourethral anastomosis without distorting the anatomy or introducing a foreign body. In their technique, the stitches are placed in the anterior vesicourethral anastomosis and anchored to the lower portion of the pubic bone and periostium. Six months after the surgery, 32% of the patients in the suspension group were completely continent versus 12% in the nonsuspension group. The mean Valsalva leak point pressure (VLPP) was also significantly higher in the patients with suspension stitches (89.6 ± 21.6 cm H_20 vs 74.0 ± 16.7 cm H_20; $p = 0.015$). The authors concluded that the placement of anastomotic urethral suspension stitches during RRP may increase the incidence of complete postoperative urinary continence.

Noguchi et al. [6,23] also described a suspension technique of the vesicourethral anastomosis during open RRP. In their technique, the anastomotic sutures at the 1 and 11 o'clock positions are anchored to the ligated complex (including both the DVC and the puboprostatic ligaments) to suspend the vesicourethral anastomosis. They conducted a prospective, single-blind, randomized clinical trial of the suspension technique during RRP for localized PCa. The suspension technique resulted in significantly greater continence rates at 1, 3, and 6 mo after RRP of 53% versus 20%, 73% versus 47%, and 100% versus 83% [23]. Postoperative VLPP at all points of measurement was also significantly higher in the suspension group than in the nonsuspension group ($p < 0.0002$) [23]. The authors concluded that the suspension technique has a significant effect on earlier recovery of urinary continence after RRP and proposed the application of this technique in laparoscopic and/or robotic RP.

To our knowledge, our article is the first description of the use of a suspension technique during RALP. Our

technique is similar to the technical refinement described previously by Walsh [8] in open RRP. It differs from the technique described by Campenni et al. [7] because our suspensor stitch is passed through the DVC and periurethral tissue, not through the vesicourethral anastomosis. It also differs from the technique described by Noguchi et al. [22], because we use the pubic bone, not the DVC and puboprostatic ligaments to anchor the anastomosis. Our results showed a higher recovery of complete urinary continence at 3 mo after RALP with the placement of the suspension stitch. In addition, our procedure did not affect the frequency of PSM. Complete removal of the cancer is still the primary end point of RALP, and any modifications of the surgical technique must not compromise the oncologic outcome.

The exact mechanism of the early recovery of continence using the suspension stitch is unclear. We believe that the suspension of the periurethral complex can provide additional anterior support to the striated sphincter, stabilizing the posterior urethra in its anatomical position in the pelvic floor. This stabilization can aid in the preservation of the urethral length during the dissection of the prostatic apex, facilitating the vesicourethral anastomosis. Furthermore, we believe that the suspension stitch helps to control the venous bleeding from the DVC and enables the surgeon to visualize more clearly the plane between the anterior prostatic apex and the DVC, as emphasized by Walsh previously [8].

Our study evaluated patients who underwent RALP performed by a single surgeon, after his learning curve, using two different technical variations. Patient characteristics were similar in both groups. However, these patients were not randomized in the two groups, which is the most important limitation of our study. Moreover, the number of patients in each group was asymmetric, with relatively few patients in the group without the suspension stitch.

5. Conclusions

We added the periurethral suspension stitch to our standard RALP technique with the initial purpose of improving hemostasis of the DVC and facilitating the dissection of the prostate apex and urethra. This study showed that the placement of the suspension stitch during RALP also results in a statistically significantly shorter interval to recovery of continence and higher continence rates at 3 mo after the procedure. The continence rates at 6 and 12 mo and the PSM rates were not significantly affected.

Author contributions: Vipul R. Patel had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Patel, Palmer, Coelho, Rocco.
Acquisition of data: Palmer, Coelho.
Analysis and interpretation of data: Coelho, Palmer.
Drafting of the manuscript: Coelho, Palmer.
Critical revision of the manuscript for important intellectual content: Patel, Rocco.
Statistical analysis: Coelho.
Obtaining funding: Patel.
Administrative, technical, or material support: Patel.
Supervision: Patel.
Other (specify): None.

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Appendix A. Supplementary data

The Surgery in Motion video accompanying this article can be found in the online version at doi:10.1016/j.eururo.2009.06.007 and via www.europeanurology.com. Subscribers to the printed journal will find the Surgery in Motion DVD enclosed.

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