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ARTICLE

Simple suturing of the bladder neck muscle layer at the vesicourethral anastomosis site to the dorsal vein complex during anterior reconstruction led to a better postoperative urinary continence after robot-assisted laparoscopic prostatectomy

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ABSTRACT

Objectives: To elucidate whether a modified technique for anterior reconstruction could improve urinary continence after robot-assisted laparoscopic radical prostatectomy (RALP).

Methods: Among 325 consecutive patients who underwent RALP at our hospital, 297 patients were included in this retrospective study, who had complete records including the status of postoperative urinary continence. Among these 297 patients, 194 underwent anterior reconstruction by suturing the lateral bladder wall to the arcus tendineus of the pectineal fascia without fixation of the vesicourethral anastomosis site to the dorsal vein complex (DVC) (lateral-suture group). In the remaining 103 patients, simple suturing of the bladder neck muscle layer at the vesicourethral anastomosis site with DVC to immobilize the vesicourethral anastomosis site (immobilized group) was performed. Those who did not required a pad was defined as continent.

Results: Operative and console times were significantly shorter in the immobilized group (242 vs. 268 min; $p = 0.03$, and 174 vs. 203 min; $p = 0.009$, respectively). Although there was no significant difference between the groups regarding the recovery of urinary continence within 3 months after RALP (21 vs. 22% at 1 month; $p = 0.77$, and 54 vs. 60% at 3 months; $p = 0.33$, respectively), more patients achieved urinary continence in the immobilized group than lateral-suture group after 6 months (71 vs. 83% at 6 months; $p = 0.03$ and 82 vs. 96% at 12 months; $p = 0.001$, respectively).

Conclusions: Simple suture of the bladder neck muscle layer at the vesicourethral anastomosis site to DVC led to a better urinary continence status 6 months or later after RALP.

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Anterior reconstruction; continence; immobilize; robot-assisted laparoscopic radical prostatectomy; vesicourethral anastomosis site

Introduction

One of the most common complications following prostatectomy for prostate cancer is urinary incontinence, which markedly impairs the quality of life (QOL) of patients. The reported incidence of urinary incontinence in patients after prostatectomy ranges from 6 to 20% [1,2]. Although more than 90% of patients achieve urinary continence by 12 months following prostatectomy, urinary incontinence improves only marginally after 12 months [3].

We previously reported a significant correlation between the bladder neck location based on a postoperative cystogram and recovery of urinary incontinence after robot-assisted laparoscopic prostatectomy (RALP) [4]. The location of the bladder neck above the middle of the pubic symphysis height was a significant predictor of postoperative urinary continence. Furthermore, the higher the bladder neck, the earlier the achievement of urinary continence after RALP [4].

Some surgical techniques have been proposed to achieve early urinary continence, such as bladder neck preservation [5], nerve-sparing techniques [6,7], avoidance of thermal injury to the external urethral sphincter during disconnection of the apex of the prostate [8], and preservation of the distal urethral length [9]. In addition, as other surgical techniques related to urinary reconstruction, posterior reconstruction [10], anterior reconstruction [11], bladder neck sling suspension [12], and bladder neck plication [13] have been reported to improve postoperative urinary incontinence.

In this study, we retrospectively compared anterior reconstruction techniques on RALP for postoperative urinary continence. In addition, we investigated whether the technique subsequently contributed to a higher bladder neck location based on a postoperative cystogram.

Materials and methods

The institutional review board of Nara Prefecture General Medical Center approved this retrospective study (No. 524).

Among 325 patients with prostate cancer who underwent RALP at our hospital between March 2013 and August 2018, 297 were included in this study, who had complete records of preoperative demographics as well as perioperative and postoperative outcomes including the status of postoperative

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urinary continence. There was no patient with neurogenic bladder or end-stage kidney disease.

RALP was performed using the da Vinci Si system (Intuitive Surgical Inc., Sunnyvale, CA) with a transperitoneal approach using a standard 4-armed configuration with an additional two assistant ports. Almost all RALP in this manuscript was performed by expert surgeons (SF, YK, SS), who have operated RALP around 100 surgeries at that time.

A nerve-sparing procedure was employed based on the clinical stage and NCCN risk criteria. We did not carry out a bladder neck preservation procedure on a routine basis. All patients received posterior and anterior reconstructions. The van Velthoven's running suture [14] was employed for vesico-urethral anastomosis.

Among the 297 patients, 194 received anterior reconstruction: suturing the lateral bladder wall to the arcus tendineus of the pectineal fascia without fixation of the vesicourethral anastomosis site to the dorsal vein complex (DVC) (lateral-suture group) (Figure 1(a)). The remaining 103 patients received anterior reconstruction: simple suturing of the bladder neck muscle layer at the vesicourethral anastomosis site with DVC tightly to immobilize the vesicourethral anastomosis site (immobilized group) (Figure 1(b)).

All patients underwent cystography at 6–8 days after RALP. Contrast medium was instilled into the bladder through a urethral catheter until a patient declared the maximum desire to void or instilled saline volume reached 200 mL. Cystograms were obtained with an anterior-posterior view without catheter tension, and findings were interpreted by experienced urologists without information on the continence status.

We defined the bladder neck location as the lowest extension of tapering contrast medium in the bladder, and its relation with the pubic symphysis was evaluated [4]. The bladder neck location was divided into the following two categories: above and below the middle of the pubic symphysis height (Figure 2).

Preoperative clinical characteristics included the age, body mass index (BMI), NCCN risk criteria, and PSA value at diagnosis. Perioperative outcomes including the operative and console times, prostate volume, and preservation of the neurovascular bundle (no, unilateral, or bilateral) were also evaluated.

The continence status at 1, 3, 6 and 12 months after RALP was surveyed each time using the same questionnaire, including the pad usage during a day (no pad per day, 1 pad per day, 2 pads per day, 3 pads or more per day). In analyses of urinary continence, patients who did not need a pad (no pad per day) were defined as continent.

The collected data were analyzed using JMP® 13 (SAS Institute Inc., Cary, NC). The Mann-Whitney test, Chi-square test and Fisher's exact test were employed to compare the data of the patients between the lateral-suture and

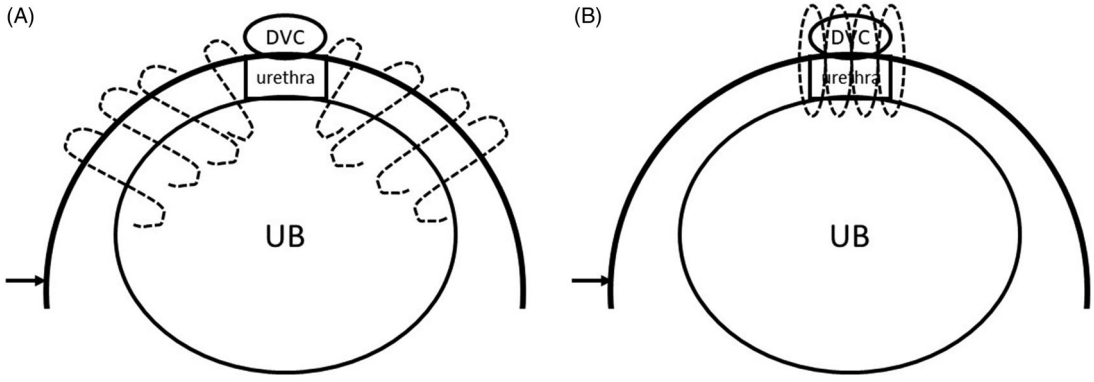

Figure 1. Surgical techniques for anterior reconstruction. (A) suturing the lateral bladder wall to the arcus tendineus of the pectineal fascia without fixation of the vesicourethral anastomosis site to the dorsal vein complex (DVC). (B) simple suturing of the bladder neck muscle layer at the vesicourethral anastomosis site with DVC tightly to immobilize the vesicourethral anastomosis site. An arrow: arcus tendineus of the pectineal fascia. UB: urinary bladder.

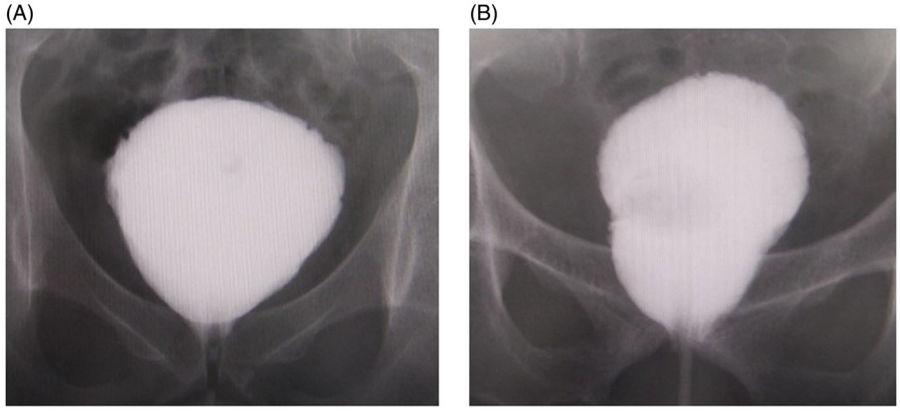

Figure 2. The location of the bladder neck. (A) Above the middle of the pubic symphysis. (B) Below the middle of the pubic symphysis.

Table 1. Patients' characteristics of lateral-suture and immobilized groups.

	Lateral-suture group ($n = 194$)	Immobilized group ($n = 103$)	p Value
Age (years, median [IQR])	68 (65–71)	71 (65–72)	0.001[b]
PSA (ng/mL, median [IQR])	8.1 (5.8–11.3)	7.1 (5.3–9.2)	0.57
BMI (median [IQR])	23.5 (21.9–25.3)	24.0 (22.3–25.0)	0.36
PV (mL, median [IQR])	44.0 (35.5–52.5)	46.0 (39.5–54.0)	0.09[b]
NCCN risk criteria			
Low	39 (20)	16 (16)	0.61
Intermediate	99 (51)	57 (55)	
High	56 (29)	30 (29)	
Operation time (min, median [IQR])	268 (65–71)	242 (65–72)	0.03[b]
Console time (min, median [IQR])	203 (5.8–11.3)	174 (5.3–9.2)	0.009[b]
Blood loss (mL, median [IQR])	200 (21.9–25.3)	150 (22.3–25.0)	0.03[a]
Nerve sparing (n, %)			
None	104 (54)	56 (54)	0.86
Unilateral	67 (35)	33 (32)	
Bilateral	23 (11)	14 (14)	
Resected margin positive (n, %)	48 (24)	25 (24)	1.00

[a]Fisher's exact test.
[b]Mann–Whitney test.

Table 2. Urinary continence after RALP of lateral-suture group and immobilized group.

Period after RALP	lateral-suture group ($n = 194$)	Immobilized group ($n = 103$)	p Value
1 month (n, %)	40 (21)	23 (22)	0.77
3 months (n, %)	104 (54)	62 (60)	0.33
6 months (n, %)	138 (71)	85 (83)	0.03[a]
12 months (n, %)	159 (82)	97 (96)	0.001[a]

[a]Fisher's exact test.

immobilized groups. A p-value of less than 0.05 was considered significant.

Results

Patients' characteristics of both groups are presented in Table 1. The median age of patients at RALP was 68 years in the lateral-suture group and 71 years in the immobilized group ($p = 0.001$). There was no significant difference between the groups in terms of the PSA value at the diagnosis of prostate cancer, BMI, prostate volume and NCCN risk criteria.

The perioperative parameters showed that operative and console times were significantly shorter in the immobilized group than in the lateral-suture group (242 vs. 268 min; $p = 0.03$, and 174 vs. 203 min; $p = 0.009$, respectively). The blood loss volume during surgery was significantly less in the immobilized group (150 vs. 200 mL; $p = 0.03$). No blood transfusion was needed. A nerve-sparing procedure was performed in a similar proportion in both groups (unilateral sparing in 67 patients (35%), and bilateral in 23 (11%) in the lateral-suture group, and unilateral in 33 (32%), and bilateral in 14 (14%) in the immobilized group, $p = 0.86$). A histopathologically positive resected margin was seen in similar proportions in both groups: 48 patients (24%) in the lateral-suture group, and 25 patients (24%) in the immobilized group; $p = 1.00$).

In postoperative cystograms, the location of the bladder neck above the middle of the pubic symphysis height was seen in 122 patients (63%) in the lateral-suture group and 67 (65%) in the immobilized group, with no significant difference ($p = 0.8$).

Urinary continence at 1, 3, 6, and 12 months after RALP was achieved in 40 (21%), 104 (54%), 138 (71%), and 159 (82%) patients in the lateral-suture group (194 patients), and 23 (22%), 62 (60%), 85 (83%), and 97 (96%) patients in the immobilized group (103 patients), respectively. Although there was no significant difference between the groups regarding recovery of urinary incontinence within 3 months after RALP (21 vs. 22%; $p = 0.77$ at 1 month, and 54 vs. 60%; $p = 0.33$ at 3 months, respectively), better results regarding urinary continence were achieved in the immobilized group than in the lateral-suture group at 6 and 12 months: 71 vs. 83%; $p = 0.03$, and 82 vs. 96%; 0.001, in the lateral-suture and immobilized groups, respectively (Table 2).

Discussion

It was reported that approximately 5% of patients after prostatectomy remained incontinent at a level that might impair their QOL [15], and various surgical techniques to improve incontinence in such patients have been proposed: preservation of the bladder neck and/or neurovascular bundle, avoidance of thermal injury to the external urethral sphincter during resection of the apex of the prostate, and preservation of the distal urethral length. In addition, some intraoperative techniques during urinary reconstruction have been described. Rocco et al. [10] mentioned the usefulness of posterior wall reconstruction. Other intraoperative techniques are: sling suspension of the bladder neck, suspension of the paraurethral tissue, bladder neck plication and anterior reconstruction.

In our previous report [4], we showed a significant correlation between the bladder neck location based on a

postoperative cystogram and early recovery of urinary continence at 3 months. In addition, the higher the bladder neck location within the pubis on a postoperative cystogram, the earlier the urinary incontinence recovery after RALP ($p < 0.001$). We also demonstrated that preoperative MRI findings were significantly correlated with the bladder neck location, i.e. the vesicourethral anastomosis site on a postoperative cystogram [16]. There were patients whose preoperative MRI predicted higher location of bladder neck on postoperative cystography showed lower location of bladder neck on postoperative cystography, subsequently worse recovery of urinary continence after RALP. On the other hand, patients whose preoperative MRI predicted lower location of bladder neck on postoperative cystography showed higher location of bladder neck on postoperative cystography, subsequently achieve early recovery of urinary continence after RALP. According to these results, not only the anatomical differences defined by preoperative MRI image, but also the postoperative bladder neck location played a very important role in achieving early recovery of urinary continence after RALP. We investigated how to support and maintain the bladder neck at the anatomic retropubic location after RALP. We considered that, in addition to preservation of the urethral length as long as possible, tight stiches of the bladder neck muscle layer at the anastomosis site and DVC as an anterior reconstruction procedure may suspend the bladder neck, i.e. the vesicourethral anastomosis site, at the retropubic location. In this study, we evaluated whether these surgical techniques could contribute to a higher location of the bladder neck, and subsequently achieve early recovery of urinary incontinence after RALP.

As mentioned above, this study showed that simple fixation of the vesicourethral anastomosis site to DVC led to a better urinary continence status 6 months after RALP with significantly shortened operative and console times compared with lateral-suture procedure during anterior reconstruction despite having a similar nerve-sparing status, although our surgical technique did not contribute to a higher location of the bladder neck on postoperative cystography .

Recently, a challenging surgical technique of RALP, retzius-sparing RALP (RS-RALP), was reported that facilitated good results regarding postoperative urinary continence [17]. Aside from its oncological efficacy based on a limited number of patients undergoing the RS-RALP, its excellent results are very suggestive of the etiology of postoperative urinary incontinence. and may be one of the focus points to investigate possible mechanisms leading to good results of postoperative urinary incontinence.

There were some limitations of this study. First, this was a retrospective study with a relatively small number of patients. Second, not a single surgeon but three experienced console surgeons performed RALP in this series, which might influence the results according to differences in surgeons' surgical techniques. Third, we perform cystography only one time and we did not perform cystography regularly after RALP. We could not evaluate whether the lateral-suture procedure cause postoperative instability of anastomosis site, and the immobilized procedure can cause postoperative stability of anastomosis site, which may lead early recovery of urinary continence. Further studies are needed to clarify.

In conclusion, a surgical technique proposed by us, simple tight stiches of the bladder neck muscle layer at the vesicourethral anastomosis site with DVC, did not contribute to a higher location of the bladder neck on postoperative cystography. However, this simple anterior reconstruction technique led to a better urinary continence status at 6 months or later after RALP with significantly shortened operative and console times.

Author contributions

Shinji Fukui: project development, data collection, data analysis, manuscript writing; Yoriaki Kagebayashi: project development; Yusuke Iemura: data collection; Yoshihiro Tatsumi: data collection; Yoshiaki Matsumura: data collection; Shoji Samma: data collection.

Disclosure statement

The authors declare that they have no conflict of interest.

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