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Comparison of perioperative outcomes between running versus interrupted vesicourethral anastomosis in open radical prostatectomy: A single-surgeon experience

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Purpose: To compare perioperative outcomes between running and interrupted vesicourethral anastomosis in open radical prostatectomy (RP).

Materials and Methods: The medical records of 112 patients who underwent open RP for prostate cancer at our institution from 2006 to 2008 by a single surgeon were retrospectively reviewed. Preoperative, intraoperative, and postoperative parameters were measured.

Results: Of 112 consecutive patients, 62 patients underwent vesicourethral anastomosis by use of the running technique, whereas 50 patients underwent anastomosis with the interrupted technique. The groups did not differ significantly in age, body mass index, prostate-specific antigen, prostate volume, or pathologic findings. The intraoperative extravasation rate was significantly lower in the running group (8.1% vs. 24.0%, p=0.01). The mean anastomosis time was 15.1±5.3 and 19.3±4.6 minutes in the running and interrupted groups, respectively (p=0.04). The rates of postoperative extravasation were similar for both groups (6.4% vs. 10.0%, p=0.12). The duration of catheterization was significantly shorter in the running group (9.0±3.0 days vs. 12.9±6.4 days, p<0.01). The rate of urinary retention after catheter removal and the rate of bladder neck contracture were not significantly different between the two groups. The rate of urinary continence at 3, 6, 9, and 12 months after RP was also similar in both groups.

Conclusions: Both anastomosis techniques provided similar functional results and a similar rate of postoperative urine extravasation. However, running vesicourethral anastomosis decreased the rate of intraoperative extravasation and time for anastomosis, without increasing the risk of urinary retention or bladder neck contracture.

Keywords: Prostatectomy; Prostatic neoplasms; Surgical anastomosis; Urine

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INTRODUCTION

Radical prostatectomy (RP) is a challenging operation that demands high levels of surgical expertise and experience. RP can be performed with open or with minimally invasive laparoscopic or robot-assisted approaches. Vesicourethral anastomosis is the most technically challenging part of the procedure and can be performed with either interrupted or running sutures, both in open RP and in laparoscopic prostatectomy. Urinary vesicourethral anastomotic extravasation is a common short-term complication of RP. Insufficient vesicourethral anastomosis can cause significant postoperative urinary extravasation, which can result in a longer catheterization time with patient discomfort and an increased risk of long-term anastomotic strictures [1,2]. Most urinary extravasation occurs immediately after surgery; it is mostly self-limiting and resolves without additional intervention. However, further intervention is occasionally required for persistent vesicourethral anastomotic urinary extravasation, which if severe, can require reoperation and reanastomosis.

Thus far, only 2 previous studies have compared the use of interrupted anastomosis with running anastomosis for laparoscopic RP [3,4]. In laparoscopic RP, running anastomosis is usually used, with reports that it is quicker and technically less challenging than interrupted anastomosis [4]. The running anastomosis is theoretically more watertight and reinserting the catheter is safer and easier, because the catheter tip is less likely to pass posteriorly and extravesically [5]. Several studies have reported that running anastomosis is technically feasible and provides safe and early catheter removal in open RP [5-8]. However, for open RP, most surgeons perform vesicourethral anastomosis by use of interrupted sutures because of the difficulty of anastomosis and the lack of studies comparing outcomes for open RP using running and interrupted techniques. Here we describe the easier method of vesicourethral running sutures for open RP and compare perioperative outcomes of the two anastomosis approaches.

MATERIALS AND METHODS

1. Study population and data collection

After Institutional Review Board approval of Gangneung Asan Hospital was obtained, a retrospective review was carried out of the medical records of 112 patients who underwent open RP for prostate cancer performed by a single surgeon (J.Y.P.) between 2006 and 2008. Vesicourethral anastomosis had been performed by both running and interrupted suture methods. Patients who had hormone therapy or radiation therapy were excluded from the study, as were patients with missing 3-month follow-up data.

2. Surgical technique

Open RP was performed up to the stage of vesicourethral anastomosis as per Walsh's technique [9]. Bladder neck preservation and nerve-sparing procedures were carried out when appropriate. We used the technique described by Walsh for interrupted anastomosis suturing [9].

For the running anastomosis technique, we prepared a single anastomotic suture by tying the tails of two 3-0 Monosyn (monofilament) sutures on a 5/8 circle needle. We used a modified version of the technique described by Van Velthoven et al. [10] by using approximately 12 sutures; the length of each suture was 15 cm. Initially, the knot was located at the 4 o'clock position of the bladder neck and anchored the anastomotic stitch at this location. One of the needles was sutured from the outside in to the left of the 4 o'clock position of the bladder neck (Fig. 1A). We proceeded with a clockwise running suture in the left lateral wall of the anastomosis from the 4 o'clock position of the bladder neck to the 8 o'clock position on the outside of the urethral wall. The needle was always driven full-thickness from the outside in into the bladder wall and from the inside out on the urethral stump. We used a nephrostomy catheter for facilitating in-to-out suture placement at the urethral stump instead of the urethral catheter or metal sound. The needle tip was placed to the inside of the nephrostomy catheter lumen (Fig. 1B), and we then pulled the catheter into the urethra (Fig. 1C). The surgeon can place the suture smoothly

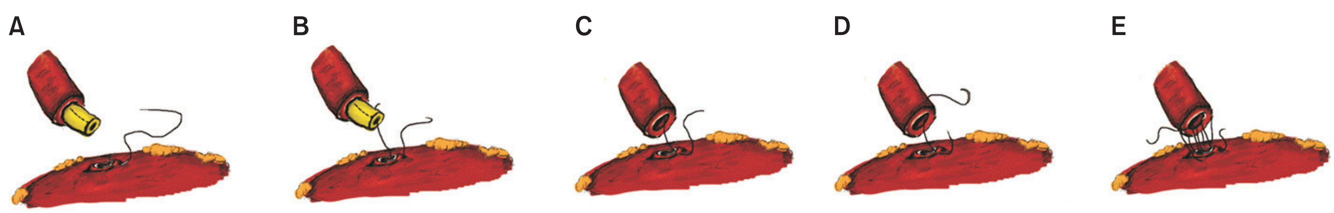

Fig. 1. (A-E) Schematic diagram for running vesicourethral anastomosis technique using nephrostomy catheter.

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and easily at the desired urethral location. This makes it technically easier than using a metal sound or urethral catheter and prevents injury to the urethral stump (Fig. 1D). Gentle traction was applied to the end of the suture to avoid loosening the suture and the other needle was driven from the outside in to the right of the 4 o'clock position of the bladder neck, and this suture was used to perform a counter-clockwise running suture in the right bladder wall to the 2 o'clock position from the urethral stump (Fig. 1E). At this point, the 18-French urethral catheter was introduced into the bladder. Then, the left running suture was completed from the 8 o'clock to the 12 o'clock position and the right side was also completed from the 2 o' clock to the 12 o'clock position. After gentle traction of each suture, it is easy to access the site of the anastomosis. The 2 suture ends were tied together under direct visual inspection. We then checked for vesicourethral anastomosis urine leaks after instillation of 150 mL of normal saline into the bladder. If there was significant urine leakage, we performed an additional suture. After surgery, the urethral catheter was placed without traction.

3. Patient follow-up

Cystography was performed on all patients at 6 or 8 days after open RP. If no urine leaked, the urethral catheter was removed. If patients were unable to void adequately, the urethral catheter was inserted for 3 to 5 additional days. Cystography was repeated 5 to 7 days later to reevaluate the patient for catheter removal.

All patients were followed up after open RP every 3 months for the first year, biannually during the second year, and annually thereafter. Each visit included a clinical examination and prostate-specific antigen measurement. During follow-up, patients were asked how many pads they used daily. Continence was defined as no pads required for any activity that was routine before the operation. Bladder neck contracture was detected by uroflowmetry and cystoscopy in patients complaining of voiding difficulty.

4. Statistical analysis

Clinicopathologic factors were compared between the 2 groups by using Student t-test for continuous variables and Pearson chi-square test for categorical variables. All statistical tests were 2-tailed, with $p<0.05$ considered significant. The SPSS ver. 12.0 (SPSS Inc., Chicago, IL, USA) was used for all statistical analyses.

RESULTS

Of 112 patients, 62 patients underwent vesicourethral anastomosis with the running technique, whereas 50 patients underwent the procedure with the interrupted technique. The demographic and baseline characteristics of the patients are summarized in Table 1. The groups did not differ significantly in age, body mass index, prostate-specific antigen, prostate volume, or pathologic findings.

Table 2 presents the perioperative data for the two groups. The intraoperative extravasation rate was significantly lower in the running group than in the interrupted group (8.1% vs. 24.0%, p=0.01). However, the rates of postoperative extravasation were similar for both groups (6.4% vs. 10.0%, p=0.12). The time of anastomosis was significantly shorter in

Table 1. Comparison of patient characteristics and pathologic data according to the suture technique performed for open radical prostatectomy

Parameter	Running technique (n=62)	Interrupted technique (n=50)	p-value
Age (y)	66.9±6.0	65.6±5.7	0.23
Body mass index (kg/m^2)	24.5±2.9	24.8±2.5	0.52
PSA (ng/mL)	20.7±39.6	17.6±25.2	0.62
Prostate volume (g)	25.9±9.6	30.9±9.7	0.08
Previous transurethral surgery	3 (4.8)	3 (6.0)	0.88
Pathologic Gleason scores			0.12
2–6	18 (29.1)	14 (28.0)	
7	33 (53.2)	25 (50.0)	
8–10	11 (17.7)	11 (22.0)	
Pathologic T stage			0.82
pT2	35 (56.4)	29 (58.0)	
pT3a	18 (29.0)	14 (28.0)	
pT3b	9 (14.6)	7 (14.0)	

Values are presented as mean±standard deviation or number (%).
PSA, prostate-specific antigen.

Table 2. Comparison of perioperative data between the patients who underwent the running or interrupted suture technique for open radical prostatectomy

Parameter	Running technique (n=62)	Interrupted technique (n=50)	p-value
Bladder neck preservation	36 (58.1)	27 (54.0)	0.76
Neurovascular sparing	40 (64.5)	32 (64.0)	0.84
Extravasation on leak test	5 (8.1)	12 (24.0)	0.01
Anastomosis time (min)	15.1±5.3	19.3±4.6	0.04
Extravasation rate on cystogram	4 (6.4)	5 (10.0)	0.12
Retention after catheter removal	5 (8.1)	4 (8.0)	0.36
Catheterization time (d)	9.0±3.0	12.9±6.4	<0.01
Continence rate (zero pad)			0.75
3 Months	37 (59.7)	28 (56.0)	
6 Months	43 (69.4)	37 (74.0)	
9 Months	49 (79.0)	40 (80.0)	
12 Months	52 (83.9)	42 (84.0)	
Bladder neck contracture	0 (0)	1 (2.0)	0.76

Values are presented as number (%) or mean±standard deviation.

the running group than in the interrupted group (15.1±5.3 minutes vs. 19.3±4.6 minutes, p=0.04). The duration of catheterization was also significantly shorter in the running group (9.0±3.0 days vs. 12.9±6.4 days, p<0.01) Urinary retention occurred within 24 hours after urethral catheter removal in 4 patients (8.0%) from the interrupted group and in 5 patients (8.1%) from the running group, respectively (p=0.36). This urinary retention was treated by repositioning for 3 to 5 days. The urethral catheter reinsertion was uneventful in 2 patients. We performed cystoscopy-guided catheter reinsertion in 2 patients from the interrupted group. The cause of the inability to catheterize was partial distraction of the anastomosis posterior in each case. Table 2 also compares the frequency of bladder neck contracture with the two techniques; there was no significant difference between the groups (0% vs. 2%, p=0.76). The rates of urinary continence at 3, 6, 9, and 12 months after RP were similar in both groups.

DISCUSSION

Although most urinary extravasations are not clinically important, urinary extravasation can result in delayed catheter removal, decreased quality of life, longer hospital stays, increased costs, and increased risk of anastomotic strictures [11]. The vesicourethral anastomosis procedure should consist of watertight closure with urethral realignment and mucosal coaptation. The interrupted vesicourethral anastomosis technique results in gaps between the suture sites than can cause extravasation and stricture formation. Despite the fact that the running suture technique is theoretically more watertight, most surgeons use the interrupted technique because of the difficulty of anastomosis in open RP. Previous studies have shown that using the running suture technique for open RP is technically feasible and permits safe, early catheter removal [5-8]. To the best of our knowledge, this is the first study to compare perioperative outcomes of the running and interrupted techniques for RP.

We found fewer instances of contrast medium extravasation during cystography in the running suture group (8.1%) than in the interrupted suture group (10.0%), but without statistical significance (p=0.12). Lieber et al. [3] compared the running and interrupted suturing techniques for porcine vesicourethral anastomosis and reported greater muscle fibrosis in the interrupted suture group. However, those authors reported no difference in anastomotic leakage. Poulakis et al. [4] compared the two techniques in 250 patients prospectively and found no significant differences in extravasations, catheterization time, or the occurrence of anastomotic strictures. However, in previous studies, postoperative cystography was not performed in all patients; therefore, the extravasation rate may have been underestimated. We performed the intraoperative leak test and postoperative cystography in all patients.

Even though these results were similar to our results, we suggest that the running anastomotic suture may decrease the risk of postoperative urine extravasation. One explanation for our opinion is that we found that the rate of intraoperative extravasation was lower in the running suture group (8.1%) than in the interrupted suture group (24.0%, p=0.01). A positive leak test may indicate the need for additional sutures or even complete revision of the anastomosis in the case of a major leak and can predict a leak on postoperative cystography [12,13]. A previous study

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showed that postoperative urine extravasation was more common in patients with unsatisfactory test results than in patients with satisfactory test results [14]. However, we performed additional sutures and kept the urethral catheter in place for longer after open RP if the result of the intraoperative leak test was not satisfactory. Therefore, we suggest that the additional suture and duration of catheterization might affect the postoperative extravasation rate. In a previous study, we compared the complications of RALP with those of open RP, and our results support this view. Ryu et al. [15] reported extravasation to be higher in an open RP group with use of the interrupted suture technique than in the RALP group with use of the running suture technique.

Our running technique further simplifies the anastomosis process. The time taken to complete vesicourethral anastomosis was much less in our series, although there was no significant difference in total operative time. Similarly, Poulakis et al. [4] found that the operation time was 8 minutes shorter when the running suture technique was used for laparoscopic RP. Furthermore, by using a nephrostomy tube, we prevented the risk of damage to the urethral stump that is usually observed when forceps are used. Our running technique starts and ends at the 4 and 8 o'clock positions, respectively, thus minimizing the risk of a distraction defect at the 6 o'clock position. The intraluminal knots may promote edema in the mucosa, thereby leading to retention; the more knots used, the greater the risk of periurethral muscle fibrosis [3,5]. Therefore, we anchored the anastomosis with two sutures in the 12 o'clock position and one extraluminal knot [4].

The rate of urinary retention in both groups was not significantly different. In the study by Harper and Brien, the urinary retention rate was higher (19%). However, this was not due to the running technique and may have been due to postoperative edema or removing the catheter too early. Another study suggested that the running suture technique did not increase the rate of urinary retention and might allow early catheter removal because earlier healing to a watertight state could lead to an earlier decrease in edema. The literature supports our findings and etiopathogenesis appears to be related to edema and postoperative bladder neck overtone [16,17].

In this study, we found only one patient with bladder neck contracture in the interrupted suture group and none in the running suture group. The literature suggests that the incidence of bladder neck contracture is highly variable, ranging from 0.5% to 32% [18,19]. The main risk factors for anastomotic strictures are perianastomotic urinary extravasation, blood loss, urethral ischemic damage, catheter withdrawal time, and previous transurethral resection of the prostate. The risk of ischemia is not increased by too many sutures, knots being too tight, or excessive suture tension [4,15].

The rate of continence, defined as not requiring pads, was not significantly different between the two groups in our study. Early recovery of continence may be delayed owing to vesicourethral urinary extravasation and there is a higher associated incidence of incontinence [20,21]. However, incontinence is a complication that has been attributed to the RP itself. The consensus is that extravasation does not affect long-term incontinence.

The present study had some limitations because the findings represent the clinical experience of a single center and a single surgeon and only a small number of patients underwent open RP. Furthermore, the study design was retrospective and nonrandomized, and we suggest that well-designed prospective randomized trials that include a larger patient population are warranted. However, the baseline clinical characteristics of the patients were not significantly different between the two groups in the present study and we used the two methods under same conditions. This remains the first comparative study of the use of the two approaches in open RP.

CONCLUSIONS

Both anastomosis techniques provide similar results in terms of restoring function. However, running anastomosis may decrease the risk of intraoperative urine extravasation and had a shorter duration than the interrupted technique, without increasing the risk of urinary retention or bladder neck contracture after open RP. We recommend the running anastomosis technique for open RP because it is technically feasible and safe. A prospective randomized trial is needed to confirm these preliminary findings.

CONFLICTS OF INTEREST

The authors have nothing to disclose.

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