Case Report

Continuous Suture of a Single Absorbable Suture: A New Simplified Vesicourethral Anastomosis Technique in Laparoscopic Radical Prostatectomy

Jie Yang*, Peng-fei Shao*, Qiang Lv, Ning-hong Song, Jie Li, Wei Zhang, Pu Li, Li-xin Hua, Chang-jun Yin*

Department of Urology, First Affiliated Hospital of Nanjing Medical University, Nanjing, China

The purpose of this study was to describe a new simplified technique for facilitating vesicourethral anastomosis in laparoscopic radical prostatectomy. After prostate removal, an approximately 15-cm-long absorbable suture with one three-eighths arc needle is passed from the outside in on the full thickness of the bladder neck at the 9 o'clock position and then from inside out on the full thickness of the urethra at the 9 o'clock position. It is knotted with the suture tail. Subsequently, a continuous suture is completed between the bladder neck and urethra. A 20-French silastic catheter is placed into the bladder before completing the anterior row of sutures. Three hundred twelve consecutive patients with localized prostate cancer who had undergone the new simplified vesicourethral anastomosis were included in this retrospective study. The average time of anastomosis was 10.5 minutes (range, 8–30 minutes), as recorded for an experienced laparoscopic surgeon. The incidence rate was 2.2% for urine leakage and 1.3% for bladder neck stenosis, and the continence rate was 86.9% at 1 month, 93.3% at 3 months, 98.1% at 6 months, and 98.7% at 1 year. We present a new simplified method for vesicourethral anastomosis. The method takes little operating time and is easy for novice laparoscopists to master. Moreover, this technique has low rates of urinary leakage and bladder neck stricture.

Key Words: Continuous suture – Laparoscopic radical prostatectomy – Vesicourethral anastomosis

Corresponding authors*: Chang-jun Yin, MD, E-mail: drcjyin@163.com, and Li-xin Hua, MD, E-mail: hlx5858@163.com. Department of Urology, First Affiliated Hospital of Nanjing Medical University, Nanjing 210029, China. Tel.: +86-25-86863886; Fax: +86-25-83724440

* The authors equally contributed to this article.

Laparoscopic radical prostatectomy (LRP) was first introduced by Schuessler in 1992.¹ It has been proven to be comparable with open radical prostatectomy. However, the technique is a challenge for most urologists, especially given the difficult and time-consuming step of performing urethrovesical anastomosis.²⁻³ Initially, many surgeons adopted an interrupted suture requiring 6 to 10 knots.² Van Velthoven *et al* then reported an anastomosis technique⁴ that has become widely used because of its low rates of urinary leakage and bladder neck stricture. However, the average time of Van Velthoven anastomosis still lasted 35 minutes when it was reported for the first time in 2003.⁴

Since 2006, in order to further simplify the surgical procedure and reduce the operating time, we have developed a simpler continuous suture technique that uses only a single absorbable suture with 1 needle, can be more easily mastered, and requires less operating time. We describe this technique and present functional outcomes and incidence rates of complications compared with other reported LRP series applying conventional Van Velthoven anastomosis.

Materials and Methods

Subjects

From June 2006 to January 2012, 312 consecutive patients with localized PCa applied to have the new simplified vesicourethral anastomosis, which has been approved by the ethical committee of Nanjing Medical University in June 2005. Those who had had previous hormone therapy, chemotherapy, radiotherapy, or surgery for PCa were excluded.³ All patients were pathologically confirmed by routine transrectal biopsy before operation except 14 cases that were found by postoperative pathology of transurethral prostatic resection (TURP) (Table 1).

Surgical technique

After prostate removal, an approximately 15-cm-long absorbable suture (2-0 single strand, Vicryl) with one three-eighths arc needle (Ethicon, Inc., Somerville, NJ, USA) was prepared. The continuous suture was initiated by passing the needle from the outside in on the full thickness of the bladder neck at the 9 o'clock position (Fig. 1A, a) and then from the inside out on the full thickness of the

urethra at the 9 o'clock position (Fig. 1B, b), after which it was tied into a knot with the suture tail (Fig. 1C, c). When suturing the urethra, an assistant can press the perineum of the patient and insert the catheter to facilitate suture.⁵ Subsequently, the suture was passed from the outside in on the bladder neck at the 11 o'clock position (Fig. 1D, d) and then from the inside out on the urethra at the 7 o'clock position (Fig. 2E, e). Similarly, the single suture was continuously passed on the bladder neck at the 1 o'clock position and on the urethra at the 5 o'clock position, on the bladder neck at the 3 o'clock position and on the urethra at the 3 o'clock position, on the bladder neck at the 5 o'clock position and on the urethra at the 1 o'clock position (Fig. 2F, f), as well as on the bladder neck at the 7 o'clock position and on the urethra at the 11 o'clock position (Fig. 2G, g). To avoid postoperative incontinence or anastomotic stricture because of the retraction of the urethral stump, continuous suture should pass inside out on the urethra mucosa prior to full thickness of the posterior urethra except the first suture at the 9 o'clock position, which passes full thickness of the posterior urethra to prevent tissue avulsion. Finally, after a 20-French (F) silastic catheter filled with 10 mL water in the balloon was placed into the bladder, a knot was tied with the suture tail at the 9 o'clock position (Fig. 2H, h). The catheter was left in place for 5 to 8 days.

Postoperative evaluations and follow-up

Complications were recorded according to Dindo-Clavien classification⁶ (Table 2). Each patient must completely undergo a strict follow-up for monitoring serum prostate-specific antigen (PSA) levels, continence, and erectile function recovery at 4 weeks after operation, then at 3-month intervals during the first year and every 6 months subsequently.^{7,8} Urinary incontinence is defined as the loss of bladder control after catheter removal,⁷ and patients complain of involuntary urine outflow from the urethral orifice. Urinary leak is defined as continuous urine outflow from the pelvic drainage tube, which can be confirmed by measuring creatinine value. The satisfactory rate for postoperative erectile function was estimated by a 5-grade scale including very dissatisfied, dissatisfied, moderate, satisfied, and very satisfied. All data were collected by different urologists at follow-up visits.

Table 1 Preoperative demographics and pathologic data of patients

Characteristics	n (%) or Mean (range)
Total cases	312
Mean age (years)	65.5 (48–74)
Age grouping	
≤65 years	134 (42.9)
>65 years	178 (57.1)
BMI (kg/m ²)	23.7 (20.2–26.8)
Mean PSA value (μg/L) PSA grouping	11.9 (2.5–40.2)
<10	162 (51.9)
10–20	91 (29.2)
>20	59 (18.9)
Mean prostate volume (mL)	44.5 (26–82)
Gleason score	
6	76 (24.4)
7	183 (58.6)
8	50 (16.0)
9	3 (1.0)
Pathologic diagnosis method	
Transrectal biopsy	298 (95.5)
TURP	14 (4.5)

BMI, body mass index; PSA, prostate-specific antigen; TURP, transurethral prostatic resection.

Results

The mean age of patients was 65.5 years old (range, 48–74 years), and the mean body mass index (BMI) was 23.7 kg/m² (range, 20.2–26.8 kg/m²). The preoperative mean value of PSA was 11.9 μg/L (2.5–40.2 μg/L), and the mean volume of prostate measured via B-ultrasound was 44.5 mL (26–82 mL). The Gleason score was from 6 to 9 and was classified as Gleason (Gl.) 6 in 76 patients, Gl. 7 in 183 patients, Gl. 8 in 50 patients, and Gl. 9 in 3 patients, respectively (Table 1).

All 312 LRPs were successfully performed, and there was no case with conversion to open surgery. The mean time of anastomosis was 10.5 minutes (range, 8–30 minutes), and the mean time of total LRP was 87 minutes (range, 65–185 minutes) as performed by an experienced laparoscopic surgeon (CY). The average blood loss was 150 mL (range, 50–850 mL), and catheters were removed after a mean of 6.4 days (range, 5–11 days). Patients were hospitalized for a mean of 6.2 days (range, 5–15 days) after LRP and median follow-up was 15 months (range 6–36 months).

Fig. 1 Part 1 of Yin's anastomosis. (A, a) A continuous suture is initiated by passing the needle outside in on the full thickness of the bladder neck at the 9 o'clock position. (B, b) The suture is passed inside out on the full thickness of the urethra at the 9 o'clock position. (C, c) The suture is tied into a knot with the suture tail. (D, d) The suture is passed outside in on the bladder neck at the 11 o'clock position.

Fig. 2 Part 2 of Yin's anastomosis. (E, e) The suture is passed inside out on the urethra at the 7 o'clock position. (F, f) The suture is continuously passed on the bladder neck at the 5 o'clock position and on the urethra at the 1 o'clock position. (G, g) The suture is continuously passed on the bladder neck at the 7 o'clock position and on the urethra at the 11 o'clock position. (H, h) A knot is tied with the suture tail at the 9 o'clock position.

Table 2 Complication rates of 312 LRPs except urinary incontinence and Dindo–Clavien classification^a

Classification of complications	Number	Rate
Total cases	48	15.4%
Grade 1	16	5.1%
Urine leakage	7	2.2%
Subcutaneous hematoma	4	1.3%
Lymphatic leakage	3	1.0%
Incision fat liquefaction	2	0.6%
Grade 2	21	6.7%
Urinary tract infection	14	4.5%
Incision infection	5	1.6%
Paralytic ileus	1	0.3%
Epididymitis	1	0.3%
Grade 3	10	3.2%
Bladder neck stricture	4	1.3%
Lymphocele	2	0.6%
Rectal injury	2	0.6%
Active bleeding	1	0.3%
Ureteral injury	1	0.3%
Grade 4	1	0.3%
Hypostatic pneumonia	1	0.3%
Grade 5	0	0.0%

LRP, laparoscopic radical prostatectomy.

^aDindo–Clavien classification of complications.⁶

The total complication rate for the 312 LRPs was 15.4% except urinary incontinence, including 5.1% for grade 1, 6.7% for grade 2, 3.2% for grade 3, and 0.3% for grade 4 according to Dindo–Clavien classification⁶ (Table 2). Seven patients suffered from urine leakage after the operation, which we handled only by towing the catheter using a 250-mL saline bag for 2 to 4 days. Then, when we removed the catheter, there was no clinical evidence of postoperative urine leakage.

After catheter removal, the continence rate was 62.2% immediately, 86.9% at 1 month, 93.3% at 3 months, 98.1% at 6 months, and 98.7% at 1 year. Forty-three of 312 patients (13.8%), who had satisfactory preoperative erection, had undergone nerve-sparing technique, and the satisfaction rate for postoperative erectile function was 62.8% (27 of 43) at 3 months, 74.4% (32 of 43) at 6 months, and 83.7% (36 of 43) at 1 year.

Discussion

The most difficult and time-consuming step during LRP is performing urethrovesical anastomosis.³ The difficulties with laparoscopic urethrovesical anasto-

mosis are usually considered to come from several aspects, such as differentiating the urethral stump, suture order, and tying multiple intracorporeal knots.³ At the early stage of LRP development, many surgeons adopt an interrupted suture technique requiring 6 to 10 knots,² which often takes a lot of time to perform and tends to cause fatigue in surgeons.⁹ These challenges even led many surgeons to consider LRP an impractical technique until the Van Velthoven anastomosis technique was introduced in 2003.⁴ Van Velthoven anastomosis uses two 6-inch absorbable sutures with 2 needles and only requires a single knot.⁴ However, because of the relatively complex suture pattern involved, the average time of Van Velthoven anastomosis lasted 35 minutes (range, 14–80 minutes) when it was first reported in 2003.⁴ Recently, Simone *et al*¹⁰ reported that the mean time to complete Van Velthoven anastomosis was still 18.2 minutes (range, 15–29 minutes) in a group of 125 cases. Simultaneously, Simone *et al* also described a laparoscopic “single knot–single running” suture for vesicourethral anastomosis with posterior musculofascial reconstruction, and the mean time of anastomosis was 20.1 minutes (range, 13–30 minutes) in 155 consecutive patients.¹⁰

To further shorten the operation time, approximately 6 years ago in our center, we simplified the popular Van Velthoven anastomosis technique and designed a simpler continuous suture technique, without posterior musculofascial reconstruction, that uses only 1 approximately 15-cm-long absorbable suture with 1 three-eighths arc needle and requires 2 knots. Through continuous improvement in practice, we finally determined the optimal suture pattern and order and have successfully applied the new simplified vesicourethral anastomosis technique in 312 cases. We initiate our anastomosis by towing the bladder neck to the urethral stump at the 9 o'clock position (Fig. 1A, a), and then press the perineum of the patient to facilitate suture and insert the catheter to show the urethral stump (Fig. 1B, b). To avoid the influence of greater suture tension, we first suture the posterior bladder neck to the posterior lip of the urethra (Fig. 1D, d, and Fig. 2E, e), and to prevent postoperative incontinence and stricture, we only suture from the outside in on the bladder mucosa instead of the full thickness of the bladder wall except the first suture at the 9 o'clock position. Compared with conventional Van Velthoven anastomosis, our simplified method significantly shortens the operating time and can easily be mastered, even by novices. The average

time of anastomosis in our proposed method is 10.5 minutes (range, 8 to 30 minutes), and it actually took an experienced laparoscopic surgeon (CY) less than 12 minutes to perform it in approximately half of the cases. Even for a novice laparoscopist (PS), the procedure still did not exceed 25 minutes. Partly owing to the greatly reduced time of urethrovesical anastomosis, the LRP can be completed in mean 87 minutes (range, 65–185 minutes). This new simplified urethrovesical anastomosis technique was designed by CY, so we name it Yin's anastomosis.

As the simplified anastomosis technique already has the advantage of shorter operating time, only the rates of urinary leakage and bladder neck stricture after LRP remain as primary concerns as these 2 complications are closely related with the operation of urethrovesical anastomosis. Simone *et al* report that the incidence rate for urinary leakage was 2.4% and for bladder neck stricture was 3.2% in 125 LRPs with Van Velthoven anastomosis.¹⁰ In our cohort of 312 LRPs, the incidence rate for urinary leakage was 2.2% and for bladder neck stricture, 1.3% (Table 2), which are both comparable with other recent reports.^{7,10} We attribute the low rates of urinary leakage and bladder neck stricture to the benefits of continuous suture of a single suture and clear exposure in laparoscopy. Moreover, during the minimum follow-up at 6 months, the rates of complications, urinary continence, and biochemical recurrence after LRP in our group all compared favorably with those in large reported series of LRPs.^{3,7,10–13} In 43 LRPs (13.8%) applying nerve sparing technique, the satisfactory rate for erectile function is 83.7% (36 of 43) at 1 year, which is also favorably comparable with the satisfactory rate of 81.5% reported by Gao *et al*.⁷

Several continuous suturing techniques have been reported in related articles of robot-assisted LRP because robotic arms can greatly facilitate continuous suturing. But, during common LRP, it is still a difficult and time-consuming step to complete urethrovesical anastomosis by Van Velthoven technique. So, until now, only 1 published article has presented a laparoscopic continuous suturing technique.¹⁰ In China and other economically underdeveloped areas of the world, robot-assisted LRP cannot be popularized because of the high cost of robot-assisted operations. So, we introduce the novel simplified method of common laparoscopic vesicourethral anastomosis; it should be promoted in areas of the world that can't afford the robot-assisted surgical system.

Some limitations of this new technique should be acknowledged. First, there was no comparison between the new simplified anastomosis and the currently popular Van Velthoven anastomosis. In addition, single center report with only a single surgeon's experience, no control cohort, and retrospective design must all be acknowledged as limitations of this study. Further prospective randomized trials should be designed to detect differences and to prove advantages of this new anastomosis when comparing with Van Velthoven anastomosis.

Conclusions

We present a new simplified method for vesicourethral anastomosis in LRP. The method only requires the use of a single absorbable suture with 1 needle and takes only a little operating time. It is also easier for novice laparoscopists to learn and master the method. Moreover, this technique appears to have low rates of urinary leakage and bladder neck stricture.

Acknowledgments

CY and LH conceived and designed the study. JY and PS drafted the manuscript. QL, NS, JL, WZ, and PL interviewed patients for postoperative follow-ups and collected the data. JY and PS performed data analyses and revised the manuscript. All authors read and approved the final version.

The authors declare that they have no conflict of interest.

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