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ORIGINAL ARTICLE

Prostate Disease

Transurethral assistant transumbilical laparoendoscopic single-site radical prostatectomy

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The laparoendoscopic single-site (LESS) technique is the latest technical innovation in laparoscopic surgery to undergo exponential development in urology. This study undertaken to illustrate our initial experience LESS radical prostatectomy (RP) and analyze early outcomes. Nineteen patients diagnosed with prostate cancer underwent LESS-RP in our institute. The patients were divided into two groups: conventional LESS and transurethral assistant LESS. Preoperative, perioperative, postoperative, pathologic, and functional outcomes data were assessed. With the help of a transurethral assistant, the mean operation and anastomosis time were decreased markedly. No focal positive margins were encountered. No prostate-specific antigen recurrence was detected 1 month postoperatively. Complete continence recovery (no pad) was observed in 32% of the patients at 1 month after the operation. No intraoperative and postoperative complications were reported. LESS-RP is a feasible and effective surgical procedure for treatment of prostate cancer. Moreover, transurethral assistant LESS could reduce the difficulty of LESS-RP and shorten the operation time. *Asian Journal of Andrology* (2017) 19, 473–476; doi: 10.4103/1008-682X.173437; published online: 29 March 2016

Keywords: laparoendoscopic single-site surgery; prostate cancer; transurethral assistant

INTRODUCTION

Since Clayman *et al.*¹ first reported laparoscopic nephrectomy in 1991, remarkable progress has been achieved in minimally invasive surgery in urological oncology. Laparoscopic radical prostatectomy (LRP) has been widely used as a minimally invasive surgery to treat prostate cancer for >15 years.² The laparoscopic technique has been demonstrated to decrease postoperative pain, improve cosmesis, decrease lengths of hospital stay, decrease blood loss, and achieve earlier recovery of potency while maintaining equivalent outcomes to traditional open approaches.³ Laparoendoscopic single-site (LESS) surgery, which allows the introduction of surgical instruments through a single incision, can further reduce incisional morbidity and improve cosmesis of laparoscopic surgery.^{4–6} In our clinical practice, we designed transurethral assistant transumbilical LESS that greatly reduced the difficulty of LESS and shorten operating time. Herein, we present our initial experience of transurethral assistant LESS-RP.

PATIENTS AND METHODS

Patients

Between January 2014 and March 2015, 19 cases of LESS-RP were conducted in Department of Urology, Affiliated Hospital of Nanjing University of Traditional Chinese Medicine. Eleven cases underwent conventional transumbilical LESS (Group 1) and eight underwent transurethral assistant transumbilical LESS (Group 2). Diagnosis of these patients was accomplished by transrectal ultrasonography-guided prostate biopsy, digital rectal examination, pelvic CT or MRI examination and bone-scan in our hospital. This study was approved

by the Ethics Committee of our hospital. **Table 1** lists the clinical and pathological characteristics of the 19 patients.

Patient positioning

Under general anesthesia and endotracheal intubation, the patients in Group 2 were placed in the supine lithotomy position instead of the routine supine position (**Figure 1a**). An umbilical 2.5 cm skin incision was made circumferentially in the infraumbilical crease at first.

Instruments

A multichannel port QuadPort (Innovex, Shanghai, China) (**Figure 1a**) containing three 10 mm, and one 12 mm trocars were placed through the umbilical incision (**Figure 1d** and **1e**). The port had an insufflation channel that allowed carbon dioxide insufflation at a pressure of 15 mmHg. A 5-mm and 30° lens rigid laparoscope (Olympus, Tokyo, Japan) was used. Conventional straight and precurved laparoscopic instruments (Olympus) and Harmonic scalpel (Olympus) were utilized (**Figure 1b**). A home-made, blunt tip trocar was inserted through the urethra (**Figure 1c**). The trocar was made from an outer sheath of an F25.6 plasmakinetic resectoscope (ACMI, Duluth America).

Operative technique

All the instruments were placed through the QuadPort multichannel port. First, the bladder was dissected from the anterior abdominal wall which the procedure was similar to conventional LRP.⁷ Then, fatty tissue surrounding the prostate was swept free to expose the anterior aspects of the bladder and prostatic gland (**Figure 2b**). The endopelvic fascia was then incised sharply (**Figure 2a**). The prostate was mobilized off the levator fibers, and the puboprostatic ligaments were divided.

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Self-anchoring sutures (SAS) were used to ligate the deep dorsal venous complex. The anterior bladder neck was identified and transected. The presence of the prostatic median lobe, location of the ureteral orifices, and the base of the prostate were carefully examined. A male urethral sound instead of a Foley catheter was inserted through the urethra to expose the posterior and lateral wall of the bladder neck (**Figure 2c**). The posterior bladder neck was then gradually dissected away from the prostate. The

Table 1: Demographic and preoperative data

Variables	Group 1	Group 2	P
Number of patients	11	8	
Age (year)	72.2±6.2	70.9±4.8	0.627
BMI (kg m ⁻²)	22.5±3.9	24.2±1.5	0.237
PSA (ng ml ⁻¹)	15.1±9.5	10.8±4.8	0.247
Prostate volume (ml)	43.4±16.5	37.8±17.0	0.476
Clinical TNM stage (n)			
T1c	2	0	
T2a	4	2	
T2b	3	5	
T2c	2	1	
Gleason score (biopsy pathology, n)			
3+3	3	2	
3+4	4	4	
4+3	3	2	
5+3	1	0	

BMI: body mass index; PSA: prostate specific antigen; TNM: tumor node metastases

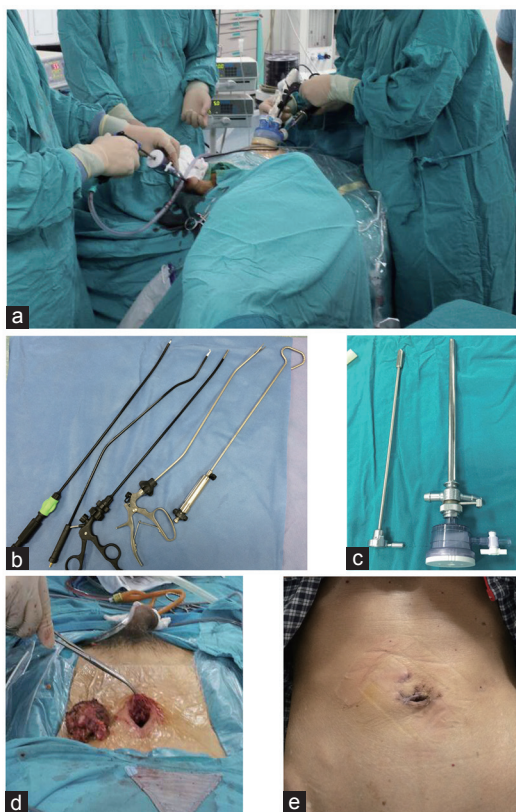


Figure 1: (a) QuadPort and the operator's positions. (b) Instruments used in LESS-RP. (c) Home-made blunt tip trocar that was inserted through the urethra. (d) External picture of an extracted prostate and reconstructed umbilical incision. (e) Postoperative scar in the umbilicus 1 month after surgery.

posterior bladder neck was then completely transected, and the anterior layer of Denonvillier's fascia was incised. The vas deferens and seminal vesicles were identified bilaterally and mobilized with the harmonic scalpel and athermally with Hem-o-lok clips (Weck, Morrisville, USA). The urethra was identified and divided sharply using cold flexible shears.

In the first 11 cases, a urethral sound was placed through the urethra by an assistant to identify the urethral lumen after the bladder neck was disconnected. In the latter eight cases, most steps were performed as in previous cases. The main difference between the two groups was that the urethral sound was replaced with a blunt tip trocar to assist LESS-RP after the bladder neck was disconnected in Group 2. That is, the urethra is used as a potential approach without an additional incision, which permits inserting the trocar through natural orifices. The assistant used this trocar to cooperate with the operator. Through this channel, we could insert a variety of devices, such as forceps, aspirator, and ultrasonic scalpel. These instruments helped to expose the anatomic structures of the pelvis, retrograde dissect the prostate and make urethrovesical anastomosis quickly. To be more specific, when releasing the prostate from the rectal bed, the harmonic scalpel dissect up the anterior surface of the rectum through the urethra, thus, avoid the possibility of rectal injury (**Figure 2d**). When performing urethrovesical anastomosis, a forcep held the bladder tissues through the urethra, thus making suturing easier (**Figure 2e**).

Statistical analysis

Data are presented as a mean ± standard error of the mean. Statistical analysis was performed using SPSS version 11.0 (SPSS Inc., Chicago, USA). Patient characteristics were expressed as mean ± standard deviation. Differences between groups were analyzed with Student's *t*-test. *P* < 0.05 was considered statistically significant.

RESULTS

The mean operation time was recorded from skin incision to skin closure. All cases in Group 2 were completed successfully in a mean operative time of 167.5 ± 21.3 min which was lower

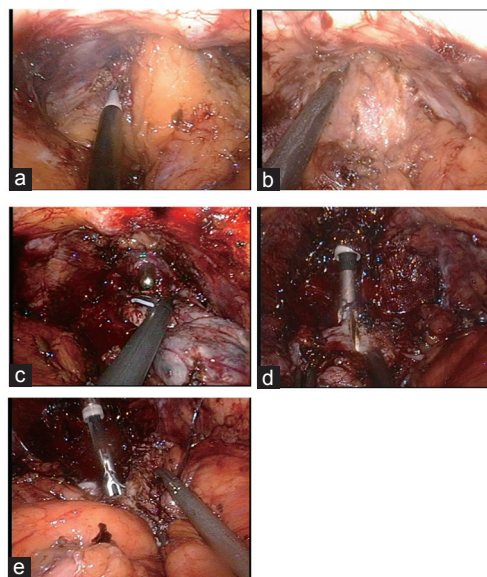


Figure 2: (a) Intraoperative image of endopelvic fascia incision. (b) Fatty tissue surrounding the prostate was swept free. (c) A male urethral sound was inserted through the urethra. (d) Anterior surface of the rectum was dissected up through urethra. (e) Transurethral assistant urethrovesical anastomosis.

than that in Group 1 ($P < 0.05$). The mean urethrovesical anastomosis time was declined from 45.2 ± 7.0 min (Group 1) to 29.6 ± 4.0 min (Group 2) ($P < 0.05$) (Table 2). The mean estimated blood loss was 136.4 ± 156.2 ml in Group 1 and 110.0 ± 119.6 ml in Group 2. No patients were converted to open surgery or conventional LRP in either group. One patient in Group 1 required an additional abdomen port besides the QuadPort device. No major intraoperative and immediately postoperative complications were occurred, and there was no significant difference between the groups in term of estimated blood loss. Two patients in Group 1 required blood transfusion. The pathological findings are listed in Table 2. There was no focal positive margin noted after Radical Prostatectomy in these two groups.

Prostate-specific antigen (PSA) level was measured 1 month postoperatively. PSA level was <0.02 ng ml⁻¹ in all patients in both groups, as compared with preoperative PSA values. Postoperative incontinence was evaluated by the number of pads used per day, per night and over 24 h. Complete continence recovery (no pad) was observed in 32% of the patients at 1 month after the operation.

None of the patients requested preservation of sexual function; therefore, nerve-sparing LESS-RP was not conducted in this preliminary group of patients. All of the patients had their Foley catheters removed on day 14 after surgery (range, days 12–15).

DISCUSSION

Since Schuessler *et al.*² first described LRP in the field of urology, laparoscopic radical surgery has been developed in unprecedented ways. Minimally invasive surgery aims to provide effective treatment by placing all instruments through a single small skin incision thereby reducing postoperative pain, improving cosmesis, decreasing lengths of hospital stay and improved convalescence.⁸ The development of optics and instrumentation has led to increase in LESS practice.

Table 2: Perioperative and postoperative outcomes

Variables	Group 1	Group 2	P
Patients (n)	11	8	
Perioperative outcomes			
EBL (ml)	136.4±156.2	110.0±119.6	0.682
Blood transfusion (n)	2	0	
Duration of operation (min)	271.4±44.7	167.5±21.3	0.000
Urethrovesical anastomosis time (min)	45.2±7.0	29.6±4.0	0.000
Intraoperative complications	0	0	
Conversion to conventional LRP	0	0	
Additional ports	1	0	
Postoperative outcomes			
TNM stage (n)			
T2a	3	1	
T2b	4	5	
T2c	3	2	
T3B	1	0	
Pathologic Gleason score (n)			
3+3	3	2	
3+4	5	3	
4+3	2	2	
4+4	1	0	
4+5	0	1	
Margin status positive (n)	0	0	
Retention time of catheterization (day)	14	14	
Biochemical recurrence (n)	0	0	

EBL: estimated blood loss; LRP: laparoscopic radical prostatectomy; TNM: tumor node metastasis

However, LESS-RP is considered challenging because of internal and external collision of instruments and lack of appropriate triangulation, which increase operation times and require significant laparoscopic skills in suturing and knotting. Considering these difficulties, doctors performing LESS-RP require a long learning curve and extensive training.

In our conventional LESS-RP group, the operation time was 271.4 min, the mean operative time for urethrovesical anastomosis was 45.2 min, which were similar to a previous study.⁹ The mean urethrovesical anastomosis time in our Group 2 was less than that in Group 1 and the previous study.

Continued innovations, including curved laparoscopic or articulating instruments may reduce the main technical problems associated with triangulation of the instruments. Indeed, urethrovesical anastomosis presents a significant challenge for LESS reconstructive procedures.^{9,10} To reduce the difficulties presented by LESS urethrovesical anastomosis, several solutions have been proposed.

We have introduced a new operative method in which the Foley catheter is replaced with laparoscopic forceps to assist operation after the bladder neck is disconnected. The urethra could function as a natural orifice for insertion of the laparoscopic instrument without any additional incision. The main benefit of transurethral assistant urethrovesical anastomosis can be summarized as follows: (1) the urethra could serve as a potential approach that eliminates the need for additional incision; (2) in conventional LESS, the instruments are close to each other and usually crossed to triangulate, the internal and external collision of instruments is dramatically decreased with the help of the natural orifice; (3) when releasing prostate from the rectal bed, the laparoscopic instrument inserted through the urethra is used to augment exposure; (4) when performing urethrovesical anastomosis, a forceps can orient the needle to stitch from the inside of the urethra outwards; and (5) the anterior surface of the rectum is dissected up through urethra with the harmonic scalpel, to avoid the possibility of rectal injury. A recent study has shown that transurethral assistant urethrovesical anastomosis reduce the difficulties involved in LESS in an economical porcine model.¹¹ Consistent with our results, transurethral assistant LESS could reduce the difficulties associated with LESS urethrovesical anastomosis.

When performing urethrovesical anastomosis, SAS with a running technique was used for tissue approximation in all cases. SAS is a novel suture design first used for wound closure in plastic surgery, gynecology, and obstetrics.^{12,13} The initial application of SAS to achieve good results in urological surgery, laparoscopic pyeloureteral anastomosis and vesicourethral anastomosis has been well-documented.^{14,15} The mean anastomosis and knotting time were decreased with the help of this additional approach. Our study is the first report on the use of SAS in urethrovesical anastomosis during LESS-RP.

Our study had several limitations. First, the results were based on the experience of only one surgeon. Thus, the intraoperative and postoperative values have limited generalizability. Second, this study was a retrospective analysis, and the two groups were not selected through match-pairing. Third, the sample size was small, and long-term follow-up data were not available. Future studies are required with long-term follow-up after transurethral assistant LESS to evaluate the clinical significance of the procedure.

CONCLUSIONS

Although LESS in its infancy, overall, is a feasible and effective surgical procedure for RP in the treatment of prostate cancer. In addition, transurethral assistant LESS can reduce the difficulty of LESS



urethrovessical anastomosis and shorten operating time. Further studies are necessary to corroborate these results.

AUTHOR CONTRIBUTIONS

CZ, JS, LY drafted the manuscript and performed the statistical analysis; YZ, ZJL, YS and NHW collected clinical data and analyze the data; XJG and QYZ conceived of the study, and participated in its design and coordination. All authors have read and approved the final version of the manuscript.

COMPETING INTERESTS

All authors declare no competing interests.

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