# The Effect of Single-port Transvesical Laparoscopic Radical Prostatectomy on Erectile Function and Urinary Continence Compared to Intrafascial Endoscopic Extraperitoneal Radical Prostatectomy

Yi Yang[1]*, Guoliang Hou[2]*, Hongbing Mei[1], Xintao Zhang[1], Xiaohong Han[1], Jun Pang[3], Xin Gao[4]

**Purpose:** To compare the erectile function and urinary continence of patients after single-port transvesical laparoscopic radical prostatectomy (STLRP) with intrafascial endoscopic extraperitoneal radical prostatectomy (IEERP).

**Materials and Methods:** Patients treated with STLRP (35) or IEERP (52) were recruited from September 2013 to June 2017. At baseline preoperatively and 2-year follow-up postoperatively, sex and continence assessments were performed by International Index of Erectile Function-6 (IIEF-6) and daily pads, respectively.

**Results:** The sexual function at 3 months after RP declined obviously. 71.4% (STLRP) and 38.5% (IEERP) patients recovered potency at 6 months postoperatively ($P < .01$). 82.9% (STLRP) and 59.6% (IEERP) patients recovered potency at 2 years postoperatively ($P < .05$). 97.1% (STLRP) and 75.0% (IEERP) patients recovered continence (0 pad/day) at 3 months postoperatively ($P < .01$). Continence achieved 100.0% at 2 years after RP in both groups.

**Conclusion:** Patients receiving STLRP may obtain better and faster postoperative functional recovery than the ones receiving IEERP. As an exploratory research, STLRP may be another effective treatment for organ-confined prostate cancer.

**Keywords:** radical prostatectomy; transvesical; single-port; erectile; continence

## INTRODUCTION

Worldwide, prostate cancer (PCa) is the second most common malignancy among men. In America, the incidence of prostate was 105.1 per 100000. In middle east/Iran, the rate was 11.52 per 100000. In China, the rate was 20.7 per 100000 males. For early PCa, surgical treatment can achieve the goal of radical cure, and the five-year survival rate can reach 100%.[1]

In recent years, laparoscopic radical prostatectomy (LRP) is recommended in low-risk organ-confined prostate cancer (PCa) patients who present with significant obstructive symptoms, which can not only resolve the obstruction but also control the PCa development. Because LRP do not significantly reduce PCa mortality for low-risk patients,[2] the operation effect on health-related quality of life for PCa patients with long term survival becomes pretty important. Postoperative sexual and urinary function, playing important roles in quality of life (QOL), is quite important to the success of LRP.[3-5] Intrafascial endoscopic extraperitoneal radical prostatectomy (IEERP) has been widely accepted for its limiting trauma to the surrounding fascia of prostate, which can protect the enclosed neurovascular bundles and bring a better sexual and urinary functional recovery than the previous operations.[6] Still, modifications have been in progress to improve the functional recovery in operation.

We first launched single-port transvesical laparoscopic radical prostatectomy (STLRP) for patients with low-risk organ-confined PCa (PSA $\leq$ 10 ng/mL, Gleason score < 7, and clinical stage T1~T2aN0M0) in 2010. Compared with IEERP, STLRP can utilize the natural space of bladder lumen, avoid the bladder and perivesical space, not only to minimize the dissection of the tissue around the bladder neck, prostate and urethra but also to completely preserve the surrounding tissue of bladder, which may bring better erectile function and urinary continence postoperatively.[4] However, a long-term follow-up study is still required.

In order to better assess the superiority of this novel way (STLRP), we surveyed 87 patients treated with STLRP or IEERP at 2-year follow-up postoperatively, compared the sexual and urinary functional recovery.

## MATERIALS AND METHODS

### *Patients' selection*

This retrospective study was conducted in accordance with the guidelines of the Ethics Committee of the Third Affiliated Hospital of Sun Yat-sen University. From September 2013 to June 2017, a total of 87

[1]Department of Urology, Shenzhen Second People's Hospital, The First Affiliated Hospital of Shenzhen University, Shenzhen, 518039, China.
[2]Department of Urology, Foshan First Municipal People's Hospital, Foshan, China.
[3]Department of Urology, The Seventh Affiliated Hospital, Sun Yat-sen University, Shenzhen, China.
[4]Department of Urology, The Third Affiliated Hospital, Sun Yat-sen University, Guangzhou, China.
* These authors contributed equally to this work.
*Correspondence: Department of Urology, The Third Affiliated Hospital, Sun Yat-sen University, Tianhe Road 600, Guangzhou, 510630, China.
Telephone: +86-20-85252990; Fax: +86-20-85252678, Email: urologygx20@163.com.
Received July 2020 & Accepted September 2020

**Table 1.** Preoperative, intraoperative and postoperative data.

| | STLRP (35 cases) | IEERP (52 cases) | *P*-value |
|---|---|---|---|
| *Preoperative* | | | |
| Mean (range) age, years | 60 (45-69) | 61 (42-68) | .772 |
| Mean (range) BMI, kg/m$^2$ | 23.2 (21-25.8) | 23.1 (20.5-25.6) | .825 |
| ASA score, n | | | .830 |
| 1 | 21 | 30 | |
| 2 | 14 | 22 | |
| Mean (range) PSA, ng/mL | 7.54 (6.15-9.25) | 7.15 (5.28-9.16) | .729 |
| Mean prostate volume (range), ml | 31.5 (12.8-65.5) | 33.5 (12.6-75.2) | .350 |
| Biopsy Gleason score, n | | | 1.000 |
| 3+3 | 35 | 52 | |
| Clinical stage, n | | | .721 |
| T1c | 26 | 39 | |
| T2a | 9 | 13 | |
| IPSS score, n | | | .663 |
| 21~25 | 22 | 30 | |
| 26~30 | 13 | 21 | |
| 31~35 | 0 | 1 | |
| QOL score, n | | | .540 |
| 4 | 20 | 25 | |
| 5 | 15 | 26 | |
| 6 | 0 | 1 | |
| IIEF score, n | | | .646 |
| 18~21 | 2 | 3 | |
| 21~25 | 33 | 49 | |
| Intraoperative | | | |
| Mean (range) operative time, min | 105.0 (75-185) | 102.5 (72-180) | .786 |
| Mean (range) EBL, mL | 130 (65-500) | 135 (60-550) | .702 |
| Mean BTR, % | 0 | 0 | 1.000 |
| Nerve sparing, n (%) | | | |
| Bilateral | 35 (100) | 52 (100) | 1.000 |
| Intraoperative complications (Clavien), n | 0 | 0 | 1.000 |
| Postoperative | | | |
| Positive margins, n | 0 | 0 | 1.000 |
| Pathological Gleason score, n | | | .984 |
| 3+3 | 20 | 29 | |
| 3+4 | 12 | 18 | |
| 4+3 | 3 | 5 | |
| Pathological stage, n | | | .623 |
| pT2a | 24 | 33 | |
| pT2b | 11 | 19 | |
| Clavien system | | | .525 |
| Postoperative complications, grade I, n | 1 | 3 | |
| Biochemical recurrence (n) | 0 | 0 | 1.000 |

**Abbreviations:** EBL, estimated blood loss; BTR, blood transfusion rate; QOL, quality of life.

patients diagnosed with low-risk organ-confined PCa (PSA ≤ 10 ng/mL, Gleason score < 7, and clinical stage T1~T2aN0M0) combined with significant obstructive symptoms (IPSS score > 20, QOL > 3) who received STLRP (35) or IEERP (52) with bilateral nerve preservation were included in this study. The postoperative follow-up of each patient was at least 24 months. Incidence of complications was graded according to the modified Clavien system. Biochemical recurrence was defined as at least 2 consecutive detectable PSA levels > 0.2ng/mL.[7-9] We offered patients two operations (STLRP and IEERP) and informed them of the pros and cons of each. The patient chose the plan and signed the informed consent. All operations were performed by a stationary surgeon and two non-stationary assistants.

## *STLRP*

The equipment, device, methodology, etc. used for STLRP in more detail were introduced in our previous studies.[4] The main operational procedure included the following: 1. Port (similar to the single-port approach) which extended into the bladder was established between the umbilicus and pubic symphysis. 2. A posterior incision was created along the bladder neck distal to the ureteric orifices. 3. Dissection of vas deferens and

**Table 2a.** The recovery of erectile function at different intervals (STLRP VS IEERP)

| Erectile function (Timing) | IIEF-6 score | STLRP | IEERP | *P*-value |
|---|---|---|---|---|
| Baseline | ≥ 18 | 35 (100%) | 52 (100%) | 1.000 |
| | < 18 | 0 | 0 | |
| 3 Months | ≥ 18 | 4 (11.4%) | 3 (5.8%) | .341 |
| | < 18 | 31 | 49 | |
| 6 Months | ≥ 18 | 25 (71.4%) | 20 (38.5%) | .003 |
| | < 18 | 10 | 32 | |
| 12 Months | ≥ 18 | 28 (80.0%) | 26 (50.0%) | .005 |
| | < 18 | 7 | 26 | |
| 24 Months | ≥ 18 | 29 (82.9%) | 31 (59.6%) | .022 |
| | < 18 | 6 | 21 | |

**Table 2b.** Potency (STLRP VS IEERP) by generalized linear mixed models.

| Variable | Estimate | Std Error | t | *P* |
|---|---|---|---|---|
| Intercept | -.878 | .495 | -1.770 | .077 |
| time | -.077 | .042 | -1.840 | .066 |
| groups | .374 | .294 | 1.280 | .203 |
| time*group | .057 | .025 | 2.310 | .021 |

seminal vesicles, and anterograde separation of Denonvillier's fascia. 4. Lateral separation of the prostate and intrafascial nerve sparing. 5. Remove of the puboprostatic ligaments and dorsal vein complex. 6. Dissection of the urethra and prostate apex. 7. Vesico-urethral tension-reduced anastomosis.

### *IEERP*

The main operational procedure of IEERP included the following: 1. Port (establish the preperitoneal space) which carried down to the posterior rectus sheath where trocars were inserted. 2. Expose the anterior surfaces of both bladder and prostate as well as the endopelvic fascia. 3. Dissection of bladder-neck, vas deferens and seminal vesicles, and stripping down Denonvillier's fascia. 4. Lateral separation of the prostate and intrafascial nerve sparing. 5. Remove of the puboprostatic ligaments and dorsal vein complex. 6. Dissection of the urethra and prostate apex. 7. Vesico-urethral tension-reduced anastomosis.[6]

### *Functional assessment*

Sexual and urinary function at baseline and various time points (3, 6, 12, 24 Months) after surgery were evaluated using the IIEF-6 and ICS (International Continence Society) questionnaires, respectively. These questionnaires were relatively effective and universal measurement methods at present and they had been cited and used in many studies. Potency was defined as an IIEF-6 score $\geq$ 18 with or without phosphodiesterase 5 inhibitors (PDE5-Is) support. Continence was defined as no need for pads. Mild incontinence was defined as 1-2 pads requirement daily by patients for normal physical activity and incontinence was defined as > 2 pads daily.[8,10]

### *Statistical analysis*

We compared the two groups (STLRP VS IEERP) by Student t test for numeric values, and Chi-square test for non-numeric values. Generalized linear mixed models were used for comparison of postoperative functional recovery between the two groups. Significance was defined by $P < .05$.

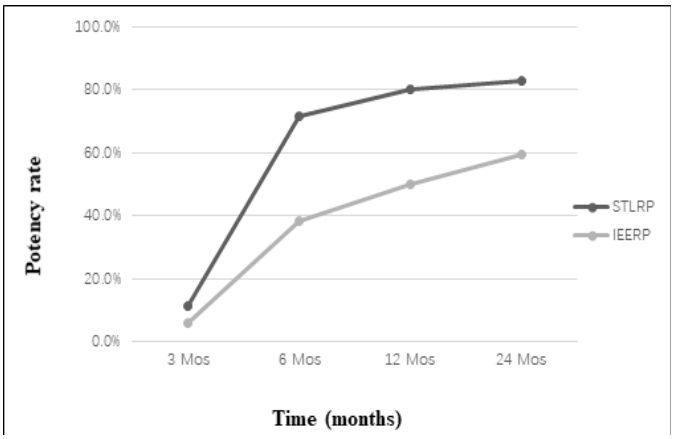


**Figure 1.** Potency recovery after RP.

## RESULTS

There were 87 patients (STLRP 35, IEERP 52) in accordance with the inclusive criteria. There was no significant difference between the two groups (STLRP VS IEERP) on clinical and pathological parameters preoperatively (**Table 1**). There were 10 cases in STLRP group received PDE5-Is after surgery, while 15 patients in IEERP.

**Table 2** lists show the erectile function of patients preoperatively (baseline) and postoperatively (3, 6, 12, 24 Months). Potency (IIEF-6 score $\geq$ 18) preoperatively achieved 100% (both STLRP and IEERP), while declined obviously at 3 months postoperatively. After RP, sexual function recovered over time, and finally, 82.9% (STLRP) and 59.6% (IEERP) patients recovered potency at 2 years postoperatively. Besides, patients (STLRP: 71.4%) obtained better potency than others (IEERP: 38.5%) at 6 months postoperatively, and generalized linear mixed models showed the erectile function of patients after STLRP recovered better than ones after IEERP on the whole (**Figure 1**).

**Table 3** lists show the urinary continence of patients preoperatively (baseline) and postoperatively (3,6,12, 24 Months). The rate of continence (0 pad/day) preoperatively in all patients was 100%. At 3 months postoperatively, the rate of continence (0 pad/day) in patients receiving STLRP achieved 97.1%, and only one patient showed mild incontinence (1-2 pads/day).

Patients (STLRP: 97.1%) obtained better continence than others (IEERP: 75.0%) at 3 months. The rate of continence returned to 100% (STLRP) and 96.2% (IEERP) at 6 months postoperatively, and continence achieved 100.0% at 12 months after RP in both groups. On the whole, the continence of patients after STLRP recovered better than ones after IEERP by generalized

**Table 3a.** The recovery of urinary continence at different intervals (STLRP VS IEERP)

| Urinary continence (Timing) | daily pads | STLRP | IEERP | *P*-value |
|---|---|---|---|---|
| Baseline | 0 | 35 (100%) | 52 (100%) | 1.000 |
| | 1-2 | 0 | 0 | |
| 3 Months | 0 | 34 (97.1%) | 39 (75.0%) | .001 |
| | 1-2 | 1 | 13 | |
| 6 Months | 0 | 35 (100%) | 50 (96.2%) | .240 |
| | 1-2 | 0 | 2 | |
| 12 Months | 0 | 35 (100%) | 52 (100%) | 1.000 |
| | 1-2 | 0 | 0 | |
| 24 Months | 0 | 35 (100%) | 52 (100%) | 1.000 |
| | 1-2 | 0 | 0 | |

**Table 3b.** Continence (STLRP VS IEERP) by generalized linear mixed models.

| Variable | Estimate | Std Error | t | *P* |
|---|---|---|---|---|
| Intercept | -31.367 | 632.190 | -.050 | .961 |
| time .142 | .061 | 2.340 | .020 | |
| groups 14.694 | 316.090 | .050 | .963 | |
| time*group | -.142 | .000 | - ∞ | <.0001 |

linear mixed models (**Figure 2**).

## DISCUSSION

Radical prostatectomy (RP) is always used aiming for prostate cancer cure, but usually, it adversely affects health-related quality of life. Cancer-specific survival approaches 96.3% at 10 years, and 95% at 15 years after surgery for early localized prostate cancer.[11] When low risk disease is common, the heavy focus will be the functional recovery. Sexual and urinary function, often being considered as part of the important quality of life, will be more significant for patients receiving RP.[12] Nerve sparing in RP may always play a critical role in functional recovery postoperatively.[13] Prostatectomy itself is a definitely traumatic operation. Preserving the external striated urethral sphincter and its innervation may facilitate the recovery of sexual and urinary function postoperatively.[14] With the intrafascial nerve-sparing, endoscopic extraperitoneal radical prostatectomy was reported to minimize the operational trauma of fascia and the related neurovascular bundle.[6] Much evidence has shown that the preservation of dorsolateral neurovascular bundles during operation may not be the only key factor in functional rehabilitation, and the unknown and complicated neural tissue distributing around bladder, prostate and urethra or in fascia may also participate in sex and continence.[15,16] Single-port transvesical enucleation of the prostate was reported as an effective treatment for large-volume obstructive BPH and all patients (34 cases) receiving this operation got no incontinence.[17] Recent studies also showed that sex and continence-relevant nerves may largely exist in the periprostatic and perivesical space, and careful separation of prostate from its surroundings (periprostatic fascia) could improve functional outcome.[18] STLRP can utilize the natural entry point and space of bladder, avoid the bladder, perivesical space and fascia, minimize the dissection of tissue and the injury of operation, and maximize the preservation of nerve plexus around the bladder neck, prostate and urethra, from which better recovery of erectile function and continence may benefit. Our research showed that patients receiving STLRP can obtain better functional recovery than the ones receiving IEERP in early time following RP. Besides, patients receiving STLRP obtained better functional recovery during 2 years of follow-up, which evaluated by generalized linear mixed models. It showed that patients after STLRP got distinct advantages throughout the postoperative recovery process, which were closely related to a better quality of life.

Sexual and urinary recovery after RP is complicated and multifactorial, influenced by age, smoking status, comorbidities such as obesity and diabetes, baseline potency and continence, operation, complications and so on.[19,20] Besides, previous research has found that there is also mutual influence between sexual and urinary recovery.[21] Previous studies suggested that sexual function of patients recovered significantly within 1-2 year after surgery, and then declined slowly.[22] Our research also showed that potency recovered over time after RP (**Figure 1**), including STLRP and IEERP. STLRP, as an exploratory research, may have some advantage in potency recovery postoperatively. Besides, active adjuvant therapy, like biofeedback, phosphodiesterase-5 inhibitors, intracavernous injection, vacuum and biofeedback postoperatively, may also promote the potency recovery. However, the potency recovery will still be a long-term process, and often 1-2 year or even longer time may be supposed for improving time.[23] There were also limitations in our study for the relatively small sample size and limited follow-up years.

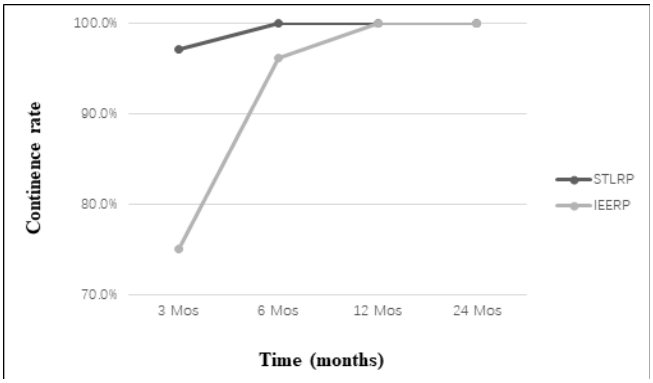


**Figure 2.** Continence recovery after RP.

## CONCLUSIONS

STLRP can minimize the nerve injury and obtain better and faster postoperative functional recovery than IEERP. STLRP may be another effective treatment for low-risk organ-confined prostate cancer.

## ACKNOWLEDGEMENT

The authors acknowledge financial support received from the Chinese National Natural Science Foundation of China (81902557, 81572503) and the Shenzhen Key Medical Discipline Construction Fund (No. SZXK020).

## REFERENCES

1. Basiri A, Eshrati B, Zarehoroki A, et al. Incidence, Gleason Score and Ethnicity Pattern of Prostate Cancer in the Multi-ethnicity Country of Iran During 2008-2010. UROL J. 2020.
2. Wilt TJ, Jones KM, Barry MJ, et al. Follow-up of Prostatectomy versus Observation for Early Prostate Cancer. N Engl J Med. 2017;377: 132-42.
3. Bianco FJ, Scardino PT, Eastham JA. Radical prostatectomy: long-term cancer control and recovery of sexual and urinary function ("trifecta"). UROLOGY. 2005;66: 83-94.
4. Gao X, Pang J, Si-tu J, et al. Single-port transvesical laparoscopic radical prostatectomy for organ-confined prostate cancer: technique and outcomes. BJU INT. 2013;112: 944-52.
5. Ellison JS, He C, Wood DP. Stratification of postprostatectomy urinary function using expanded prostate cancer index composite.

UROLOGY. 2013;81: 56-60.
6. Stolzenburg JU, Rabenalt R, Do M, et al. Intrafascial nerve-sparing endoscopic extraperitoneal radical prostatectomy. EUR UROL. 2008;53: 931-40.
7. Yang Y, Luo Y, Hou GL et al. Laparoscopic Radical Prostatectomy after Previous Transurethral Resection of the Prostate in Clinical T1a and T1b Prostate Cancer: A Matched-Pair Analysis. UROL J. 2015;12: 2154-9.
8. Yang Y, Luo Y, Hou GL, Huang QX, Pang J, Gao X. Laparoscopic Radical Prostatectomy Plus Extended Lymph Node Dissection in Combination With Immediate Androgen Deprivation Therapy for Cases of pT3-4N0-1M0 Prostate Cancer: A Multimodal Study of 8 Years' Follow-up. Clin Genitourin Cancer. 2016;14: e321-7.
9. Xu AJ, Taksler GB, Llukani E, Lepor H. Long-Term Continence Outcomes in Men Undergoing Radical Prostatectomy: A Prospective 15-Year Longitudinal Study. J Urol. 2018;200: 626-32.
10. Limoncin E, Gravina GL, Lotti F, et al. The Masturbation Erection Index (MEI): validation of a new psychometric tool, derived from the six-item version of the International Index of Erectile Function (IIEF-6) and from the Erection Hardness Score (EHS), for measuring erectile function during masturbation. BJU INT. 2019;123: 530-7.
11. Tsurumaki SY, Fukuhara H, Suzuki M, et al. Long-term results of radical prostatectomy with immediate adjuvant androgen deprivation therapy for pT3N0 prostate cancer. BMC UROL. 2014;14: 13.
12. Ko YH. Functional recovery after radical prostatectomy for prostate cancer. Yeungnam Univ J Med. 2018;35: 141-9.
13. Harris CR, Punnen S, Carroll PR. Men with low preoperative sexual function may benefit from nerve sparing radical prostatectomy. J Urol. 2013;190: 981-6.
14. Steiner MS. Continence-preserving anatomic radical retropubic prostatectomy: the "No-Touch" technique. CURR UROL REP. 2000;1: 20-7.
15. Martinez-Pineiro L. Prostatic fascial anatomy and positive surgical margins in laparoscopic radical prostatectomy. EUR UROL. 2007;51: 598-600.
16. Ganzer R, Blana A, Gaumann A, et al. Topographical anatomy of periprostatic and capsular nerves: quantification and computerised planimetry. EUR UROL. 2008;54: 353-60.
17. Desai MM, Fareed K, Berger AK, et al. Single-port transvesical enucleation of the prostate: a clinical report of 34 cases. BJU INT. 2010;105: 1296-300.
18. Alsaid B, Bessede T, Diallo D, et al. Division of autonomic nerves within the neurovascular bundles distally into corpora cavernosa and corpus spongiosum components: immunohistochemical confirmation with three-dimensional reconstruction. EUR UROL. 2011;59: 902-9.
19. Ficarra V, Novara G, Rosen RC, et al. Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. EUR UROL. 2012;62: 405-17.
20. Gacci M, Simonato A, Masieri L, et al. Urinary and sexual outcomes in long-term (5+ years) prostate cancer disease free survivors after radical prostatectomy. Health Qual Life Outcomes. 2009;7: 94.
21. Gandaglia G, Suardi N, Gallina A, et al. Preoperative erectile function represents a significant predictor of postoperative urinary continence recovery in patients treated with bilateral nerve sparing radical prostatectomy. J Urol. 2012;187: 569-74.
22. Neumaier MF, Segall CJ, Hisano M, Rocha F, Arap S, Arap MA. Factors affecting urinary continence and sexual potency recovery after robotic-assisted radical prostatectomy. INT BRAZ J UROL. 2019;45: 703-12.
23. Litwin MS, Melmed GY, Nakazon T. Life after radical prostatectomy: a longitudinal study. J Urol. 2001;166: 587-92.