Initial Experience of Robotic-assisted Radical Prostatectomy in Juntendo Nerima Hospital

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Objective: The safety and feasibility of robotic-assisted radical prostatectomy (RARP) compared with retropubic radical prostatectomy (RRP) is debated. As a result it is becoming the most common approach for prostate cancer surgery in the world. We examined whether the surgical results would be improved compared to RRP at a single facility where RARP is newly performed.

Patients: The subjects were 81 patients who underwent radical prostatectomy for localized prostate cancer at Juntendo University Nerima Hospital from March 2017 to December 2020.

Methods: Perioperative factors analyzed in this study included the total operative time, estimated blood loss (EBL), complication and hospitalization. The recovery of urinary continence (UC) was either safety-pad only or pad-free. Oncological outcomes were assessed by surgical margin status.

Results: Patients underwent RARP have the higher level of initial-PSA. But there was no significant difference on age, BMI and prostate volume between the RARP and RRP group. Perioperative EBL was less and the operative time and the length of hospital stay was shorter in the RARP group. Our study evaluating RARP and RRP reported positive surgical margins (PSM) rates. The results showed a significant difference with higher PSM rates in RRP group. Mean time to recovery of UC was no significantly difference among the two groups; 8 months in RRP group, 7 months in RARP group.

Conclusions: The newly introduced RARP confirmed shorter operative time, lower EBL, shorter length of hospital stay, and fewer complications, demonstrating that RARP is less invasive than RRP.

Key words: prostate cancer, robot-assisted surgery, radical prostatectomy

Introduction

Prostate cancer (PC) is a major disease affecting men worldwide, and radical prostatectomy (RP) is the definitive treatment for localised prostate cancer. However, open retropubic radical prostatectomy (RRP) is associated with higher overall complications, including estimated blood loss (EBL), wound infections. In recent years, robot-assisted laparoscopic radical prostatectomy (RARP) has minimized EBL and invasion, which has made it possible to accelerate postoperative recovery. In addition to cancer control, better results have been reported for functional postoperative recovery such as continence and electric function than conventional RRP.1, 2 A population-based analysis comparing RARP and RRP procedures concluded that men who underwent RARP had significantly less 30-day complications, blood transfusions, and shortened length of stay.3 As a result it is becoming the most common approach for prostate cancer surgery in the world.4 We examined whether the surgical results would be improved compared to RRP at a single facility where RARP is newly
performed.

Methods

The subjects were patients who underwent RP for localized PC at Juntendo University Nerima Hospital from March 2017 to December 2020. Patients have been newly diagnosed with clinically localised prostate cancer and have chosen surgery as their treatment approach. Clinicopathological information on these patients was extracted from their medical records. Patients who underwent RP were retrospectively divided into 2 groups RRP and RARP. In this study, open RRP was performed in the standard fashion via retrograde dissection of the prostate gland, and 1 surgeon performed RARP in a standard fashion, using the DaVinci X system (Intuitive Surgical, Sunnyvale, CA, USA). Patients who had a follow-up of <4 months were excluded from this study. Collected data consisted of preoperative variables including the age, body mass index (BMI), serum prostate specific antigen (PSA) at diagnosis, and clinical tumor stage. Perioperative factors analyzed in this study included the total operative time, EBL, and hospitalization. Complications were recorded using the Dindo modification of the Clavien Grading System. The recovery of incontinence was either safety-pad only or pad-free. Oncological outcomes were assessed by surgical margin status. Positive surgical margin (PSM) defined that was cancer at the edge of the RP resection specimen. Statistical analysis was performed using JMP (version 11.0, SAS Institute Inc., Cary, NC, USA). Categorical variables were compared using t-test, Mann–Whitney U test, and Pearson’s chi-square test, and logistic regression analysis was used for univariate analysis. This retrospective clinical study protocol conforms to the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a priori approval by the institutions human research committee. This study involved clinical data comparisons was used with consent from participants and was approved by the Institutional Review Board of Juntendo University Nerima Hospital (N21-0013).

Result

Between March 2017 and December 2020, 81 men were diagnosed with PC, of whom 35 underwent open RRP and 46 underwent RARP. Patient characteristics are summarised in Table 1. Patients underwent RARP have the higher level of initial-PSA (P = 0.018) (Table 1). But there was no significant difference on age, BMI and prostate volume between the RARP and RRP group. (Table 1). Significantly more patients underwent neurovascular bundle preservation during RARP (31% vs 6%), and no significantly difference on extent lymph node dissection were performed (9% vs 11%). Perioperative EBL was less and the operative time and the length of hospital stay (LOS) was shorter in the RARP group (Table 2). Bleeding requiring transfusion were the only RRP group and the severe postoperative complication rates among two groups were higher in RRP group (Table 2).

Table 1 Comparison of preoperative characteristics between the 2 groups

|                  | A: RRP (n=35) | B: RARP (n=46) | P-value |
|------------------|---------------|----------------|---------|
| Median age, years (IQR) | 71 (66-75)    | 70 (63-75)    | 0.532   |
| Median BMI, Kg/m² (IQR) | 23.9 (22.0-25.0) | 24.1 (22.8-26.3) | 0.057   |
| Median initial PSA, ng/mL (IQR) | 8.42 (6.0-11.0) | 9.86 (5.76-16.8) | 0.018   |
| Median prostate volume, mL (IQR) | 32.0 (24.1-44.6) | 27.6 (21.0-44.3) | 0.272   |

Clinical stage

|                  | A: RRP (n=35) | B: RARP (n=46) | P-value |
|------------------|---------------|----------------|---------|
| cT1              | 1 (3%)        | 2 (4%)         | 0.66    |
| cT2a             | 20 (57%)      | 21 (46%)       |         |
| cT2b             | 3 (8%)        | 7 (15%)        |         |
| cT2c             | 9 (26%)       | 10 (22%)       |         |
| cT3a             | 2 (6%)        | 4 (9%)         |         |
| cT3b≥             | 0 (0%)        | 2 (4%)         |         |

Patients’ characteristics

IQR: interquartile ranges  BMI: body mass index  PSA: prostate-specific antigen
The clinical and pathologic stage was similar among the groups (Table 1, Table 2). However, we noted a significantly greater incidence of PSM rates in the smaller RARP group compared with RRP group (34% versus 54%, \( P = 0.048 \)).

In RRP group, incontinence recovered 1 month after surgery in 5 cases (14%), recovered in 3 months in 13 cases (37%), and recovered in 6 months in 24 cases (69%). 29 cases (83%) recovered from incontinence at 12 months. The Kaplan–Meier curve of the time to recovery of urinary continence (UC) in each group is shown in Figure 1. The mean time to recovery of UC was no significantly difference among the two groups; 8 months in RRP group, 7 months in RARP group (\( P = 0.082 \), Wilcoxon). Median follow-up was 7 months in the RARP group and 27.1 months in the RRP group.

### Discussion

In our study of clinical data on perioperative outcomes of RARP and RRP were similar to previous reports in which RARP was associated with lower EBL, shorter lengths of LOS and lower or similar rates of PSM and complications.\(^6\)\(^7\) RARP had a lower EBL than RRP, the reason is that RARP has meticulous dissection with 3D vision and pressure hemostasis due to pneumoperitoneum which made decrease the intraoperative blood loss.

![Figure 1](image.png)

**Figure 1** Kaplan–Meier curve shows the recovery urinary continence rate after RARP and RRP. There was no significant difference between the RARP and RRP groups.
The previous reports suggested that patient outcomes and surgical approach were mainly required to improve for an accurate characterization of complications. In our study patients underwent RARP had fewer hospital stay and complications than RRP. The possible reason may be associated with lower EBL and less transfusion rate in RARP. Then a comprehensive classification of complications indicated that RRP had a higher incidence of rectal injury, wound infections, urinary leakage, and lymphocele. Although some reports have shortened the operation time of RRP, the results were short in patients who underwent RARP at our institution. Stacey C. Carter et al. reported that operative times for RARP decreased over their contemporary study while remaining stable for RRP and higher RP surgeon volume was associated with shorter operative times and selective referral to efficient. The ability to identify factors that influence the length of the operation has important implications for understanding surgeon learning curves. A short learning curve is one of the main advantages of the RARP, which makes it an interesting option for junior doctors and reduced operative time. Hugh J Lavery et al. reported that the “advanced learning curve” includes 100–300 cases, after which the operative time decreases to 165 (75–200) minutes. At our institution, RARP was performed by a surgeon with more than 300 case experiences, so it is considered that the operation time was short even in the initial experience.

Overall, pathologic T stage did not differ significantly among patients who had undergone RARP and those who had undergone RRP, nor did presence of T3 or higher disease. In our study, the PSM rates were higher than several study that reported of PSM of about 20–25% in other studies. This is thought to be due to the higher proportion of cases with pT3 in both the RRP and RARP populations compared to previous reports. Jim C. Hu et al. reported that there were lower PSM rate with RARP versus RRP for men diagnosed with cT2a and cT1c PC, and the over cT3a PSM rate was also lower for RARP than for RRP. We have several reasons for the better surgical outcomes with RARP compared RRP. First, the improved RARP surgical margin status may be attributed to better visualization of the prostate capsule, and pneumoperitoneum made tamponade venous blood loss compared with RRP. Second, preoperative staged PC using Magnetic Resonance Imaging (MRI) have made it possible to revise RARP technology and optimize cancer control for locally advanced PC.

Ficarra V et al. compared RARP with RRP urinary continence indicated that RARP had a better 12-mo urinary continence recovery than RRP. However, our results indicated that there were no statistical differences with regard to recovery UC in two groups. Not only age, BMI, prostate volume, etc., which have been pointed out to be related to factors affecting recovery UC, but also the length of the membranous urethra evaluated using MRI, it has been reported as a factor involved in recovery UC. Nguyen LN et al. reported that bilateral nerve sparing was associated with a statistically significant decreased risk of postoperative urinary incontinence at 3 months compared to non–nerve sparing. In our study, many patients chose nerve-sparing in the RARP group, but few had bilateral nerve-sparing surgery, and most cases were unilaterally conserved, suggesting that there was no difference in recovery from incontinence. In order to obtain better recovery UC in the future, it is expected that RARP will enable surgical techniques to evaluate the structure around urethra by MRI and leave a thick and long membranous urethra.

The present study had several limitations. First, the design was retrospective and observational at a single institution and single surgeon for RARP. Second, the follow-up period was relatively short in the RARP group. In conclusion, short operation time and low EBL, short LOS and few complications were confirmed by RARP rather than RRP, suggesting that the newly introduced RARP was minimally invasive surgery. Oncological outcome showed a significant difference with higher PSM rates in RRP group. No significant difference was found recovery from UC, and the short observation period was one of the factors, and it was considered that further accumulation was necessary.

Acknowledgments

Not applicable.
Conflicts of interest

The authors declare that there are no conflicts of interest.

Author contributions

All authors read and approved the final manuscript.

References

1) Novara G, Ficarra V, Mocellin S, et al: Systematic review and meta-analysis of studies reporting oncologic outcome after robot-assisted radical prostatectomy. European urology. 2012; 62: 382–404.
2) Kim SC, Song C, Kim W, et al: Factors determining functional outcomes after radical prostatectomy: robot-assisted versus retropubic. European urology. 2011; 60: 413–9.
3) Hu JC, Gandaglia G, Karakiewicz PI, et al: Comparative effectiveness of robot-assisted versus open radical prostatectomy cancer control. European urology. 2014; 66: 666–72.
4) Kawachi MH: Counterpoint: robot-assisted laparoscopic prostatectomy: perhaps the surgical gold standard for prostate cancer care. Journal of the National Comprehensive Cancer Network : JNCCN. 2007; 5: 689–92.
5) Charlson ME, Pompei P, Ales KL, MacKenzie CR: A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. Journal of chronic diseases. 1987; 40: 373–83.
6) Alemozaffar M, Sanda M, Yecies D, Mucci LA, Stampfer MJ, Kenfield SA: Benchmarks for operative outcomes of robotic and open radical prostatectomy: results from the Health Professionals Follow-up Study. European urology. 2013; 67: 432–8.
7) Lowrance WT, Tarin TV, Shariat SF: Evidence-based comparison of robotic and open radical prostatectomy. TheScientificWorldJournal. 2010; 10: 2228–37.
8) Tang K, Jiang K, Chen H, Chen Z, Xu H, Ye Z: Robotic vs. Retropubic radical prostatectomy in prostate cancer: A systematic review and an meta-analysis update. Oncotarget. 2017; 8: 32237–57.
9) Wallerstedt A, Tyrizis SI, Thorsteinsdottir T, et al: Short-term results after robot-assisted laparoscopic radical prostatectomy compared to open radical prostatectomy. European urology. 2015; 67: 660–70.
10) Carter SC, Lipsitz S, Shih YC, Nguyen PL, Trinh QD, Hu JC: Population–based determinants of radical prostatectomy operative time. BJU international. 2014; 113: E112–8.
11) Lavery HJ, Samadi DB, Thaly R, et al: The advanced learning curve in robotic prostatectomy: a multi-institutional survey. Journal of robotic surgery. 2009; 3: 165.
12) Mazzone E, Dell’Oglio P, Rosiello G, et al: Technical Refinements in Superextended Robot-assisted Radical Prostatectomy for Locally Advanced Prostate Cancer Patients at Multiparametric Magnetic Resonance Imaging. European urology. 2020.
13) Ficarra V, Novara G, Rosen RC, et al: Systematic review and meta-analysis of studies reporting urinary continence recovery after robot-assisted radical prostatectomy. European urology. 2012; 62: 405–17.
14) Kitamura K, China T, Kanayama M, et al: Significant association between urethral length measured by magnetic resonance imaging and urinary continence recovery after robot-assisted radical prostatectomy. Prostate international. 2019; 7: 54–9.
15) Nguyen LN, Head L, Witiuk K, et al: The Risks and Benefits of Cavernous Neurovascular Bundle Sparing during Radical Prostatectomy: A Systematic Review and Meta-Analysis. The Journal of urology. 2017; 198: 760–9.
16) Cameron AP, Suskind AM, Neer C, et al: Functional and anatomical differences between continent and incontinent men post radical prostatectomy on urodynamics and 3T MRE: a pilot study. Neurourol Urodyn. 2015; 34: 527–32.