

## Robotic-assisted Laparoscopic Radical Prostatectomy From a Single Chinese Center: A Learning Curve Analysis



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<b>OBJECTIVE</b>	To investigate the learning curve of robotic-assisted laparoscopic radical prostatectomy (RALP) and analyze whether a surgeon's prior surgical experience has effects on the surgery.
<b>PATIENTS AND METHODS</b>	From April 2012 to August 2015, 3 surgeons performed RALP on 355 consecutive patients with prostate cancer. Among these cases, 184 were by surgeon A with prior open experiences, 92 by surgeon B with both open and laparoscopic experiences, and 79 by surgeon C with laparoscopic experiences only. Perioperative, oncological, and functional outcomes were evaluated and compared between surgeons. Learning curve patterns were evaluated to determine the number of cases to reach plateau.
<b>RESULTS</b>	Marked difference was observed in operative time among the 3 groups (all $P < .05$ ). Length of hospital stay was also statistically significant (all $P < .001$ ), except for that between Group B and Group C ( $P = .739$ ). Continence at 1-year and 6-month postoperatively was better in Groups B and C compared with Group A ( $P < .001$ ). Intraoperative blood loss, pathologic stage, positive surgical margin, biochemical recurrence-free rate, and other pathological findings showed no statistical significance between the groups. The number of cases required to reach plateau may vary for surgeons with different surgical experiences.
<b>CONCLUSION</b>	Different early surgical background may affect the perioperative parameters of novice RALP surgeons. Previous laparoscopic experiences may provide additional advantage in learning curve parameters compared with surgeons with open experiences only. A better overall continence for laparoscopic surgeons requires further validation. UROLOGY 93: 104–111, 2016. © 2016 Elsevier Inc.

In comparison with Western experience, robotic-assisted laparoscopic radical prostatectomy (RALP) is introduced later and promoted more slowly in China, because of its higher costs and demanding training requirements, resulting in sluggish growth of surgeons' experience. With every new surgical technique comes a period of learning curve that is accompanied by a gradual improvement in operative proficiency and functional outcomes; as for RALP, with the accumulation of experience from the surgeon as well as the entire surgical team,

operative, tumor control, and functional outcomes can be depicted for understanding of the learning phase of such technique in different centers, and for such technique to be safely and proficiently promoted.

Current literature on whether RALP surgeons would benefit more and have better surgical outcomes from previous open or laparoscopic prostatectomy remains controversial. Ku and Ha<sup>1</sup> suggested that for surgeons performing RALP with abundant previous experience of laparoscopic radical prostatectomy (LRP), the learning curve of oncological and functional outcome may be shortened; however, earlier studies have shown the exact opposite, demonstrating that the complication rate of surgeons with prior open radical prostatectomy (ORP) plateaued earlier than those with LRP experiences.<sup>2,3</sup> Zorn et al<sup>4</sup> also suggested a longer learning curve for LRP surgeons than for ORP surgeons to convert to RALP. To our knowledge, there have been no existing reports about the current situation and application of RALP in Mainland China, nor has there been

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any existing study designed to describe the learning curve of RALP by 3 surgeons with different early surgical experiences. Therefore, whether these favorable outcomes of RALP could be achieved by Chinese surgeons and whether the learning curves between Chinese and Western surgeons are different to any extent remain unclear. The aim of this study was to retrospectively analyze the learning curves of 3 RALP surgeons in 1 of the largest robotic centers for urologic surgery in China to investigate whether oncological and functional outcomes are different in surgeons with prior open or laparoscopic experiences.

## PATIENTS AND METHODS

### Patients

From April 2012 to August 2015, 388 consecutive patients with localized or locally advanced prostate cancer (PCa) who underwent RALP in Changhai Hospital, Shanghai, China, performed by 3 surgeons with different early surgical experiences (184, 92, and 79 cases for surgeons A [X.G.], B [L.W.], and C [B.Y.], respectively), were enrolled in the study. Surgeon A has experienced ORP skills without experience of LRP; surgeon B has experienced ORP and LRP skills; and surgeon C has experienced LRP skills with little experience of ORP. Patients receiving perioperative adjuvant radiotherapy or androgen-deprivation therapy were excluded, leaving 355 patients to be included in the study. Preoperative data were collected, including age, serum prostate-specific antigen (PSA), body mass index, biopsy Gleason score (GS), and clinical stage (2002 American Joint Committee on Cancer TNM cancer staging system). Preoperative risk was determined by D'Amico risk stratification<sup>5</sup>: low-risk patients were clinically staged T1c or T2a and PSA levels < 10 ng/mL and a GS < 7; intermediate-risk patients were clinically staged T2b or PSA levels of 10-20 ng/mL or a GS = 7; and high-risk patients were staged T2c or above, or PSA levels > 20 ng/mL or a GS of 8-10.

### RALP Technique and Specimen Collection

We performed the RALP procedure as described previously.<sup>6-9</sup> A transperitoneal approach was made, using 6 trocar ports of a conventional 4-arm da Vinci Robotic System (Intuitive Surgical, Sunnyvale, CA). Intraoperative parameters were recorded, including operative time, blood loss, transfusion rates, and surgical-related complications. Operative time was counted from trocar placement to application of surgical dressings after closure of surgical incisions. Specimens were fixed, coated with Indian ink, and cut into systemic stepwise sections at 4 mm intervals. Pathological outcomes include postoperative GS; positive surgical margin (PSM); extracapsular, seminal vesicle and perineural invasion; as well as lymph node metastasis. PSM was defined as the presence of malignant glandular cells that were in direct contact with inked surfaces, discovered at upper, lower, and posterior surgical margins.

Oncological outcome was evaluated by biochemical recurrence (BCR)-free rate to the end of the study.

Continence was evaluated by 1-year pad-free rate. Because patients being diagnosed with PCa are at higher age and greater risk in the present study compared with Western patients, and the majority of patients were impotent or had low sexual desire before surgery, the number of patients who met the criteria for nerve-sparing RALP was low. Selective unilateral or bilateral interfascial nerve-sparing RALP was performed in 24 patients. Potency was defined as the ability to perform penetration in sexual intercourse, with or without postoperative oral administration of phosphodiesterase type 5 inhibitors.

### Data Analysis

Continuous and normally distributed variables were expressed as mean  $\pm$  standard deviation, and non-normally distributed variables were expressed as median with interquartile range. Preoperative data, and pathological and functional outcomes were analyzed for the learning curve study. Categorical data that were normally distributed were analyzed using chi-squared tests among the 3 groups, and those between 2 groups were compared using *Student-Newman-Keuls* tests. Analysis of variance was used in the continuous variables of the 3 groups whereas *t* tests were used between 2 groups. Non-normally distributed quantitative variables between multiple groups were analyzed with *Kruskal-Wallis* tests. Values of  $P < .05$  were considered statistically significant. SPSS software ver. 19.0 (SPSS Inc., Chicago, IL) was used to perform the statistical analysis. Learning curves were depicted using locally weighted scatterplot smoothing regression analysis with STATA version 12.0 (Stata Corp, College Station, TX).

## RESULTS

Patients' preoperative characteristics are shown in [Table 1](#). The entire patient population aged 67.0 years on average (range 47-87 years), with a median PSA of 12.0 ng/mL. There were 79.1% of patients who had clinically palpable disease ( $\geq$ T2a), and 7.6% of patients had locally advanced disease. GS <7, =7, and >7 determined by preoperative transrectal ultrasound-guided 10 to 12-core systematic biopsy were 94 (26.5%), 144 (40.6%), and 117 (32.9%), respectively; patients of low, intermediate, and high D'Amico Risk Group were 41 (11.5%), 116 (32.7%), and 198 (55.8%), respectively. Patient composition between groups regarding age, clinical stage, preoperative PSA, GS, and risk stratification showed no statistical significance (all  $P > .05$ ).

[Table 2](#) showed the perioperative clinical and pathological information in the 3 groups. Operative time (mean  $\pm$  SD) in groups A, B, and C were 219.2  $\pm$  63.1, 245.5  $\pm$  59.0, and 193.8  $\pm$  49.6 minutes, respectively; comparisons among the 3 groups ( $P < .001$ ), as well as that between 2 groups were all markedly different (all  $P < .05$ ). Length of hospital stay among the 3 groups was also statistically significant (all  $P < .001$ ), except for that compared between Group B and Group C ( $P = .739$ ) ([Fig. 1C](#)). Postoperative hospital stay was markedly different between

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