Journal of Clinical and Nursing Research

Research Article

BIO-BYWORD SCIENTIFIC PUBLISHING PTY LTD

The Effect of Prostate Volume on Robotic-assisted Radical Prostatectomy

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Abstract: Objective: To investigate the effect of prostate volume on robot-assisted radical prostatectomy. **Methods:** Clinical data of 75 patients underwent RARP in the Affiliated Hospital of Qingdao University were retrospectively analyzed. The patients were divided into 3 groups according to size of prostate. A total of 35 cases with prostate volume less than 30ml were recorded as group 1, 27 cases with volume of 30 to 50 ml were recorded as group 2, and 13 cases with volume greater than 50ml were recorded as group 3. Age, BMI, preoperative PSA, operation time, intraoperative bleeding volume, postoperative drainage volume, indwelling time of catheter, indwelling time of drainage tube, total hospitalization time, pathological stage, surgical margin, urine control and biochemical recurrence were observed. **Results:** All operations were performed under Da Vinci robot assistance, and no patient was transferred to open surgery. There was no significant difference in age, preoperative PSA, BMI, operation time, intraoperative bleeding volume, postoperative drainage volume, indwelling time of catheter, total hospitalization time, pathological stage, rate of positive surgical margin and recovery of urinary continence between the groups. Indwelling time of drainage tube was longer in group with larger prostate, 6.4 (±4.5) days in group 1, 6.3 (±2.9) days in group 2 and 7.1 (±2.5) days in group 3. Gleason score was lower in group with larger prostate, with statistical difference. **Conclusion:** Prostate volume had no significant effect on urinary control, rate of positive surgical margin and recurrence after RARP. Gleason score of pathological tissue was lower and indwelling time of drainage tube was longer in patients with larger prostate after RARP. Operation time and intraoperative bleeding volume of large prostate patients underwent RARP need to be further studied. RARP has certain advantages for patients with large prostate.

Keywords: *RARP, Prostate cancer, Prostate volume*

Publication date: September, 2019

Publication online: 30 September, 2019

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1 Introduction

Prostate cancer (PCa) is the second most common male malignant tumor worldwide. Its specific mortality rate ranks the 6th[1]. Due to the advancement of medical standards and improvement of people's living standards in China, population aging is getting more severe. Incidence of PCa increases year by year, which has seriously threatened the health of males in China. Robot assisted radical prostatectomy (RARP) is gradually substituting open surgery and conventional laparoscopic surgery, and has become an important approach for treating patients with PCa[2]. Some scholars believe that large volume prostate will increase the difficulty of RARP surgery and prolong the operation time[3-6]. This study selected 75 patients with PCa who underwent RARP. Their preoperative, intraoperative and intraoperative factors were analyzed to study the effect of prostate volume on RARP.

2 Materials and methods

2.1 Clinical data

Seventy-five patients with PCa who underwent RARP between October 2014 and December 2017 in the Affiliated Hospital of Qingdao University were retrospectively selected. Of which, 70 patients showed elevated prostate specific antigen (PSA) or abnormal MRI of prostate, and were diagnosed with PCa

through prostate biopsy. For the remaining 5 patients, they were diagnosed with PCa through transurethral resection of the prostate (TURP). Prostate volume was obtained by urinary system ultrasound, MR plain scan of prostate, or by postoperative prostate pathological specimen. Calculation method of prostate volume was: length×width×height×0.52, the unit used was centimeter (cm). The patients were grouped according to size of prostate, a total of 35 cases with prostate volume less than 30ml were grouped as Group 1, 30 cases with volume from 30 to 50ml were grouped as Group 2, and 13 cases with volume greater than 50ml were grouped as Group 3[5, 7].

2.2 Surgical method

Patients were given general anesthesia with tracheal intubation. After anesthesia, the patients were put in supine position with hips raised. Routine disinfection was carried out, sterile towel and sterile hole towel were applied, and urinary catheterization was given. Puncture point was at above navel. Puncture needle was inserted, pneumoperitoneum was created, and 12mm Trocar were inserted at left and right sides. At 3cm below the navel, 8mm Trocar was inserted at the outer edge of rectus abdominis muscle. Each of 8mm and 12mm Trocar was placed on left and right anterior axillary line respectively at umbilical plane (as shown in Figure 1). The 4 robotic arms were linked. Operating instruments including 30° Da Vinci dedicated dual-channel 3D laparoscopic lens, 1 single-pole bending shear, and 1 Maryland cutting plier, and 1 large needle holder; and some conventional laparoscopic surgical instruments including intestinal clamp, suction device, titanium clamp, Hem-o-lok clamp and so on were docked. Endopelvic fascia was opened up at the position of median umbilical ligament and medial umbilical ligament, it was then separated till retropubic space by sharp and blunt incision. Endopelvic fascia was incised, levator ani muscles were separated from surface of prostate to the tip of prostate using forceps and unipolar scissor. Unipolar scissor was used to cut bilateral ligament anterior to pubic bone, and 2-0 absorbable thread was used to suture the deep vascular bundle of penis. Anterior bladder wall was opened up at neck of bladder. After urinary catheter and bilateral urethral ureteral orifice were exposed, posterior lip of bladder was cut open. Bilateral vas deferens were separated and cut off. Bilateral seminal vesicles were remained to be separated. Denonvilliers' fascial space was opened up and separation was carried on down to tip of prostate. Bilateral prostatic lateral ligaments were carefully separated, and cut following ligation by Hem-o-lock. Tip of prostate was exposed at the urethral junction, urethra was separated by blunt incision at the tip of prostate, and prostate specimen was radically removed. Posterior wall of bladder neck was reconstructed with continuous suture using 2-0 absorbable line, to form neck of bladder. By using 2-0 absorbable line, neck of bladder was sutured continuously to urethra, and a 20Fr three-lumen urinary catheter was placed. It was confirmed that the anastomosis was leak-free and there was no obvious bleeding on the wound surface. A plasma drainage tube was inserted, pneumoperitoneum was shut, instrument was undocked, the specimen was taken out, and the incision was closed. The specimen was sent for pathological examination. Operation was ended.

2.3 Observation of indicators and follow-up

Data collected in this study encompassed the followings. Preoperative characteristics: age, body mass index, preoperative PSA and prostate volume. Intraoperative characteristics: operation time and intraoperative blood loss. Postoperative characteristics: postoperative drainage volume, indwelling time of catheter, indwelling time of drainage tube, total hospitalization time, postoperative pathological stage, postoperative surgical margin condition, postoperative endocrine therapy condition and postoperative pathological Gleanson score. Follow-up: postoperative chemical recurrence and urinary consistence.

Body Mass Index (BMI) was obtained by dividing body weight by square of height (m). Positive margin was defined as tumor tissue with distance less than or equal to 3 mm from surgical margin. Biochemical recurrence was defined as postoperative PSA level not reduced to 0.2 ng/mL or below, or raised from the lowest point to more than 0.2ng/mL[8]. Urinary continence was defined as no usage of urine pad after surgery, or the use of less than or equal to 1 pad per day, which was considered that postoperative urination could be controlled. Otherwise, it was considered postoperative urinary incontinence[9].

2.4 Statistical analysis

In this study, SPSS 20.0 software was used for statistical analysis of data. Quantitative variables were analyzed by variance analysis and qualitative variables were analyzed by chi-square test. Difference with $P \leq 0.05$ was considered to be statistically significant.

3 Results

All the 75 operations included in this study were performed with robotic assistance. There was no patient transferred to open surgery. All patients had no intraoperative complication and no serious postoperative complication. Mean age of the patients in Group 1 was 66.3 (±7.6) years, 68.9 (±6.3) years in Group 2, and 68.2 (±5.8) years in Group 3. There was no statistically significant difference between the three groups. At the same time, there was no significant difference in BMI and preoperative PSA. The corresponding intraoperative factors operation time and intraoperative blood loss were more varied, but there were no statistical differences between the groups. Comparison of postoperative factors of each group showed that average indwelling time of drainage tube in Group 1 was 6.4 (±4.5) days, 6.3 (±2.9) days in Group 2, and 7.1 (±2.5) days in Group 3. P=0.042, the difference was statistically significant. The larger the prostate volume, the longer the indwelling time of drainage tube. However, there was no significant difference in drainage volume between the three groups. Postoperative pathological Gleason score was divided into: less than 6 points, 7 points and greater than 7 points[10]. By Chi-square test, P=0.008, indicating there was statistical difference (Figure 2). It could be observed that patients with prostate volume greater than 50 ml had lower score compared with the other two groups. For postoperative pathological stage, there was no statistical significant difference between the 3 groups (Figure 3). There was no statistical difference of the other postoperative factors and follow-up factors (Table 1).

Table 1. Results of clinical data of prostate cancer patients with different prostate volume who underwent RARP surgery

Factor	**Volume**			***P* value**
Group	< 30	30-50	> 50	
Age	66.3(7.6)	68.9(6.3)	68.2(5.8)	0.299
BMI	25.3(3.5)	25.4(2.5)	25.3(2.4)	0.998
Preoperative PSA	13.3(18.5)	19.0(25.9)	11.9(17.0)	0.492
Operation time	243.4(70.3)	269.2(68.3)	270.8(97.2)	0.299
Intraoperative blood loss	152.9(142.3)	148.9(143.7)	161.5(168.5)	0.129
Drainage volume	189.9(195.7)	213.9(217.9)	384.5(974.7)	0.246
Indwelling time of catheter	18.9(4.3)	18.0(4.9)	16.7(3.7)	0.924
Indwelling time of drainage tube (day)	6.4(4.5)	6.3(2.9)	7.1(2.5)	0.042
Postoperative hospitalization	6.4(2.3)	6.7(2.4)	8.2(3.5)	0.112
Total hospitalization time	11.1(3.6)	11.0(3.1)	12.8(4.6)	0.277
Margin condition%				0.947
Positive	25.7	22.2	23.1	
Negative	74.3	77.8	76.9	
Postoperative endocrine therapy%				0.965
Yes	52.9	50.0	46.2	
No	47.1	50.0	53.8	
Postoperative pathological stage%				0.555
T2	38.2	32.0	41.7	
T3	50.0	64.0	58.3	
T4	11.8	4.0	0	
Chemical recurrence%				0.868
Yes	29.0	33.3	25	
No	71.0	66.7	75	
Postoperative 3-month continence condition %				0.528
Able	82.8	83.3	66.7	
Unable	17.2	16.7	33.3	
Postoperative Gleason score%				0.008
6	2.9	8.0	41.7	
7	47.1	44.0	33.3	
> 7	50.0	48.0	25	

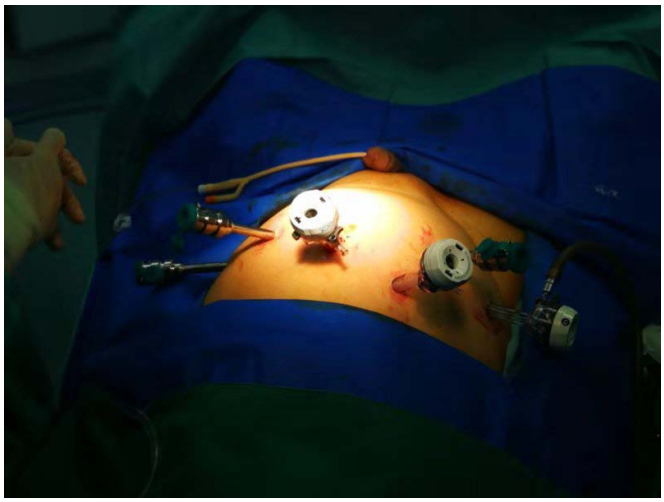

Figure 1. RARP surgical port location diagram

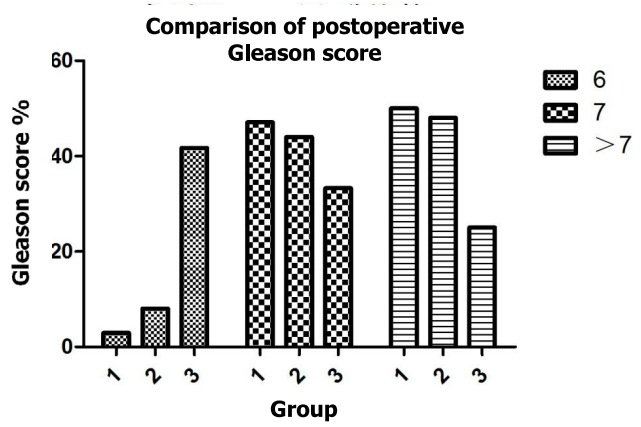

Figure 2. Percentage of Gleason score in each group of postoperative pathological specimen

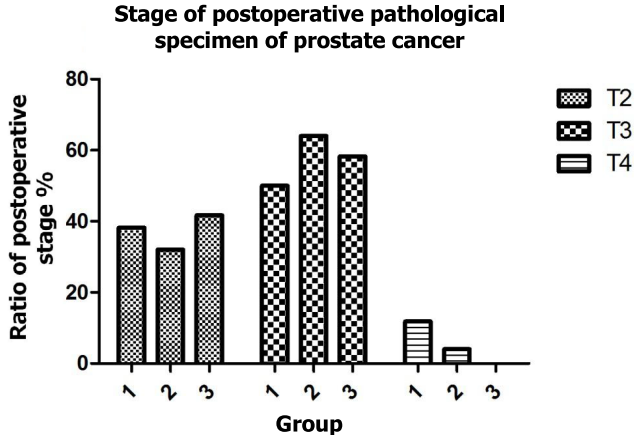

Figure 3. Distribution of postoperative pathological stage of prostate cancer

4 Discussions

In China, incidence of prostate cancer is increasing year by year. Radical prostatectomy remains as an important approach to treat prostate cancer. With the constant development of Da Vinci technology, and since Binder and Kramer used the Da Vinci system to perform a case of RALRP operation in Frankfurt in 2005, the number RALRP cases has been constantly increasing. At present, it has become an important radical treatment approach of prostate cancer[11, 12].

Related studies have shown that robot-assisted prostatectomy has obvious advantages in the aspects of intraoperative bleeding, postoperative blood transfusion, postoperative pain and rate of postoperative positive surgical margin, when compared with conventional laparoscopic prostatectomy. Robotic assisted system provides surgeon with a clearer and more stable view. In addition, robotic arms are more flexible, which can shorten operation time, reduce intraoperative blood loss and reduce rate of intraoperative blood transfusion. It also allows more accurate matching between bladder neck and urethra, more precise NVB preservation, and gives rise to more optimum postoperative urinary continence and sexual function retention[13].

Change in prostate volume had a significant effect on RARP, it also had effect on postoperative recovery of RARP. Through analysis of preoperative factors, it was found out that there were no significant differences in age, BNI and preoperative PSA between groups with different prostate volume. However, relevant studies shown that age and preoperative PSA are higher in patient group with larger prostate volume than that of group with smaller volume[5, 6, 8]. This was in contrary to our results. It could possibly due to that some of the patients undergone neoadjuvant endocrine therapy after had been diagnosed with PCa. Preoperative adjuvant endocrine therapy could effectively reduce patient's PSA level and effectively reduce the volume of prostate[14]. Our study did not exclude these patients, which posed an effect on the distribution of age and preoperative PSA and caused our results to differ from other studies.

According to the analysis of intraoperative factors, there was no statistical difference in operation time and intraoperative blood loss between the three groups of patients with different prostate volume. However, results of other studies shown that required operation time and estimated blood loss were greater for patients with large prostate volume than those with small volume[4-6]. Through analysis of the data, we found that there RARP surgery has a learning curve, this learning process is about 20 cases[13, 15]. This study had included a total of 75 RARP surgeries performed by 3 surgeons. In this study, the first 20 RARP surgeries by each surgeon were not analyzed according to the learning curve, which resulted in difference of operation time

and intraoperative blood loss between this study and related researches in other countries. Therefore, we believed that volume of prostate has an impact on RARP surgery time and intraoperative blood loss.

In this study, postoperative factors were analyzed and it can be concluded that the Gleason score was lower and postoperative drainage tube indwelling time was longer in patients with larger prostate. This was in agreement with results of other related studies[4-6]. The larger the prostate size, the larger the surgical wound. Time of postoperative deep wound was correspondingly prolonged, which led to extension of indwelling time of drainage tube. However, we did not observe difference in postoperative drainage volume. In this study, there was no significant difference in postoperative pathological staging, rate of positive surgical margin, biochemical recurrence, and length of hospital stay. Other related studies had shown the similar findings. At the present, there is no clear evidence indicating that prostate volume affects these[6, 8, 9].

Due to conditional limitation, we carried out follow-up for postoperative urinary continence at 3 months. Our study considered those patients who used less than or equal to 1 diaper pad every 24 hours as recovery of urinary continence, otherwise urinary inconsistence. Results of this study showed no statistical difference between the three groups. However, Ted A. Skolarus et al.[6] carried out follow-up on 885 patients and analyzed their postoperative urinary continence at 3 months, 6 months and 12 months. Their results showed that time to recovery of postoperative urinary continence was longer in patients with larger prostate volume. Due to insufficiency of samples and follow-up time, the results of postoperative urinary continence in this study differed from those studies in other country.

5 Conclusions

Volume of prostate had no significant effect on urinary continence, rate of positive surgical margin and postoperative recurrence after RARP treatment. However, in patients with larger prostate, post-RARP Gleason score of pathological tissue was lower and postoperative indwelling time of drainage tube was longer. Further studies are required to study operation time and intraoperative blood loss in RARP patients with larger prostate volume. However, RARP has certain advantages for patients with larger prostate volume when compared with conventional laparoscopic surgery.

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