ORIGINAL RESEARCH

Propensity-matched Analysis Comparing the Peri- and Post-operative Outcomes of Side-docking Versus Standard Lithotomy Docking for Robot-assisted Radical Prostatectomy

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Introduction: Limited access to the perineum and limited operating room space are just some of the limitations of the standard lithotomy docking for robot-assisted radical prostatectomy (RARP-LD). The side-docking technique (RARP-SD) may address these problems.
Methods: Thirty cases of robot-assisted radical prostatectomy were matched to 120 cases of RARP-LD cases by propensity scoring using age, body mass index (BMI), clinical T stage, biopsy Gleason score, and ultrasound prostate volume. Operative and docking time, complications were used to compare peri-operative and safety outcomes.
Results: Evaluation of 30 RARP-LD and 30 RARP-SD cases was done after propensity matching. Patient age, BMI, clinical T stage, biopsy Gleason score, and prostate volume were similar between the two groups ($p>0.050$). The mean docking time of RARP-SD is shorter than that of RARP-LD cases (7.56 vs. 4.12, $p<0.001$), but this did not translate to a shorter operative time. There were less peri-operative complications in the RARP-SD cases.
Conclusions: RARP-SD has a docking time and produces less complication than RARP-LD.

Key words: Robotic radical prostatectomy, prostate cancer, Side-docking

Introduction

Robot-assisted radical prostatectomy (RARP) may arguably be considered as the gold standard for surgical treatment of prostate cancer. Though it has been available for more than a decade, the technique of RARP has not ceased to evolve.[1] The robotic platform has enable urologists to develop new techniques of performing the surgery as well as how they use the robot.[2-5] While it is one of the less deliberated aspects of RARP, robot docking may play a major role in determining operative outcomes.

Historically, even while performing the open technique, the patient undergoing radical prostatectomy has been positioned in a Trendelenburg position with his legs lithotomy. However, the standard lithotomy docking for robot-assisted radical prostatectomy (RARP-LD) carries with it limitations that include restricted access to the perineum, a more challenging task of docking the robot, and its requirement for a larger operating room space.[6,7] The side-docking technique (RARP-SD) may address these problems.

Among the little that has been written about RARP-SD, most of the available literature has focused on describing docking time and neurologic complications related to positioning. To the best of our knowledge, no study has compared standard- and side-docking in terms of overall complications described using a standardized manner. In our institution, the rising concern for lithotomy-related complications after RARP provoked the exploration of using side-docking for RARP cases. If proven to be associated with a decreased risk of position-related complications, side docking may prove to be a reasonable alternative to the standard lithotomy approach. In this article, the authors describe their initial experience with RARP-SD.

Methods

This was a retrospective analysis of prospectively-collected data of 125 cases done in a single tertiary institution from 2010 to 2017. After excluding the patients who had previous transurethral prostate or urethral surgery (4 patients) and one patient who underwent a Retzius-sparing approach to prostatectomy, a total of 150 patients were included in this study. RARP-SD was done in 30 cases while RARP-LD was done in 120 cases.

The authors compared the peri-operative and safety outcomes of RARP-LD and RARP-SD. Safety was measured by complication rates and blood loss. Peri-operative outcomes were measured by operative time, console time and docking time.

Standard docking was performed with the patient's legs abducted, partially flexed on stirrups and parking the robot placed in between the legs. During side docking, the legs were maintained straight slightly abducted and the robot was docked in the patient's right side, at a 45- degree angle to the patient's main axis. The patient was maintained in a Trendelenburg position in both docking techniques.

Docking time was measured from the time that the robot was rolled towards the patient from a parked position until all robotic arms were attached to the robotic trochars.

C-RARP was performed as previously described.[6] Posterior sphincter reconstruction was performed as described by Rocco.[7]

For the purpose of analysis, 1:1 propensity score matching was done between 30 RARP-SD cases and all RARP-LD cases using age, body mass index (BMI), pre-operative PSA, biopsy Gleason score (GS), and clinical T stage. Student's *t*- test and Pearson's x^2 test were used for analysis of quantitative and qualitative variables, respectively.

All statistical analyses were performed using the SPSS version 20 software (IBM Corp., NY, USA). A p value <0.050 was considered statistically significant for all two-sided tests. This study was approved by our Institutional Review Board.

Results

The pre-operative clinico-pathological characteristics of the two groups are presented in Table 1. No significant differences in terms of the variables used in the propensity score matching (patient age, BMI, pre-operative PSA, biopsy GS, and TRUS prostate volume) existed between the two groups.

Table 2 shows the peri-operative outcomes. Docking time was significantly shorter in the side docking group. Total operative time, console time, and blood loss were not significantly different for both groups. There were significantly more complications associated with RARP-LD. For the RARP-LD group, there were five Clavien-Dindo class II complications (1 case of deep venous

Table 1. Pre-operative characteristics.

	Standard docking N=30	Side docking N=30	p-value
Age (years) ± SD	62.93 ± 8.31	61.82 ± 8.56	0.826
BMI (kg/m2) ± SD			
Pre-operative PSA (ng/dl) ± SD	19.79 + 13.92	19.03 + 16.89	0.354
Biopsy Gleason score (%)			0.061
6	14 (46.7)	7 (23.3)	
7	9 (30.0)	17 (56.7)	
≥8	7 (23.3)	6 (20.0)	
Clinical stage (%)			0.767
T1	0	0	
T2	28 (93.3)	29 (96.7)	
T3	2 (6.7)	1 (3.3)	
Prostate volume (g) ± SD	44.86 + 28.85	43.68 + 16.29	0.443

SD= standard deviation, BMI = body mass index, PSA = prostate-specific antigen, * = significant p-value

Table 2. Peri-operative characteristics.

	Standard docking N=30	**Side docking N=30**	**p-value**
Total operative time (min) ± SD	369.33 + 88.04	354.06 + 74.26	0.905
Console time (min) ± SD	327.00 + 121.86	310.43 + 87.06	0.483
Docking time (min) ± SD	7.56 + 3.07	4.12 + 1.36	<0.001*
Estimated blood loss (ml) ± SD	672.33 + 482.99	677.78 + 532.75	0.948
Pathologic Gleason score (%)			0.109
6	14 (46.7)	10 (33.3)	
7	14 (46.7)	17 (56.7)	
≥8	2 (6.6)	3 (10.0)	
Pathologic stage (%)			0.767
T1	0	0	
T2	28 (93.3)	29 (96.7)	
T3	2 (6.7)	1 (3.3)	
Complications (%)			
All types	9 (23.3)	1 (3.3)	0.024*
Complications related to positioning	6 (20.0)	0	0.010*
Clavien-Dindo (%)			0.009*
I	3	1	
II	2	0	
III	3	0	
IV	1	0	
Hospital stay (days) ± SD	6.10 ± 2.78	4.82 ± 1.42	0.111

SD= standard deviation, * = significant p-value

thrombosis, 4 cases of neuropraxia). There was only one case of Rhabdomyolysis (class IV complication) with an incidence of 3.3% in the RARP-LD group and 1.7% overall. This rhabdomyolysis patient developed renal failure, underwent dialysis and was discharged 16 days after surgery. Complications not related to patient positioning included one case of post-operative bleeding necessitating cystoscopy with clot evacuation, one case of anastomotic leak, and one case pelvic abscess that required a pigtail insertion for drainage. The sole complication in the RARP-SD group was a case of post-op bleeding that necessitated blood transfusion.

Discussion

In this study, the authors compared the peri-operative, and safety outcomes between RARP-LD and RARP-SD. Several advantages of RARP-SD were observed in their study.

In their study, docking time was significantly shorter in the SD-RARP group. This finding is similar to the findings of previous studies.[8,9] This difference, however, did not translate to a significant difference in total operative time. Failure to observe differences in total operative time is due to the fact that docking time comprises a very small portion of the total operative time. In addition, total operative time is clearly dependent on several other factors such as difficulty of the surgery and surgeon experience. While significant differences in docking time may not have much effect on the total operative time, it is not without importance. Docking the robot can be one of the most complicated steps during RARP. In their study examining the association between intra-operative flow disruption and teamwork, Weigl, et al showed that the highest disruption in the flow of the operation occurred during the docking phase.[10] Shorter time of docking in RARP-SD can be taken as evidence supporting that it is easier for the surgeon to coordinate with his assistant when performing this technique. For those new to the robotic platform, this has a potential to hasten the learning curve of robot docking.

The overall complication rate in the present study is akin to those reported in available literature. Overall complication rate of RARP has been reported to be around 10%.[11,12] In their systematic review of 110 papers evaluating RARP outcomes, Novara, et al. noted that the most common complications were lymphocoele formation, urine leakage and reoperation. In contrast, complications in the present study population consisted mainly of lower extremity peripheral neuropathy which is a Clavien-Dindo class I type of complication.

The most important result of the present study is the significantly lower complication rate of RARP-SD. Though still scarce, there have been studies that have shown less incidence of complications in RRAP-SD compared to RARP-LD.

Rhabdomyolysis is one of the most dreaded complications of prolonged Trendelenburg position. Patients who develop rhabdomyolysis are at increased risk of kidney injury and mortality, have prolonged hospital stays and spend more on treatment. In general, this complication has been found to occur rarely after RARP.[13,14] In their study of 60 patients who underwent RARP with extended pelvic node dissection, Mattei, et al reported an association between the Trendelenburg position and the occurrence of rhabdomyolysis.[15] Interestingly, the incidence of rhabdomyolysis that they reported (16.7%) is higher than what is here reported (1.3% overall) and those of other studies. One possible explanation their definition of rhabdomyolysis in terms of elevated post-operative creatinine values may have resulted in over-detection of the disease. Other than prolonged lithotomy position, other factors that have been linked to rhabdomyolysis are co-morbidities and BMI.[2]

Corneliu, et al. reported the incidence of peripheral neuropathies after RARP to be between 1.3 and 10.8%. They further illustrated that neuropathies were more commonly observed in the Lower. Comparable to the data in the present study, the incidence of peripheral neuropathy was noted to be at 6.7%.

Other reported advantages of docking the robot on the side of the patient include a better access to the perineum.[17] This is especially important in case a rectal injury does occur. Since the robot in on the patient's side, there is easier access to the perineum without needing to break sterility. In a more practical sense, side-docking saves a lot of space and is therefore more suitable for small operating theaters.[1]

In this study, SD-RARP was shown to have shorter docking time and less complications. While it is still too early to recommend that robotic prostatectomies be done using the side docking technique, it may prove useful to surgeons who wish to improve their peri-operative complication outcomes. It also has the potential to shorten the robotic team's learning curve for docking the robot.

This study is not without its limitations. First, this study still suffers from a modest sample size. Additional, better-powered studies are needed to support present findings. Secondly, results were based on consecutive cases performed by a multiple-surgeon cohort. Inter-observer bias as well surgeon's position in his learning curve may have affected the results. Randomized controlled trials comparing RARP-LD and RARP-SD should produce a more accurate analysis. However, the impetus in this institution to shift to the side-docking technique was on the authors' observation of an increasing number of complications that they attributed to patient positioning. Given the satisfactory results of RARP-SD so far, it would not be in their patient's best interest to revert back to the standard lithotomy approach just for the sake of randomization. Additional studies with greater analytical power that include functional outcomes and analysis of treatment cost for complications are still needed.

Conclusion

The advantages of RARP-SD, compared to RARP-LD include a faster docking time and less overall and position-related complications.

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