ORIGINAL RESEARCH

Perioperative and Oncologic Outcomes of Anterior versus Posterior Approach Robot-assisted Laparoscopic Radical Prostatectomy

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Introduction: Robot-assisted laparoscopic radical prostatectomy is now considered the gold standard treatment of prostate adenocarcinoma in the modern world. There are two approaches to the precise dissection of seminal vesicles (anterior and posterior) during a laparoscopic radical prostatectomy, each of which with unique advantages and disadvantages. Primarily, the authors compared the intraoperative and oncological outcomes of these two approaches. Secondary objective included the establishment of the minimum number of cases before a surgeon can enter the competent phase of the learning curve.

Materials and Methods: Chart review was performed on 111 patients who underwent RALP from 2014-2016 performed by 3 experienced robotic surgeons with interchangeability of role as console operator. Two arms were developed based on the approach of seminal vesicle dissection, that is, anterior and posterior approach. Cumulative summation of the console time was performed to obtain a chart with a) negative slope-learning phase and b) positive slope-competent phase. Patients under the competent phases were included for analysis.

Results: There were no significant differences in age, body mass index, prostate volume, preoperative prostate specific antigen (PSA), gleason score and oncologic risk. Pathology was almost similar in majority of cases under the anterior approach arm being gleason 7 (3+4) and posterior approach arm being gleason 6 (3+3). With a p-value of <0.05, console time was significantly shorter in the posterior approach at 121 ± 25.95 when compared to anterior approach at 148 ± 30.25 minutes. The other perioperative and postoperative outcomes were not significantly different between the groups.

Conclusion: Posterior approach has provided a shorter console time, while the overall oncologic and perioperative outcomes for both approaches were similar. The learning curve for the anterior approach is less steep than that of the posterior approach with only 14 versus 26 consecutive cases, respectively, to be able to competently perform RALP.

Key words: Robot-assisted laparoscopic radical prostatectomy (RALP)

Introduction

The approval by the Food and Drug Administration (FDA) for the use of Da Vinci Surgical System has revolutionized the treatment for prostate cancer. It has offered several advantages over traditional laparoscopic and open surgical techniques. Included surgeon advantages are improved ergonomics, surgical dexterity and precision, a three-dimensional view, and seven-degree of freedom which facilitates better movement of the surgical arm intracorporeally.

In addition, the assistance of robot systems has provided an avenue for reduced patient morbidity and improved patient outcomes.[1] As such, a rapid shift along the spectrum of treatment for prostate cancer towards minimally-invasive surgery has been observed. Furthermore, the application of robotics system in the treatment of prostate cancer has two acceptable approaches, based on the manner of dissection of the seminal vesicles. One is the anterior as described by Menon[2] versus the posterior as observed from the Montsouris technique.[3] These approaches provided advantages unique to the technique used. In this study, the authors introduced the use of cumulative summation as a means to avert the bias brought about by the learning curve for RALP.

Initially used as a statistical tool in the industrial sector quality improvement, cumulative summation (CUSUM) analysis has been used since the 1970s for the analysis of surgical procedure learning curve. This methodology has enabled researchers to visualize the trend and level of proficiency for certain surgical procedures.[4-5] While analysis of learning curves related to robotic surgery for prostatectomy is well-documented in several first world countries[6], no such study exists in third world countries where the use of robotics surgery is relatively new. The application of Da Vinci Surgical System was introduced in the Philippines in 2010. To the researchers' knowledge, only a single study has been published in literature comparing the anterior and posterior approaches used in RALP. Furthermore, there has been no published local study comparing the approaches used in RALP. The authors aim to compare the outcomes of each approach while minimizing the bias of learning curve by collating data after the performing cumulative summation.

Materials and Methods

This is a retrospective study that included all patients diagnosed with prostate adenocarcinoma who underwent Robot-assisted laparoscopic radical prostatectomy from 2014-2016 in a single tertiary institution performed by three urologists proficient and experienced in advanced laparoscopic urologic procedures. All three urologists have interchangeability of roles as primary surgeon and first assist, with two urologists performing the procedure one pair at a time. Review of medical records was done to assess patients' eligibility to be included for analysis. Inclusion criteria were men with newly diagnosed prostate cancer without prior treatment. Patients with previous prostate cancer treatment, neoadjuvant or adjuvant hormonal treatment were excluded from the study.

CUSUM analysis was used to quantitatively assess the learning curve of console time (CUSUMCT). This technique has provided graphical information of the trend in the outcome of consecutive procedures performed over time. Therefore, CUSUMCT is calculated as: CT for the first case minus the mean CT of all cases. The CUSUMCT for the second case would be the previous case's CUSUMCT added to the difference between the CT for the second case and the mean CT for all the cases. A recursive curve was achieved as the process was continued and all the cases were plotted. The curve was divided into two phases a) learning phase and b) competency phase. Only cases under the second phase were included for analysis so as to avert the bias brought about by the learning phase.

Data pertaining to patient characteristics (age, PSA level, Gleason score, and pathologic stage) and perioperative parameters including console time (CT), estimated blood loss and perioperative complications were retrospectively reviewed. CT is defined as the time the surgeon spent at the robotic console in performing the main procedural steps of radical prostatectomy. Complications were categorized as intraoperative and postoperative (early/ late) events. Oncologic outcomes were also analyzed.

Surgical Technique

All surgeries were performed by 3 urologists alternating as primary surgeon/ console operator and first assist per patient and worked one pair at a time. The procedures were performed using da Vinci Robotic Surgical System. Patient was placed in extreme Trendelenburg position under general anesthesia. The commencement of the operative time was marked by the placement of two 12mm laparoscopic ports, three 8mm robotic ports, and 1 5mm suction port in W configuration at the infraumbilical area. Robot was then docked in position. The primary surgeon moved to the console from which the console time commenced. Further dissection was done to expose the bladder and the prostate. Endopelvic fascia was transected up to the puboprostatic ligament and dorsal vein was ligated. The bladder was opened and bladder neck was transected. Posterior bladder wall was opened to expose the seminal vesicles and vas deferens, then eventually ligated. Lateral prostatic pedicles were controlled using Hemolok clips. The lateral neurovascular bundles were usually preserved during the procedure. Dorsal vein and urethra were transected and the prostate secured using Endocatch bag. Urethrovesical anastomosis was done over an 18Fr foley catheter using absorbable continuous sutures. Undocking of the robot marked the end of the console time. On the other hand, trocar removal under direct visualization, delivery of the specimen within the endocatch bag, and finally closure of the incisions marked the end of the operative time.

Statistical Analysis

Statistical analysis was performed with SPSS. Student's t-test and Mann- Whitney U-test was used for parametric and non-parametric variables, respectively. Differences between proportions were compared using Fisher's test or x^2 test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of 111 patients underwent robotics-assisted laparoscopic radical prostatectomy from January 2014 to December 2016. Fifty-four consecutive patients were included under the anterior approach arm, whereas the remaining 57 consecutive patients were under the posterior approach arm. Chart review was done to obtain the baseline demography, preoperative and perioperative outcomes of each patient included in the study. Cumulative summation was performed by plotting the cumulative sequential differences between each console time (CT) data point to derive the point at which the learning curve is divided into two distinct phases: a) negative slope learning phase and b) positive slope competent phase. Figure 1a demonstrates the learning curve for RALP anterior approach

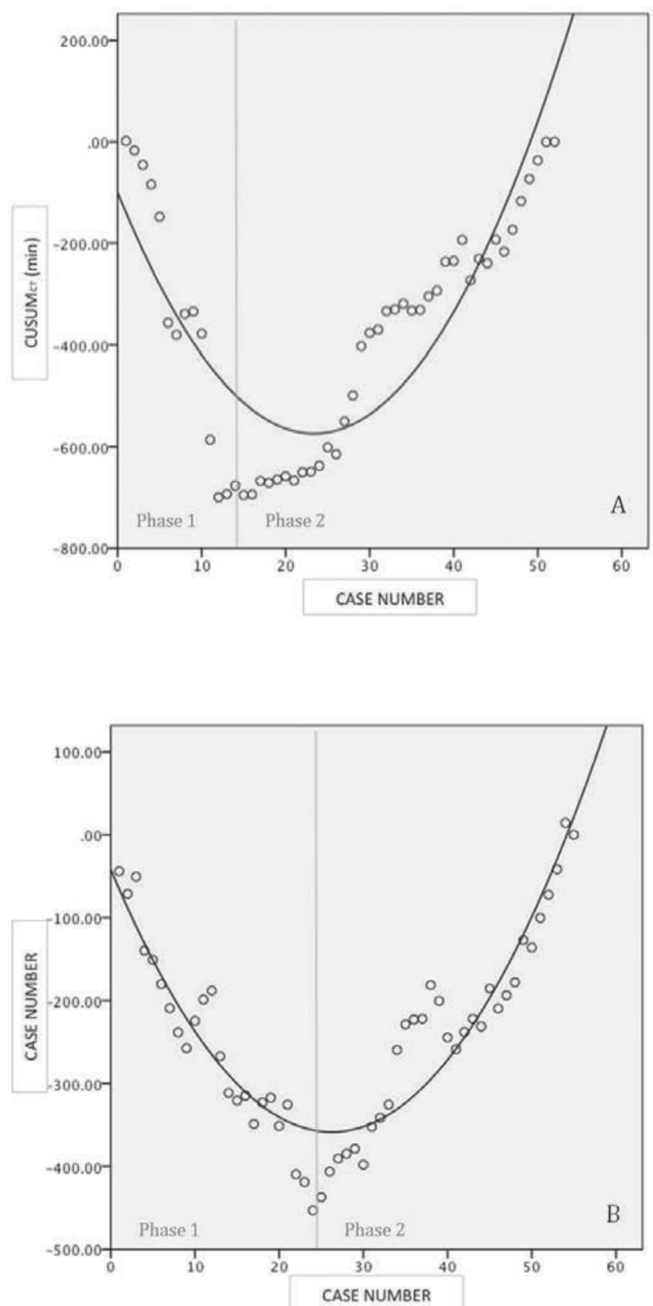

Figure 1. Two phases as divided by performing cumulative summation of console time (CT) for A) anterior and B) posterior approach

Table 1. Baseline characteristics

Variable	Approach		p-value
	Anterior (n=40)	Posterior (n=31)	
Age (years)	66 ± 7.22	63 ± 6.81	0.139
Prostate volume (grams)	42.94 ± 15.78	43.25 ± 18.90	0.939
Prostate Specific Antigen level (ng/dL)	9.62 ± 2.91	12.39 ± 10.64	0.119
Body Mass Index			
Normal	13 (32.5%)	12 (38.7%)	
Overweight	21 (52.5%)	16 (51.6%)	0.747
Obese	6 (15%)	3 (9.7%)	
Preoperative Gleason Score			
3+3	10 (25%)	13 (41.9%)	
3+4	13 (32.5%)	4 (12.9%)	
4+3	9 (22.5%)	5 (16.1%)	0.317
4+4	3 (7.5%)	5 (16.1%)	
4+5	4 (10%)	3 (9.7%)	
5+5	1 (2.5%)	1 (3.2%)	
Oncologic Risk			
Clinically localized	39	30	0.686
Locally advanced	1	1	

Table 2. Perioperative and oncologic outcomes.

Variable	Approach		p-value
	Anterior (n=40)	Posterior (n=31)	
Console time (min)	148.93 ± 30.25	121.23 ± 25.95	<0.05
Estimated blood loss (mL)	268.75 ± 134.79	214. 84 ± 99.13	0.066
Postoperative Gleason Score			
3+3	7 (17.5%)	8 (25.8%)	
3+4	25 (62.5%)	15 (48.4%)	
4+3	5 (12.5%)	6 (19.4%)	0.467
4+4	0	0	
4+5	3 (7.5%)	1 (3.2%)	
5+5	0	1 (3.2%)	
Pathologic Tumor Stage			
2b	2 (5%)	2 (6.5%)	
2c	25 (62.5%)	15 (48.4%)	
3a	8 (20%)	8 (25.8%)	0.688
3b	5 (12.5%)	6 (19.4%)	
Positive Surgical Margin (PSM)	16 (40%)	14 (45.16%)	0.662
Complications	1 (2.5%)	3 (7.5%)	0.203
Postoperative Stay (days)	3.40 ± 0.55	3.39 ± 0.62	0.926

with the CUSUM value of 14 dividing the learning curve into 2 distinct phases: learning phase, represented by the initial 14 cases and competent phase, represented by the next 40 cases. On the other hand, figure 1b demonstrates the posterior approach CUSUM value of 26, with the next 31 cases representing the competent phase. To minimize the bias of inexperience in the analysis of results, only patients under the competent phases of each approach were included for analysis, that is 40 and 31 patients in the anterior and posterior approach, respectively.

There were no significant differences in age, body mass index, prostate volume, preoperative prostate specific antigen (PSA), gleason score and oncologic risk among the two groups with the majority of patients in both groups classified under intermediate risk. Pathology was almost similar with majority of cases under the anterior approach arm having gleason 7 (3+4) and posterior approach arm having gleason 6 (3+3).

A significant difference was observed in the console time between the two approaches. With a p-value of <0.05, console time was significantly shorter in the posterior approach at 121 ± 25.95 when compared to anterior approach at 148 ± 30.25 minutes. The other perioperative outcome such as estimated blood loss (EBL) and postoperative outcomes such as gleason score, pathologic tumor stage and positive surgical margin rate, and post-operative hospital stay were not significantly different between the groups. Consistent with the preoperative gleason score, majority of the patients were gleason 7 (3+4) under the anterior approach and gleason 6 (3+3) under the posterior approach, postoperatively. It is however evident that none of the eight preoperatively diagnosed gleason 8 (4+4) remained under this category postoperatively. All 8 patients were downgraded to either gleason 4+3 or gleason 3+4. Similarly, the preoperatively diagnosed gleason 9 under the anterior approach were reclassified under gleason 4+3, postoperatively. Pathologic tumor stage 2c was observed in majority of patients in both groups. Fever complications were observed in 1 patient and 3 patients under anterior and posterior approach, respectively.

Discussion

RALP has been an acceptable therapeutic option for the management of prostate cancer since the introduction of robotics system. However, its use has been limited by a variable learning curve as observed in several studies with 8-150 consecutive cases to overcome the initial learning period.[7-8] The variability as described by Sammon[9] is due to the use of non-standardized definition of outcome measures. For this study, the authors used the console time defined as the time by which the primary surgeon performs all the procedural steps for radical prostatectomy, which ends after Jackson-Pratt drain placement.

The authors compared their initial experience in the approach in the seminal vesicle dissection among 3 surgeons alternating as primary surgeon, with two urologists performing the procedure one pair at a time. Although the surgeons were not robotic-naïve such that the procedure is no longer new to them, they eliminated the bias of learning curve by performing cumulative summation of the console time of each consecutive patient to create a graph with 2 distinct phases. They found no significant difference in the baseline characteristics of the all included patients undergoing RALP whether approached anteriorly or posteriorly. Furthermore, no significant difference was observed in the perioperative complications of both approaches with fever as the only complication noted.

They performed cumulative summation of the console time in order generate a graph that delineates learning and competent phase of anterior versus posterior approach, respectively (Figures 1a & 1b). These approaches differ by the manner of dissection of the seminal vesicles in order to create a window for the dissection of the prostate[10] and are supported by two different proponents. It is believed that posterior approach provides a wider space for dissection, which is not developed when approached anteriorly.[11] This advantage was observed in this study such that a significant difference was noted when the console time was compared between the posterior and anterior approach, respectively (121.23 ± 25.95 vs 148.93 ± 30.25, $p<0.05$). A shorter console time for the posterior approach may be attributed to a better dissection window developed in this technique. On the other hand, anterior approach has the advantage of better preservation of the neurovascular bundle, which is of utmost importance among patients with preoperative erection.[11] This advantage however was not elicited in this study as it is considered a limitation due to the lack of a preoperative and postoperative potency scoring.

Maddox, et al.[12] performed a similar study in 2013, comparing these approaches in RALP. In their study, subgroup analysis showed that posterior approach is beneficial for larger prostate gland. This finding however has not been elicited in the present study.

The authors agree in their recommendation in performing a single-surgeon prospective study to eliminate bias and better investigation of the advantages and disadvantages of these approaches.

Conclusion

Posterior approach RALP has provided a shorter console time, while the overall oncologic and perioperative outcomes for both approaches used in RALP were similar. The learning curve for the anterior approach is less steep than that of the posterior approach with only 14 versus 26 consecutive cases, respectively, to be able to competently perform the steps in RALP.

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