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Laparoscopic Versus Robot-Assisted Radical Prostatectomy: Comparison of Outcomes of A Single Surgeon

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1. Abstract

1.1. Objective: To compare the functional and oncological results of laparoscopic radical prostatectomy (LRP) and RALP performed by a single surgeon.

1.2. Methods: This retrospective cohort study included patients who underwent LRP and RALP performed by a single surgeon between June 2017 and April 2020 and were followed-up for 12 months. The Da Vinci ® robotic system was used for all surgeries. The potency, continence, surgical margins, postoperative prostate specific antigen (PSA) level, and surgical complications were compared.

1.3. Results: The cohort included 156 patients: 103 and 53 patients underwent RALP and LRP, respectively. We found that RALP were superior to LRP with respect to potency in all periods analyzed. At 3 months, 60% of the patients in the RALP group were potent, and this proportion rose to 87.1% at the end of one year, versus 36.6% and 66.7% at the corresponding periods in the LRP group. No statistical differences were observed in the surgical margins, post-operative PSA, or continence.

1.4. Conclusion: The comparison of the RALP and LRP performed by the same surgeon revealed the superiority of the former over the latter, with respect to the postoperative sexual potency. There was no difference in the continence rates, surgical margin, or persistence of disease.

2. Introduction

Prostate cancer is the most lethal neoplasm occurring in men and is responsible for 7.7 deaths per 100,000 individuals worldwide [1]. A multidisciplinary approach is required while treating patients with prostate cancer; however, radical prostatectomy remains the principal therapeutic strategy for localized disease.2Although excellent oncological results are achieved with open prostatectomy, efforts has been made to reduce the adverse effects associated with it, by optimizing the functional results of continence and potency. Laparoscopic radical prostatectomy (LRP) has emerged as an alternative modality; however, there is a lack of evidence of the functional benefits of LRP compared to the open technique, in addition to disadvantages such as the high degree of technical difficulty, long learning curve, and ergonomic hazards to the surgeon associated with LRP.3,4The first robotic platform was reported in 2001, followed by the first robot-assisted video laparoscopic radical prostatectomy (RALP).5The improvement in surgeon´s comfort, precision of movements, tremor filter, and excellent video quality for the surgical team have popularized the use of this technology in the USA, where most radical prostatectomies are performed using the robot-assisted technique. In 2011 [2]. Proposed a new concept for reporting RALP outcomes, which included the oncological results (surgical margin and biochemical recurrence), functional results (potency and incontinence), and rate of surgical complications. 6Several studies that attempted to prove the

benefits of RALP reported advantages with respect to blood loss, length of hospitalization, pain, and early continence. 7–9However, no study has established this modality as the gold standard, and the decision to perform RALP remains preferential, depending on the surgeon and patient.2There were several biases in previous studies owing to the differences in technique and surgical dexterity that extend beyond the learning curve process, and evidence suggests that the results depend more on the surgical technique than the access route.10Thus, the objective of our study was to compare the functional and oncological results of laparoscopic radical and robot-assisted prostatectomy performed by a single surgeon [3, 4].

3. Methods

This retrospective cohort study of patients who underwent LRP and RALP, which were performed by a single surgeon, between June 2017 and April 2020, was duly authorized by the relevant research ethics committee.

The eligibility criteria for the study were patients whose procedure was performed by the same surgeon after being diagnosed with prostate cancer, and had not undergone any previous curative treatment. Patients whose medical records were inaccessible or unavailable, those without proper registration, and those lost to outpatient follow-up were excluded [5, 6].

Follow-up was performed by the same surgeon during the 12-month postoperative period. The sample size was obtained for convenience, using the entire available database.

The medical records were reviewed retrospectively and data on the characteristics of the patient, disease, surgical procedure, and postoperative follow-up were collected. Two medical students (under the supervision of two urology residents) and the responsible surgeon collected the data between August 2020 and November 2020. The requisite data of interest that were absent from the medical records were supplemented by telephone contact with patients initiated by the assistant surgeon.

All patients were staged using the total prostate specific antigen (PSA), digital rectal examination, and computed tomography or abdominal-pelvic magnetic resonance imaging. Eleven patients who were designated as high-risk, according to the European guidelines, were additionally staged with computed tomography of the chest and bone scintigraphy.2

All procedures were performed via laparoscopy before 2017, while the robotic technique started to be offered to patients and became the surgeon's technique of choice as of June 2017 [7- 15]. The choice between the two techniques was made by the patient based on personal preferences and financial feasibility since robotic technology is not covered by health care plans in Brazil. The Da Vinci ® robotic system was used in all surgeries; 90% of cases were operated using the Si version, while the Xi version was used in 10% of cases. The standard surgical procedure in both techniques involved the preservation of the endopelvic fascia without ligating the prostatic dorsal venous plexus. Retroperitoneal access was the route of choice until 2019, which was replaced by the transperitoneal route thereafter (as preferred by the surgeon). Control of the vascular pedicles was performed using ligatures with polymer clips and anterograde preservation of the neurovascular bundle was achieved bilaterally, whenever feasible, during the intraoperative period. Reconstruction of the posterior and anterior walls was not performed routinely, but only in a few patients with hemostasis. The urethrovesical anastomosis was achieved with continuous 3-0 barbed sutures using the classic Van Vetholven technique. The hermeticity of the anastomosis was always verified with bladder hydrodistension with 120 mL of saline solution. A drain was placed only in case of overflow. Bilateral external iliac and obturator lymphadenectomy was performed routinely, while extended lymphadenectomy was performed only in patients with high-risk disease. The bladder catheter was preferably removed on the 7th postoperative day, without performing urethrocystography. The body mass index was calculated by the nutrition team at hospital admission. Information about any comorbidities was obtained from the pre-anesthetic evaluation records [15-20]. The last available biopsy Gleason score and PSA levels before surgery were considered to be the preoperative values. The duration of the procedure was calculated by subtracting the start time from the end time of the procedure according to perioperative nursing records. Patients were considered to be "potent" if they reported penetration without the use of injectable or oral medication. They were considered "impotent" if it was necessary to use injectable medication for intercourse or if their condition was refractory to medication. Patients who were impotent during the preoperative period were excluded from the statistical analysis for postoperative potency assessment. All patients who did not complain of impotence before surgery were considered to be potent. Patients who did not use pads or lining for protection were considered to be continent. The PSA level was measured preferentially on the 45th postoperative day, and a result> 0.2 was considered to be representative of persistent disease. The surgical margin, pathological staging, and prostate weight were obtained from pathological anatomy reports. Complications were described according to the Clavien-Dindo classification. The quantitative variables were presented as the minimum, median, mean, standard deviation (SD), and maximum, as well as the 95% confidence interval of the mean. Qualitative variables were presented as the absolute and relative frequencies. The assumption of normality was considered because the sample size was sufficiently large. The mean difference T-test and the Chi-square test (or Fisher's test when necessary) were used to compare the variables of the two surgical methods.

4. Results

Thirty-three of the 189 eligible patients were excluded from the analysis, since they fulfilled the exclusion criteria. Data from 103 robotic and 53 laparoscopic surgeries were evaluated. The quan-

titative and qualitative pre-surgical variables are summarized in (Table 1 and Table 2), respectively. Although the number of comorbidities was greater in the laparoscopic surgery group than that in the robot-assisted surgery group (mean: 1.53 versus 0.86), no statistically significant difference was observed between patients with diabetes and hypertension. The preoperative Gleason score was similar between the two groups. The quantitative and qualitative post-surgical variables are shown in (Table 3 and Table 4), respectively. The use of extraperitoneal access (75% versus 46%) and drains (32% versus 15%) was significantly more frequent in the LRP group than that in the LRP group. The duration of the procedure was significantly shorter with the RALP approach (average: 115 versus 174 minutes). No statistically significant difference was observed in the length of hospitalization, transfusion, or duration of bladder catheter use. No difference was observed in the cancer outcomes, such as the rate of disease persistence, nor the number of positive margins. Stratification of the topography of the margin revealed that the incidence of positive bladder margins was higher in the LRP group compared to the RALP group (13% versus 1.9%). Although radical margins were more prevalent in robotic surgery compared to laparoscopic surgery, the difference was not statistically significant (18.4% versus 11.3%). The potency outcomes for RALP were statistically significant superior to those of LRP in all the analyzed periods. There was no difference in the rate of continence during any period.

All complications were classified as Clavien-Dindo II. The complication rate was 5.7% for LRP versus 2.94% for RALP, and the difference was not statistically significant.

Table 1: Statistics summary and Confidence Interval (CI) of 95% to pre surgical quantitative variables in general and stratified by surgery type. P Value of T-Test to mean difference.

Variable	Minimum	Median	Mean (DP)	Maximum	CI 95%	p Value
Age	46	66	65.06 (7.79)	86	63.82 – 66.31	
Laparoscopic	48	66	65.23 (8.10)	86	62.99 – 67.46	0.855
Robotic	46	66	64.98 (7.66)	79	63.47 – 66.49	
BMI	19	25	25.88 (3.59)	38	25.23 – 26.52	
Laparoscopic	19	26	26.27 (4.07)	37	25.08 – 27.46	0.370
Robotic	19	25	25.64 (3.26)	38	24.90 – 26.38	
Comorbidities	0	1	1.08 (1.05)	5	0.90 – 1.26	
Laparoscopic	0	1	1.53 (1.18)	5	1.18 – 1.89	0.001
Robotic	0	1	0.86 (0.91)	4	0.68 – 1.05	
Pre-Surgical PSA	0.60	5.50	7.72 (7.25)	65	6.52 – 8.92	
Laparoscopic	0.60	4.78	8.66 (9.96)	65	5.82 – 11.49	0.343
Robotic	0.75	4	7.21 (5.22)	26	6.13 – 8.30	
Prostate Size	22	46	53.95 (27.65)	180	49.35 – 58.56	
Laparoscopic	22	45	52.85 (29.80)	180	44.38 – 61.32	0.735
Robotic	25	49	54.56 (26.54)	170	49.03 – 60.09	

Table 2: Frequency (%) to pre-surgical quantitative variables in general and stratified by surgery type. P Value of Chi-Square or Fisher Tests*

Variable	Category	Freq. (%)	Type of Surgery		p Value
			LRP. (%)	RALP. (%)	
Diabetes or Hipertension	None	96 (69.06)	27 (60)	69 (73.40)	0.140*
	Diabetes Only	3 (2.16)	0 (0)	3 (3.19)	
	Hipertension Only	29 (20.86)	14 (31.11)	15 (15.96)	
	Diabetes AND Hipertension	11 (7.91)	4 (8.89)	7 (7.45)	
Potent	Não	28 (17.95)	8 (15.09)	20 (19.42)	0.655
	Sim	128 (82.05)	45 (84.07)	83 (80.58)	
Gleason	1	46 (31.5)	17 (34.7)	29 (29.9)	0.911*
	2	49 (33.6)	16 (32.7)	33 (34.0)	
	3	24 (16.4)	9 (18.4)	15 (15.5)	
	4	23 (15.8)	6 (12.2)	17 (17.5)	
	5	4 (2.7)	1 (2.0)	3 (3.1)	
Type of Surgery	LRP	53 (33.97)	-	-	-
	RALP	103 (66.03)	-	-	
Lenght of Stay	Up to 2 days	149 (95.5)	50 (94.3)	99 (96.1)	0,690*
	Over 2 days	7 (4.5)	3 (5.7)	4 (3.9)	
Acess	Extra-Peritoneal	88 (56.4)	40 (75.5)	48 (46.6)	0.002
	Trans-Peritoneal	59 (37.8)	12 (22.6)	47 (45.6)	
	No information	9 (5.8)	1 (1.9)	8 (7.8)	

Table 3: Statistic summary and confidence interval (CI) of 05% to post-surgical quantitative variables by type of surgery. P Value of T-Test for mean differences.

Variable	Surgery	Minimum	Median	Mean (SD)	Maximum	IC 95%	p Value
Surgery Lenght	LRP.	75	175	174.7 (60.70)	300	157.47 – 191.97	<0.0001
	RALP	50	100	115.8 (41.15)	245	107.56 – 123.98	
Lenght of stay	L RP	1	1	1.40 (0.60)	3	1.23 – 1.56	0.0314
	RALP	1	1	1.18 (0.52)	4	1.08 – 1.29	
Time to catheter removal	LRP.	3	7	7.49 (1.50)	12	7.08 – 7.90	0.5806
	RALP	5	7	7.35 (1.51)	15	7.05 – 7.65	

Table 4: Frequency (%) to post-surgical quantitative variables by type of surgery. P Value of Chi-Square or Fisher Tests*.

Variable	Category	Type of Surgery		p Value
		LRP (%)	RALP (%)	
Transfusion	No	48 (90.57)	99 (96.12)	0.2749*
	Yes	5 (9.43)	4 (3.88)	
Drain	No	36 (67.92)	87 (84.47)	0.0286
	Yes	17 (32.08)	16 (15.53)	
Continent	No	9 (17.3)	19 (18.8)	0.82
3 months	Yes	43 (82.7)	82 (81.2)	
Continent	No	3 (5.8)	6 (5.9)	0.999*
6 months	Yes	49 (94.2)	95 (94.1)	
Continent	No	3 (5.8)	0 (0)	0.039*
12 months	Yes	49 (92.4)	99 (100)	
Potent	No	26 (63.4)	31 (38.3)	0.009
3 months	Yes	15 (36.6)	50 (61.7)	
Potent	No	22 (53.7)	16 (21.3)	<0.001
6 months	Yes	19 (46.3)	59 (78.7)	
Potent	No	11 (33.3)	8 (12.9)	0.018
12 months	Yes	22 (66.7)	54 (87.1)	
Margem positiva	No	38 (71.70)	78 (75.73)	0.7245
	Yes	15 (28.30)	25 (24.27)	0,101*
	T2	11 (73.3)	10 (40.0)	
	T3+	4 (26.7)	13 (52.0)	
	No Information	0 (0.0)	2 (8.0)	
Margin Topography	Vesical	7 (13.2)	2 (1.9)	0.008
	Radial	6 (11.3)	19 (18.4)	0.357
	Urethral	5 (9.4)	9 (8.7)	0.999*
PSA 45 days	≤ 0.2			0.177
	> 0.2			
	No information			
Gleason	1	8 (15.38)	9 (8.82)	0.7642*
	2	20 (38.46)	39 (38.24)	
	3	15 (28.85)	36 (35.29)	
	4	6 (11.54)	11 (10.78)	
	5	3 (5.77)	7 (6.86)	
Stage	pT2	43 (81.1)	75 (72.8)	0.571*
	pT3	9 (17.0)	24 (23.3)	
	Sem informação	1 (1.9)	4 (3.9)	
Complication	Não	49 (94.23)	99 (97.06)	0.4063*
	Sim	3 (5.77)	3 (2.94)	
Clavien-Dindo	II	4 (7.55)	2 (1.94)	0.1810*
	Não	49 (92.45)	101 (98.06)	

5. Discussion

Our study compared the results of patients who underwent for LRP or RALP for prostate cancer and found no difference between the cancer outcomes of the two surgical methods. Due to the short follow-up period of this study, we used the PSA level obtained 45 days after surgery as a marker of oncological quality to determine the biochemical recurrence described in the pentafecta. 6The proportion of positive margins was 28.3% in the LRP and 24.3% in the RALP groups, congruent with the results of a meta-analysis of 12 studies and 3983 patients, 9 and discordant with a single-center Japanese study that compared only oncological outcomes 11and demonstrated the advantages of RALP (20.7% versus 31.2%). Stratification by the tumor stage revealed that 52% of the positive margins were associated with T3 lesions treated with RALP versus 26.7% treated with LRP, although the difference was not significant. We assume that the robotic platform could have increased the surgeon's confidence in performing bundle preservation even in challenging cases, which could have led to margin compromise in our study.

We found no significant difference in the recovery of continence. Our data are similar to those reported in the literature, although recent meta-analyses showed that patients who underwent robot-assisted surgery showed a tendency to become continent at 12 months.12,13 We identified early continence in 80% of participants from both groups, which escalated to 92 and 96% at the end of 12 months in the LRP and RALP groups, respectively.

We identified a statistically significant difference in the potency of the two groups during all periods evaluated. At 3 months, 60% of the patients in the RALP group were potent, which rose to 87.1% at the end of one year, versus 36.6% and 66.7% in the LRP group. Our potency data are consistent with a meta-analysis that assessed the prevalence of erectile dysfunction in patients after prostatectomy.14The potency rate after RALP in a case series with more than 100 participants ranged between 39-90% 12 months after surgery. Five studies evaluated in this review that compared the two techniques showed the superiority of RALP 12 months postoperatively. A more recent review 15ratified the superiority of RALP over the LRP, and this difference is even more striking in our data. We understand that attempting bilateral preservation in all patients, unlike studies that included partial preservation, could have influenced our higher postoperative potency rates, without conferring any additional apparent oncological safety.

Surgical complications were observed in only 3 patients in each group (<5%), with no difference between them. One patient in the LRP group had wound infection, another patient had lymphocele and orchiepididymitis, and the third presented with urinary retention upon removal of the catheter. One patient developed pyelonephritis due to multi-drug resistant microbes in the RALP group, another patient developed an infected lymphocele, and the third developed catheter obstruction. Repeat surgery was not was necessary in any case.

The evaluation of the perioperative variables showed that extraperitoneal access was performed in 75% of LRP and 46.6% of RALP procedures. This difference can be explained by the change in technique adopted by the surgeon through his/her career, when there were still few robotic cases.

The duration of the procedure was significantly shorter for RALP compared to LRP, with an average operative time of 115.8 versus 174.7 min, respectively. We compared several single-surgeon studies and noticed a great variation among specialists, which may be associated with the variability of the learning curve and the results. 16–20

The duration of hospitalization was significantly longer in the RALP group (1.18 versus 1.4 days) but 95% of patients in both groups were discharged within less than 48 h.

Both the length of hospitalization and operative time were much shorter compared to other single-surgeon case series, 15,17,19but similar to an Australian series 20.

The use of drains was greater in the laparoscopic group than that in the robotics group (32% versus 15%). It is worth noting that the option for the drain was common in 2017 and 2018, but became an atypical practice after this period.

There was no difference in the transfusion rate or duration of use of bladder catheters.

We have presented the comparison of our principal results with those of other single-surgeon studies in Table 4 and Table 5 [16–20].

Table 5: Comparison of functional and oncologic results of single surgeon´s case series.

	N		RECURRENCE		CONTINENCE		POTENCY		MARGIN STATUS		COMPLICATION	
	LRP	RALP	LRP	RALP	LRP	RALP	LRP	RALP	LRP	RALP	LRP	RALP
NILO ET AL	53	103	9,4	8,7	92,4	96,1	48,9	68	28,3	24,2	5,7	2,9
PARK ET AL	62	44	-	-	95	94,4	47,6	54,5	13	9	11,3	11,4
PARK B ET AL	144	183	83,3	86,9	78,1	87,4	32,7	36,5	15,3	13,7	18,9	12
YOON KU ET AL	100	50	-	-	81	96	12	14	34	28	-	-
TRABULSI ET AL	45	205	-	-	82	94	-	81	24	16	-	-
PAPACHRISTOS ET AL	100	100	11	5	82	93	29	46	13	10	12	9

The limitations of our study are its retrospective design, possibility of memory bias, and the lack of validated questionnaires for patients. Furthermore, the collection of data from medical records is subject to observation bias, since surgeons tends to overestimate the results of the method of their preference. It is also worth mentioning that up to 25% of data, mainly concerning potency between 6-12 months, could have been lost from both groups.

6. Conclusion

Our single-surgeon study that compared the pentafecta of outcomes between RALP and LRP concluded that the potency after RALP was superior to that of LRP. There was no difference in the continence, cancer outcomes, or complications. The operative time of RALP was shorter than that of LRP, without affecting the oncological and functional results. Further studies comparing outcomes of LRP and RALP performed by the same surgeon, including prospective studies, are needed to assess the impact of the robotic platform on the surgical results. We opine that the rapid replacement of LRP by RALP makes studies like ours increasingly relevant and important from a clinical perspective.

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