Radical prostatectomy: a single surgeon comparison of retropubic, perineal, and robotic approaches

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Objective: *To compare perioperative, functional and oncological outcomes of a single surgeon's experience with retropubic (RRP), perineal (RPP), and robotic assisted (RARP) radical prostatectomy.*

Methods: *Results from 150 radical prostatectomies performed by a single surgeon were compared. The groups consisted of the last 50 consecutive RRP (group 1) and RPP patients (group 2) and his first 50 RARP patients (group 3). He had significant experience in RRP and RPP and extensive training prior to performing RARP. The data was obtained from record review and patient survey. Patient demographics, operative parameters, pathological characteristics, complications, and functional outcomes were compared between groups.*

Results: *The groups were comparable with respect to patient demographics. Hospital stay, blood loss, and transfusion requirements were significantly better in the robotic group. Complications were least in the robotic group. Urinary continence (one pad or less) at 12 months was 96% in RRP, 96% in RPP, and 96% in RARP group. Positive surgical margins in organ confined disease were significantly lower for RARP although overall positive margins were similar. Potency data was still maturing and was not included in this analysis.*

Conclusions: *There were no major differences in outcomes between the RRP and RPP groups. The RARP group had equal or better perioperative outcomes in all analyzed categories with the least complications. Urinary function outcomes were excellent in all groups. Prior open experience and extensive training facilitate encouraging outcomes for robotic prostatectomy even in a surgeon's initial series of patients.*

Key Words: prostate cancer, robotics, perineal, retropubic prostatectomy

Introduction

Radical retropubic prostatectomy (RRP) has been the gold standard for surgical treatment of localized prostate cancer for over 20 years.[1] In the 1990's there was a resurgence of radical perineal and laparoscopic prostatectomy primarily due to both patient and surgeon desire for minimally invasive approach and more rapid convalescence.[2,3] Reported drawbacks of perineal prostatectomy (RPP) include lack of expertise with perineal anatomy and inability to perform a concurrent lymph node dissection and laparoscopic radical prostatectomy has demonstrated a steep learning curve.[4] There are few reports in literature comparing different surgical approaches and those that do usually have more than one surgeon which

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introduces a multitude of confounding factors. Surgeons typically vary in operative acumen and experience and will vary in their patient selection process, perioperative management algorithms, and postoperative evaluation. Allowing for the natural refinement of both technique and management over time, our single surgeons' comparison attempts to eliminate some of the variability that will occur in a multi-surgeon and multi-institutional analysis.

Materials and methods

Groups consisted of the last 50 consecutive RRP and RPP patients and the first 50 RARP patients after the training period was completed. All procedures were performed by a single surgeon (HS) who had extensive experience in RRP and RPP as a urological oncologist for over 10 years. Prior to being credentialed for robotic prostatectomy the surgeon underwent an extended training process with an active robotic program. He observed over 20 cases. He scrubbed as the patient-sided assistant for over 10 cases. He then performed increasing amounts of the procedure as console surgeon for another 20 cases. All data for robotic prostatectomy included in this study was collected after this training period (approximately 50 patients). RRP was performed using the technique described by Walsh et al,[5] RPP was performed via the technique described by Harris et al[6] and RARP was performed using the technique described by Menon et al.[7] Parameters evaluated included preoperative: age, serum PSA, biopsy Gleason sum, clinical stage; perioperative: operative time (defined as time from skin incision to skin/port closure), estimated intra operative blood loss, pathologic stage, path Gleason sum, surgical margin status, duration of hospital stay, and perioperative complications. The decision of whether to undergo RRP, RPP, or RARP was made by the patient after thorough discussion of the advantages and disadvantages of each approach with the surgeon. Body habitus, prostate gland size, and prior surgery are not considered contraindications for robotic surgery at our institution but carry with them appropriate risks that were presented to the patient at the time of consultation. Complications were reported based on classification by Clavien et al.[8] Urinary function outcomes were obtained at clinical visits using patient reported IPSS questionnaires. Continuous variables were analyzed using Analysis of Variance (ANOVA) for parametric and Kruskal-Wallis test for non parametric variables. Categorical variables were compared using a Chi-square test.

Results

The three groups were comparable with respect to pre operative patient characteristics. The mean follow up was 44.4 months for RRP, 27.7 months for RPP, and 12.2 months for the robotic cohort. Significant differences were seen between the three groups with respect to operative time, estimated blood loss, transfusion requirement and hospital stay, Table 1. Patients who had RARP had significantly lower blood loss and shorter hospital stay as compared to patients who had RRP and RPP ($p < 0.0001$). Additionally, none of the RARP patients had perioperative transfusions whereas nine patients (18%) in the RRP group and seven patients (14%) in the RPP group received transfusions.

Perioperative complications were seen in 8% of RRP, 10% RPP, and 2% of RARP patients. No patients in either RARP or RRP group had a grade III or grade IV complication whereas one patient in the RPP group had a grade III complication. All other complications were minor (Clavien grade I or II) and are listed in Table 2. There was no difference in return of urinary continence amongst three groups at both 6 and 12 months post operatively. Data on continence prior to 6 months was not consistently recorded across groups and was not considered for analysis. More patients in the RARP group had pT3 disease (32%) as compared to RRP (28%) and RPP (20%) although this difference was not significant ($p = 0.387$). Positive surgical margins in organ confined disease was less in the RARP group as compared to other two groups ($p = 0.055$); however pT3 positive margins were similar, Table 2. For overall margin rate the RARP and RPP were lower (22% and 26%, respectively) but this did not reach statistical significance.

Discussion

Although radical retropubic prostatectomy remains the gold standard for the treatment of localized prostate cancer, minimally invasive techniques such as RPP, RARP and laparoscopic radical prostatectomy (LRP) are gaining popularity, however there are few reports in literature comparing these techniques.[9-11] Superiority of one technique over another can be best assessed by prospective randomized trials however these are not likely to ever be completed, especially in our environment where patient preference plays a large role in the selection of surgical approach. There are many difficulties in comparing different techniques such as different surgeons or institutions,

TABLE 1. **Patient characteristics and clinical and pathologic staging**

Variable		RRP (n = 50)	RPP (n = 50)	RARP (n = 50)	p-value
Age	Mean (SD)	61.7 (7.12)	61.8 (7.96)	59.8 (7.47)	0.337[a]
	Median	62	64	59	
	Range	43, 73	44, 75	43, 74	
Serum PSA (ng/ml)	Mean (SD)	8.8 (7.01)	5.8 (3.88)	6.6 (4.20)	0.104[b]
	Median	5.95	5.10	5.20	
	Range	0, 33	2, 29	2, 24	
Clin Gleason sum	No (%)				
≤ 6		32 (62)	29 (58)	29 (58)	0.69[c]
3+4		12 (24)	25 (30)	13 (26)	
4+3		1 (2)	2 (4)	4 (8)	
8-10		5 (10)	2 (4)	4 (8)	
OR time (mins)	Mean (SD)	184.8 (46.2)	213.0 (59.3)	186 (36.8)	0.006[a]
	Median	180.5	209	185	
	Range	95, 392	100, 390	119, 331	
Transfusions	N (%)	9 (18)	7 (18.4)	0 (0)	0.006[b]
	Mean (SD)	0.4 (0.95)	0.5 (1.13)	0 (0)	
Blood loss (cc)	Mean (SD)	835 (477.8)	676 (321.9)	140 (84.53)	<.0001[b]
	Median	750	600	100	
	Range	225, 2000	250, 1500	50, 400	
Hospital days	Mean (SD)	2.4 (0.64)	1.6 (1.71)	1.0 (0.20)	<.0001[b]
	Median	2.0	1.0	1.0	
	Range	1, 4	1, 12	1,2	
Prostate volume (g)	Mean (SD)	46.2 (18.3)	38.5 (12)	42.2 (15.3)	0.051
	Median	44	37	36	
	Range	19-93	23-72	19-80.2	
Body mass index	Mean (SD)	27.5 (2.59)	29.4 (5.2)	28.8 (4.3)	0.082
	Median	27	28	29	
	Range	23-35	20-43	21-39	
Nerve sparing	No (%)	27 (58.6)	24 (50)	36 (73)	0.052
Path Gleason sum	No. (%)				
≤6		14 (28%)	15 (30%)	15 (30%)	0.635*
3 + 4		19 (38%)	19 (38%)	25 (50%)	
4 + 3		7 (14%)	9 (18%)	5 (10%)	
8-10		10 (20%)	6 (12%)	5 (10%)	
Path stage	No. (%)				
T2a		4 (8%)	7 (14%)	2 (4%)	0.387*[d]
T2b		30 (46%)	30 (60%)	11 (22%)	
T2c		9 (18%)	3 (6%)	21 (42%)	
T3a		11 (22%)	8 (16%)	15 (30%)	
T3b		2 (4%)	2 (4%)	1 (2%)	
T3c		1 (2%)			

[a]p-value from Analysis of Variance model
[b]p-value from Kruskal-Wallis test
[c]p-value from Chi-square test
*Chi-square test compared combined T2 and T3 stages

TABLE 2. **Functional and oncological outcomes**

Variable		RRP (n = 50)		RPP (n = 50)		RARP (n = 50)		p value
		6 mo	12 mo	6 mo	12 mo	6 mo	12 mo	
Continence	0	39 (78)	43 (86)	34 (68)	43 (86)	32 (64)	45 (90)	0.686[a]
	1	7 (14)	5 (10)	12 (24)	5 (10)	12 (24)	3 (6)	
	2	2 (4)	1 (2)	2 (4)	2 (4)	5 (10)	2 (4)	
	≥ 3	2 (4)	1 (2)	2 (4)	0 (0)	1 (2)	0 (0)	
Complications	No. (%)							
	Major	0 (0)		2 (4)		0 (0)		
	Minor	4 (8)		3 (6)		1 (2)		
		Fever unknown origin (2)		A Fib (1)		Urinary retention (1)		
		Oxygen desaturation (1)		Rectal injury (3):				
				Minor (2)-1˚repair				
		Persistent		w/o sequelae				
		hypotension (1)		Major (1)-colostomy				
				Vesicocutaneous fistula (1)				
Positive margins	No. (%)							
	pT2	10 (28%)		7 (18%)		2 (6%)		0.055[b]
	pT3	8 (57%)		6 (60%)		9 (56%)		0.982[b]
	Overall	18 (36%)		13 (26%)		11 (22%)		0.278[b]

[a]p-value from Fisher's Exact test
[b]p-value from Chi-square test

different clinical pathways for patient care, patient referral patterns, selection bias, and learning curve and expertise of the surgeons. These drawbacks make comparison of different techniques difficult. Our study arose out of the unique opportunity to compare all three surgical techniques performed by a single surgeon at a single institution. It attempts to eliminate many but not all of these potential biases.

Perioperative outcomes (transfusion requirement, estimated blood loss and hospital stay) were significantly better in the RARP group, Table 2 and this is in line with reports from other centers.[12] Ghavamian et al in a similar evaluation of RRP and LRP demonstrated shorter operative times, lower blood loss and transfusion requirements in the LRP group. Others have shown higher operative times for the LRP however these studies were biased in that the surgeon was more experienced in RRP and within the learning curve of LRP.[13] The learning curve of RARP has been shown to be shorter than LRP and in our study the surgeon's prior experience with open radical prostatectomy probably had a positive influence in this regard.[14] Our operative time for RARP (including port placement and robotic docking times) were significantly shorter than RPP and no different from RRP.

An internal comparison of incidence of positive surgical margins among the three groups showed a potential advantage with robotic prostatectomy over the other two techniques especially for organ confined disease, Table 2. Since surgeon and patient factors were similar, we conclude that the lower margins in the RARP group may be due to the advantage rendered by the robot in identifying normal tissue planes. No benefit was demonstrated for pT3 disease between the groups. This is consistent with prior reports that pT3 margins are more a function of tumor biology than surgical technique.[15] Overall and minor complications (Clavien grade I and II) were similar across groups, Table 2.

Continence was evaluated by use of pads at both 6 and 12 months. Overall, continence was maintained in a high percentage of patients irrespective of surgical approach. Using a strict definition of 0 pads and no urinary leakage, 86% RRP, 86% RPP, and 90% RARP patients were continent at 1 year, Table 2. Using the commonly employed definition (0 to 1 pad per day), 96%, 96%, and 96% of RRP, RPP, and RARP groups respectively were continent. Although published literature indicates that return of continence is more rapid with RARP, in our series all three groups had similar rates at both timed endpoints.[16] Collectively, continence rates in all three groups were excellent and higher than

previously reported in other series for both RRP and RPP.[17,18] We did not collect longitudinal data for the first 6 months and are unable to comment statistically on rapidity of return of continence. Because of the variability of follow up across groups and the lack of data collection in the earlier patient cohorts, potency data could not be reasonably compared.

Limitations of the analysis include both the relatively small patient cohorts and the retrospective non randomized nature of the study. Surgeon bias may exist in patient length of hospital stay because our robotic patient cohort have a standard clinical pathway for discharge at post operative day 1 which was not applied to the open prostatectomy patients. Recent publications have indicated that implementing discharge pathways for both open and minimally invasive approaches for radical prostatectomy can facilitate and equalize target postoperative length of stay without increasing readmission rates.[19]

Although the surgeon in our study had a greater experience with RRP and RPP than RARP, our analysis reveals results with RARP that are comparable and in some parameters superior to RRP and RPP. It is surprising that despite this being his initial series of RARP patients, improvements were observed in hospital stay, blood loss, morbidity, and oncological outcomes compared with RRP and RPP. In addition to the prior operative experience of our surgeon, we believe that the extensive training process and robotic team experience were partly responsible for the results observed. An experienced patient side assistant can independently reduce intra operative complications and improve outcomes especially in the learning phase.

Conclusion

In a single surgeon experience three different approaches to radical prostatectomy were compared. There were no major differences in outcomes between the retropubic and perineal groups. The RARP group had equal or better perioperative outcomes in all analyzed categories with the least complications. Patients in all three groups postoperatively had excellent urinary control. Open surgical expertise, rigorous training, and an experienced team can result in very good results in the RARP group even in a surgeon's initial series of patients. □

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