ARTICLE

A Comparative Analysis of Physiotherapy for Stress Urinary Incontinence after Open or Robotic-Assisted Radical Prostatectomy

Anika Sehgal, BA (Hons);[*] Richard Baverstock, MD, FRCSC;[†‡] Ian Wright, MD;[†] Candace Frey, LPN;[§] Trafford Crump, PhD;[‡] Kevin Carlson, MD, FRCSC[†‡]

ABSTRACT

Purpose: We determined whether the patient-reported benefits of physiotherapy for stress urinary incontinence (SUI) symptoms differ significantly between men who have had open prostatectomy and those who have had robotic-assisted laparoscopic prostatectomy. ***Method:*** We conducted a retrospective analysis of data collected from the Rapid Access Clinic 4 offered by the Prostate Cancer Centre in Calgary, Alberta. Baseline characteristics were measured at the pre-surgery appointment, including demographics, health factors, and potential risk factors for SUI. Patient-reported SUI symptoms were measured pre- and post-surgery using the global score of the International Consultation on Incontinence Questionnaire–Urinary Incontinence. ***Results:*** Data from 56 men were included in the analysis, evenly split between the open and robotic sub-groups. At 3 months post-surgery, no statistically significant differences were found in the factors associated with incontinence between the two sub-groups. There was a statistically significant improvement in self-reported incontinence symptom severity from 3-month to 2-year follow-up for both sub-groups. Physiotherapy did not differentially affect either sub-group in a significant way. ***Conclusions:*** The self-reported benefits of physiotherapy for SUI symptoms did not differ significantly between the two types of prostatectomy surgery at 2 years post-surgery.

Key Words: prostatectomy; urinary incontinence; stress.

RÉSUMÉ

Objectif : déterminer si les avantages de la physiothérapie décrits par les patients pour contrer l'incontinence urinaire à l'effort (IUE) sont très différents entre les hommes qui ont subi une prostatectomie ouverte et ceux qui ont subi une prostatectomie par laparoscopie robotisée. ***Méthodologie :*** les chercheurs ont procédé à l'analyse rétrospective des données extraites du programme *Rapid Access Clinic 4* offert par le *Prostate Cancer Centre* de Calgary, en Alberta. Ils ont mesuré les caractéristiques de référence au rendez-vous avant l'opération, y compris les données démographiques, les facteurs liés à la santé et les facteurs de risque potentiels d'IUE. Ils ont mesuré les symptômes d'IUE décrits par les patients avant et après l'opération au moyen du score global du questionnaire international de consultation sur l'incontinence – incontinence urinaire. ***Résultats :*** les données de 56 hommes ont été incluses dans l'analyse, réparties également entre le groupe de chirurgie ouverte et celui de laparoscopie robotisée. Trois mois après l'opération, il n'y avait pas de différence statistiquement significative entre les deux groupes pour ce qui est des facteurs associés à l'incontinence. Les deux groupes présentaient une diminution statistiquement significative de la gravité des symptômes d'incontinence décrits par les patients entre le suivi au bout de trois mois et celui au bout de deux ans. La physiothérapie n'avait pas d'effet différentiel significatif sur l'un ou l'autre sous-groupe. ***Conclusions :*** deux ans après l'opération, les avantages de la physiothérapie décrits par les patients pour contrer les symptômes d'IUE ne différaient pas de manière significative entre les deux types de prostatectomie.

Radical prostatectomy is the most frequently used procedure to treat prostate cancer. Approximately 50% of men diagnosed with prostate cancer will have their prostate removed using this procedure.[1] However, patients face several potential complications after a radical prostatectomy, including urinary incontinence.[2] Some studies have estimated that approximately 49% of men who undergo a radical prostatectomy experience urinary incontinence, making it one of the most pervasive side effects of the surgery.[3]

The International Continence Society defines *urinary incontinence* as the involuntary leakage of urine.[4] Stress urinary incontinence (SUI) is the prevailing type of incontinence after radical prostatectomy.[5] With SUI, leaking usually occurs when one laughs, sneezes, coughs, or participates in some form of physical activity.[5] These symptoms tend to begin immediately after the catheter is removed, approximately 2 weeks after surgery. The severity of SUI symptoms varies by individual; for some, the

From the: [*]Department of Psychology, University of Waterloo, Waterloo, Ont.; [†]Vesia [Alberta Bladder Centre]; [‡]Department of Surgery, University of Calgary; [§]Prostate Cancer Centre, Calgary, Alta.

Correspondence to: Anika Sehgal, Department of Psychology, University of Waterloo, 200 University Ave. W., Waterloo, ON N2L 3G1; a22sehga@uwaterloo.ca.

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symptoms will disappear on their own; for others, intervention is necessary.

One non-invasive intervention aimed at improving SUI after radical prostatectomy is physiotherapy.[5] Specifically, pelvic floor muscle therapy (PFMT) can aid an individual in regaining continence by strengthening and increasing the endurance of the pelvic floor muscles.[6] During PFMT, the individual repeatedly contracts the pelvic floor muscles, which improves their efficacy and strength, allowing the individual to regain continence. PFMT has been observed to decrease the severity of SUI,[7] shorten the duration of symptoms after surgery,[8,9] and increase quality of life.[9]

A systematic review examined multiple studies that investigated the use of PFMT for SUI.[7] The authors found numerous discrepancies among the studies, variations in methods, and inconsistent results. The results suggested that evidence about the benefits of PFMT for either treating or preventing incontinence after surgery is conflicting. What this systematic review did not assess, however, was whether physiotherapy had a differential effect on men depending on the type of radical prostatectomy they had undergone.[7] To the best of our knowledge, no published studies have compared the efficacy of PFMT between open prostatectomy and robotic-assisted laparoscopic prostatectomy (RALP). Many of the studies cited previously examined only patients who had undergone an open radical prostatectomy. In recent years, the use of RALP has grown in popularity, but the evidence about its side effects compared with open radical prostatectomy is mixed.[10–12]

The purpose of our study was to determine whether the patient-reported benefits of physiotherapy for SUI symptoms differed significantly between men who had undergone open prostatectomy and men who had RALP. Our study's results could be used to better inform surgeons, physiotherapists, and patients about the effect of physiotherapy on the different approaches to radical prostatectomy.

METHODS

We conducted a retrospective analysis of data collected from the Rapid Access Clinic 4 (RAC 4) offered by the Prostate Cancer Centre in Calgary, Alberta. The purpose of RAC 4 is to provide patients with a follow-up programme after surgical treatment for prostate cancer. All men undergoing a radical prostatectomy for prostate cancer in Calgary are invited to RAC 4, with no inclusion or exclusion criteria. In 2016, 414 men underwent prostate surgeries, including open, RALP, and cryoablation procedures. Approximately 76% of these men elected to attend.

RAC 4 prospectively collects data from participating men at several points in time: approximately 3 weeks or less before their radical prostatectomy and at 3 months, 9 months, 2 years, 3 years, and finally 4 years post-surgery. Pre-surgery and 3 months post-surgery, a full clinical assessment is done by a trained nurse, whereas patient-reported outcomes (PROs) are collected at other time points. These data are entered into a clinical registry, which was used for this study.

RAC 4 provides two physiotherapy sessions, free of charge, to men who experience urinary incontinence within the first year of surgery. The sessions are provided by a single physiotherapist. The first session includes an assessment of a patient's condition and symptoms and an internal examination to provide information about the pelvic floor muscles, nerves, and other structures in the area. On the basis of this assessment, the patient receives an individualized treatment plan, including a personalized home exercise programme. The specific regimen differs depending on the patient, but generally everyone learns how to contract and relax their pelvic muscles. They also learn conditioning exercises for the pelvic muscles. In addition, biofeedback is carried out, primarily using a mirror to help the patient see the muscles contract.

The second physiotherapy session acts as a follow-up; here, the treatment plan is modified if improvements in strength and symptoms are not being made. After the two free sessions, men have the option to continue physiotherapy sessions at their own cost.

Our study examined all men in RAC 4 who had undertaken at least two physiotherapy sessions by the 9-month post-surgery follow-up. The primary outcome of interest was the patient-reported severity of SUI symptoms at 2 years post-surgery; because self-reported SUI symptoms typically resolve themselves within the first few years, looking further than 2 years post-surgery would not be relevant to the immediate impact of physiotherapy. Recognizing the overlap between SUI and overactive bladder (OAB), we also examined the severity of patient-reported OAB symptoms at 2 years post-surgery as a secondary measure. This study was approved by the Conjoint Health Research Ethics Board at the University of Calgary.

Measures

To measure patient-reported SUI symptoms, we used the global score of the International Consultation on Incontinence Questionnaire–Urinary Incontinence (ICIQ–UI).[13] The ICIQ–UI is a brief measure that assesses symptoms of incontinence and their effect on an individual's quality of life.[13] It consists of four items related to urinary incontinence. Three items are responded to using a Likert scale. The first item is rated on a scale of 0–5 points, the second item is rated on a scale of 0–6 points, and the third item is rated on a scale of 0–10 points. Higher scores represent more severe symptoms. Responses are scored and aggregated to arrive at an overall urinary incontinence global score, which ranges from 0 (*no symptoms*) to 21 (*severe symptoms*). A difference of 5 points at 12 months and

4 points at 24 months on the global score has been demonstrated to be clinically meaningful.[14]

The fourth item asks when the individual leaks urine and provides several options, allowing multiple selections. This item is not scored and is generally used for clinical purposes; therefore, we excluded it from this study's analysis.

To measure patient-reported OAB symptoms, we used the Overactive Bladder–Validated 8 questionnaire (OAB–V8). The OAB–V8 is an eight-item awareness tool that measures how bothered an individual is by OAB symptoms.[15] These eight items are scored using a Likert scale ranging from 0 (*not at all*) to 5 (*a very great deal*). Men add 2 points to their scores to compensate for their lower threshold of OAB symptoms, and the total is scored out of 40.[15] A score of 8 or more indicates the possibility of OAB.[15]

All RAC 4 participants' baseline characteristics were measured at the pre-surgery appointment, including their demographic characteristics, health factors, and potential risk factors for SUI. The patient-reported symptoms, including their scores on the ICIQ–UI and OAB–V8, were measured pre- and post-surgery.

Analysis

The pre-surgery baseline characteristics of the men who had participated in physiotherapy by their 9-month follow-up visit were compared with those of the men who had not participated in physiotherapy. To ensure that there were no pre-surgical differences among these men, we used Student's *t*-test or Pearson's χ^2 to test for any differences. Incontinence-related characteristics collected at the 3-month follow-up visit were compared between the open prostatectomy and RALP sub-groups.

To test for differential treatment effects, we used inverse probability weighting with regression adjustment to model both the change in ICIQ–UI score (or change in OAB–V8 score, for our secondary analysis) and the non-random treatment assignment into open prostatectomy and RALP sub-groups. The change in ICIQ–UI and OAB–V8 scores was calculated by subtracting the score elicited at the 3-month follow-up visit from the score elicited after the 2-year follow-up period. The regression model was adjusted for participants' baseline age, baseline BMI, and pre-operative ICIQ–UI or OAB–V8 score. We considered a differential treatment effect if the surgery type co-variate had a CI that did not include zero.

Missing data were not imputed. Differences between measures that resulted in $p < 0.05$ were considered statistically significant. All statistical analysis was conducted using STATA, Version 14.2 (StataCorp LLC, College Station, TX).

RESULTS

Data from 1,224 men were reviewed from the RAC 4 clinical registry. Of those men, 253 had 2-year post-surgery data. Of these, 56 men had participated in physiotherapy and had complete data at baseline and 2-year follow-up. This group was nearly evenly split between treatment types: 52% (n = 29) had undergone an open radical prostatectomy, and 48% (n = 27) had a RALP. This sample's pre-surgery characteristics were compared with those of men who had not participated in physiotherapy (see Table 1). No significant differences were found between these groups in terms of age, BMI, comorbidities, or self-reported SUI symptoms, as measured by before-surgery scores on the ICIQ–UI (mean scores: physiotherapy 2.1, no physiotherapy 1.5; p = 0.18), or in OAB symptoms, as measured by the OAB–V8 (mean scores: physiotherapy 9.9, no physiotherapy 8.0; p = 0.11).

Urinary incontinence symptoms were examined at 3 months post-surgery in both the open prostatectomy and the RALP sub-groups. No statistically significant differences

Table 1 Baseline Characteristics of the Physiotherapy and No-Physiotherapy Sub-Groups

Characteristic	Physiotherapy (n = 56)	No physiotherapy (n = 197)	Test for statistical differences
Age, y, mean (SD)	64.1 (5.9)	62.2 (7.3)	$t_{(251)} = -1.73$; $p = 0.09$
BMI, mean (SD)	27.8 (10.4)	27.6 (4.7)	$t_{(251)} = -0.20$; $p = 0.84$
Comorbidity, no. (%)			
Diabetes	6 (11)	10 (7)	Pearson $\chi^2_1 = 0.66$; $p = 0.42$
Hypertension	22 (39)	55 (40)	Pearson $\chi^2_1 = 0.001$; $p = 0.97$
Surgery, no. (%)			
Open prostatectomy	29 (52)	73 (53)	Pearson $\chi^2_2 = 0.01$; $p = 0.93$
RALP	27 (48)	66 (47)	
Patient-reported outcome, mean (SD)			
ICIQ–UI	2.1 (2.8)	1.5 (2.5)	$t_{(251)} = -1.36$; $p = 0.18$
OAB–V8	9.9 (6.8)	8.0 (6.1)	$t_{(251)} = -1.60$; $p = 0.11$

RALP = robotic-assisted laparoscopic prostatectomy; ICIQ–UI = International Consultation on Incontinence Questionnaire–Urinary Incontinence; OAB–V8 = Overactive Bladder–Validated 8 questionnaire.

Table 2 Urinary Incontinence Assessment for Open versus Robotic-Assisted Laparoscopic Prostatectomy at 3 Months after Surgery

			Test for statistical differences	
Urinary incontinence assessment	Open prostatectomy ($n = 29$)	RALP ($n = 27$)	t-test or Pearson χ^2	p-value
Patient-reported outcome, mean (SD)				
ICIQ–UI	12.2 (4.8)	10.4 (4.2)	$t_{(54)} = 1.48$	0.14
OAB–V8	13.8 (7.2)	12.6 (6.3)	$t_{(54)} = 0.62$	0.54
Type of incontinence, no. (%)				
None	0 (0)	1 (4)	Pearson $\chi^2_4 = 3.33$	0.50
Stress	20 (69)	14 (52)		
Urge	1 (3)	1 (4)		
Mixed	5 (17)	9 (33)		
Continuous	3 (10)	2 (7)		
Pads/day, mean (SD)	3.0 (3.2)	1.7 (1.4)	$t_{(54)} = 2.01$	0.05
Pads/night, mean (SD)	0.7 (0.5)	0.5 (0.9)	$t_{(54)} = 0.79$	0.43
Voids/day, mean (SD)	7.8 (0.7)	7.4 (0.7)	$t_{(54)} = 0.45$	0.66
Voids/night, mean (SD)	1.6 (1.0)	2.3 (1.9)	$t_{(54)} = -1.69$	0.10
Urgency, no. (%)	22 (76)	19 (70)	Pearson $\chi^2_1 = 0.22$	0.64
Dysuria, no. (%)	2 (7)	0 (0)	Pearson $\chi^2_1 = 1.93$	0.17
Stream, no. (%)				
Weak	3 (10)	1 (4)	Pearson $\chi^2_3 = 2.40$	0.49
Fair	10 (34)	6 (22)		
Strong	15 (52)	19 (70)		
Don't know	1 (3)	1 (4)		
Flow, no. (%)				
Intermittent	1 (3)	1 (4)	Pearson $\chi^2_2 = 0.95$	0.62
Continuous	27 (93)	26 (96)		
Don't know	1 (3)	0 (0)		
Strain to void	0 (0)	1 (4)	Pearson $\chi^2_1 = 2.27$	0.52
Hematuria	1 (3)	0 (0)	Pearson $\chi^2_1 = 1.93$	0.38
Impaired emptying	2 (7)	0 (0)	Pearson $\chi^2_1 = 3.22$	0.36

RALP = robotic-assisted laparoscopic prostatectomy; ICIQ–UI = International Consultation on Incontinence Questionnaire–Urinary Incontinence; OAB–V8 = Overactive Bladder–Validated 8 questionnaire.

Table 3 Comparison of Self-Reported Symptom Scores at 3-Month and 2-Year Follow-Up

Outcome, mean	Open prostatectomy ($n = 29$)	Paired $t(28)$	p-value	RALP ($n = 27$)	Paired $t(26)$	p-value
ICIQ–UI		5.72	< 0.001		4.01	< 0.001
3 mo	12.2			10.4		
2 y	6.4			6.8		
OAB–V8		3.79	< 0.001		2.73	0.01
3 mo	13.8			12.6		
2 y	9.4			9.4		

RALP = robotic-assisted laparoscopic prostatectomy; ICIQ–UI = International Consultation on Incontinence Questionnaire–Urinary Incontinence; OAB–V8 = Overactive Bladder–Validated 8 questionnaire.

were observed between the two sub-groups in type of incontinence (none, stress, urge, mixed, and continuous), pad usage, voiding times, or stream (see Table 2), nor did these groups significantly differ in terms of their scores on the ICIQ–UI or OAB–V8. Men in the open prostatectomy sub-group compared with those in the RALP sub-group had a mean ICIQ–UI score of 12.2 compared with 10.4 ($p = 0.14$) and a mean OAB–V8 score of 13.8 compared with 12.6 ($p = 0.54$), respectively.

A comparison of the self-reported symptom scores between 3-month and 2-year follow-up is provided in Table 3. Both the open prostatectomy and RALP sub-groups had statistically significant improvements in their ICIQ–UI and OAB–V8 scores. The change in ICIQ–UI

Table 4 Results of the Inverse Probability Weighting with Regression Adjustment for Treatment Effects

	Change in ICIQ–UI				Change in OAB–V8			
Treatment effects	Coefficient	Robust Standard Error	*p*-value	95% CI	Coefficient	Robust Standard Error	*p*-value	95% CI
Average treatment effect								
Open prostatectomy vs. RALP	0.94	1.75	0.59	−2.48, 4.37	1.49	2.20	0.50	−2.82, 5.80
Regression								
Age	0.16	0.14	0.26	−0.12, 0.45	0.20	0.19	0.31	−0.18, 0.58
BMI	0.04	0.36	0.90	−0.67, 0.75	0.29	0.30	0.33	−0.30, 0.89
Pre-op ICIQ–UI	0.42	0.48	0.38	−0.51, 1.35	—	—	—	—, —
Pre-op OAB–V8	—	—	—	—	−0.18	0.13	0.16	−0.42, 0.07
Constant	−17.53	13.44	0.19	−43.87, 8.81	−23.15	16.22	0.15	−42.90, 8.63

Note: Dashes indicate that score was not applicable.
ICIQ–UI = International Consultation on Incontinence Questionnaire–Urinary Incontinence; OAB–V8 = Overactive Bladder–Validated 8 questionnaire; RALP = robotic-assisted laparoscopic prostatectomy.

scores met the threshold for being clinically meaningful (i.e., > 4 points) for the open prostatectomy sub-group, and that in the RALP sub-group was nearly so. Although there was a reduction in OAB–V8 scores, the scores reported at the 2-year follow-up were still above the threshold for suspected OAB (i.e., > 8).

Results from the inverse probability weighting with the regression adjustment for treatment effects model for the ICIQ–UI are provided in Table 4. The average treatment effect of open prostatectomy versus RALP was 0.94, indicating that open radical prostatectomy accounted for just below an average 1-point increase in ICIQ–UI score from the 3-month to 2-year follow-up period compared with RALP. This increase, however, was not statistically significant. From the regression model for the ICIQ–UI, we observed that age, BMI, and pre-surgery ICIQ–UI scores were not significant for either the open prostatectomy or the RALP sub-groups.

Results from the inverse probability weighting with regression adjustment for treatment effects model for the OAB–V8 are also provided in Table 4. As with the ICIQ–UI, the average treatment effect associated with open prostatectomy was positive, increasing the average OAB–V8 score by 1.49 points from the 3-month to the 2-year follow-up period compared with the RALP group. This result was also not statistically significant. The regression models indicated that age, BMI, and pre-surgery OAB–V8 scores were not significant factors in the difference in scores.

DISCUSSION

The purpose of our study was to determine whether the patient-reported benefits of physiotherapy for SUI symptoms significantly differed between men who had undergone open radical prostatectomy and those who had RALP. We did not observe any significant differences in the change in PRO scores between the surgical sub-groups at the 2-year follow-up. The open prostatectomy and RALP sub-groups had similar SUI-related symptoms 3 months before follow-up, leading to us to conclude that there were no measurable differences before physiotherapy. Those individuals who ultimately participated in physiotherapy, regardless of the type of surgery they had undergone, had demographic characteristics similar to those who did not participate in physiotherapy before surgery.

Patients did report significantly improved SUI and OAB symptoms at the 2-year follow-up compared with those reported at the 3-month follow-up. These observed improvements are concordant with those reported in other studies on PFMT. For example, early pelvic floor exercises for urinary incontinence after radical prostatectomy have been shown to increase continence as early as 6 weeks post-surgery.[8,16]

What our study adds to the literature is the comparative analysis of the effectiveness of PFMT in treating patient-reported SUI symptoms across common prostatectomy procedures. To the best of our knowledge, this study is the first to conduct such an analysis. The results from this comparative analysis could be interpreted in a number of ways. The first is that PFMT benefits patients with SUI, regardless of the type of prostatectomy they have undergone. This would suggest that the model of offering free physiotherapy through the RAC 4 has been successful, at least from a patient's perspective. The second interpretation is that there do not appear to be any demographic characteristics that predispose a man to report significantly better or worse outcomes. Thus, we cannot say whether a particular sub-group of men should be specifically targeted for physiotherapy intervention.

This study has some limitations that may limit its generalizability. The first limitation is the study's small

sample size, which may result in an underpowered study. However, given that this was a retrospective analysis, this could be viewed more as a hypothesis-generating study, one on which future prospective studies could be based. A second limitation is that there were no follow-up periods from 9 months to 2 years after surgery. As a result, we cannot say whether the physiotherapy intervention had more immediate effects on one group over another or whether they simply regressed to the mean over the intermittent time period. This situation could be addressed in a prospective study specifically aimed at evaluating the effects of physiotherapy on the two prostatectomy groups.

CONCLUSION

The self-reported benefits of physiotherapy for SUI symptoms did not significantly differ on the basis of type of prostatectomy surgery, nor did we observe any significant differences between the two sub-groups in their self-reported OAB symptoms, as a secondary outcome. The dearth of peer-reviewed published evidence in this area warrants further investigation with a properly designed prospective study aimed at measuring more robust SUI outcomes.

KEY MESSAGES

What is already known on this topic

Pelvic floor muscle therapy (PFMT) aids men in regaining continence by strengthening their pelvic floor muscles, decreasing the severity of stress urinary incontinence (SUI), shortening symptoms after surgery, and overall increasing an individual's quality of life. Whether physiotherapy has a differential effect on men depending on the type of radical prostatectomy they have undergone is unclear. No study to date has compared the effects of physiotherapy for SUI symptoms between men who have undergone open radical prostatectomy and men who have undergone robotic-assisted laparoscopic prostatectomy.

What this study adds

This study is the first to conduct a comparative analysis of the effectiveness of PFMT in treating patient-reported SUI symptoms across common prostatectomy procedures. The results from our comparative analysis suggest that PFMT benefits patients with SUI, regardless of the type of prostatectomy they have undergone.

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