

Effect of Pelvic Floor Muscle Strengthening Exercises on Urinary Incontinence and Quality of Life among Patients after Prostatectomy

Zizi Fikry Mohamed Abd Elrasol⁽¹⁾, Ola Ezzat Eltohamy Mohamed⁽²⁾, & Ola Gouda Mohamed Elshiekh⁽²⁾

1) Assistant professor of Medical-Surgical Nursing, Faculty of Nursing, Damanhour University, Egypt.

2) Lecturer of Gerontological Nursing, Faculty of Nursing, Damanhour University, Egypt.

Corresponding author: E-mail:Dr.ola.ezzat@hotmail.com

Abstract

Background: Urinary incontinence remains one of the most significant discomforting complications of prostatectomy. This clearly has negative quality of life implications for men. Training pelvic floor muscle exercise can greatly contribute to the prevention and treatment of urinary incontinence. **Aim of the study:** is to determine the effect of Pelvic Floor Muscles Strengthening Exercise on urinary incontinence and quality of life among patients after prostatectomy. **Study design:** A quasi-experimental research design was used in this study. **Settings:** The study was conducted at urology inpatient unit and urology outpatient clinics affiliated to National Medical Institute in Damanhour, El-Behera Governorate, Egypt. **Subjects:** A randomly sample of sixty patients, were selected from patients post prostatectomy, randomly divided into control and intervention group; 30 patients each. **Tools:** Three tools were used. Tool I: Socio-demographic and clinical data questionnaire. Tool II: The urinary incontinence questionnaire: International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF), Tool III: Thequality of life questionnaire I-QOL. **Results:** There was a statistically significant difference between the control and intervention group of prostatectomy patients in relation to the degree of urinary incontinence and quality of life after three months from implementation of pelvic floor muscle strengthening exercises **Conclusion:** it can be concluded that performing of pelvic floor muscle strengthening exercise had statistical significant improvement on degree of urinary incontinence and quality of life among patients post prostatectomy than the control. **Recommendations:** The nurses must emphasize to provide continuous follow up care for reinforcing the importance of the pelvic floor muscles exercises practice and stimulating the motivation to persist in the urinary incontinence management.

Keywords: Pelvic Floor Muscle Strengthening Exercise, Urinary Incontinence, Quality of Life, Prostatectomy

Introduction

Prostate cancer is one of the most common cancer types in men, and the prevalence increases with age. However, by far the highest incidence and prevalence is reached by benign prostatic hyperplasia (BPH) (Vidmar et al., 2017; Bray et al., 2018). BPH is one of the most common cancer types in adults and older adults, the most common type of prostatic disorders in patients above 40 years old is benign prostatic hyperplasia, by the age of 60 more than half of men have BPH. However, by the age of 85-year-old, 90% of men will be surfaced by their symptoms of BPH (Almarkhan et al., 2018; Rawla, 2019). In Egypt, the incidence of PC was ranked the 9th most common cancer male cancer patients (Fitzmaurice et al., 2017). The choice of treatment depends on the stage of the tumor and the age of the patient. Although radical prostatectomy (RP) is considered golden the standard treatment option for patients with a life expectancy of more than 10 years, for the treatment of organ-limited prostate cancer, post-RP patients are still at risk of surgical and post-surgical complications such as, bleeding, urinary incontinence and sexual impotence.

Urinary incontinence remains one of the most significant discomforting complications of prostatectomy (Mohamad Al-Ali et al., 2017).

Urinary incontinence (UI) is defined as an involuntary loss of urine, according to the International Continence Society (ICS) (Continence Foundation of Australia; Schröder et al., 2010; Thüroff et al., 2011). This clearly has negative quality of life implications for men. Quality of life QoL is a multidimensional construct that involves relevant aspects of the patient's life, such as the health status in general, symptoms related to the treatment of the disease, physical capacity, psychological state and social factors (Appleton et al., 2015).

In this context, men with prostatectomy need pay attention to and care about the UI related factors that affect their QoL. Urinary incontinence can cause embarrassment, loss of self-esteem, impaired mental health, anxiety, interpersonal and sexual problems, and social isolation. It also has a dramatic effect on the adults and older adult's patients' physical, social and emotional indicators and activities, thereby creating an embarrassing

situation and ultimately leading to the social isolation of the individual. This complication is critical to Muslims who believe in ritual purity (**Gavin et al., 2015; Lardas et al., 2017**). Social isolation affects the overall health of the patient and may even cause diseases such as osteoporosis, high blood pressure, heart disease, depression and anxiety, thereby reducing personal quality of life (**Baker et al., 2016**).

The nursing intervention for this complication is based on the principle that urinary incontinence is not inevitably dependent on the disease and is usually reversible and curable. Pelvic floor muscle exercise is a non-drug, non-invasive and cost-effective method to control the urinary system disorders of these patients. These patients are easily trained by health care professionals including nurses, to perform it (**Chang et al., 2016**). As nurses are in direct and constant contact with patients, it appears reasonable that they play an important role in helping patients accept non-medicinal treatments (**Zhang et al., 2015**).

Pelvic floor muscle exercise (PFME) involves the repetitive contraction of the pelvic floor muscle, which builds strength and perineal support, and improves muscle tone (Dijkstra-Eshuis et al., 2015). Since the pelvic floor muscles are composed entirely of striated muscles, the following principles should be followed when performing striated muscle strength training: try to adjust and strengthen the pelvic floor muscles (Stafford et al., 2016). Training pelvic floor muscles can greatly promote prevention and treatment of urinary incontinence (Zaidan & da Silva, 2014; Hsu et al., 2016). Various therapeutic methods could be used to treat UI, including behavioral treatment, pharmacotherapy, and surgical therapy. Pelvic floor muscle exercise is the most common conservative management for UI, which can improve the strength and endurance of striated muscles of the pelvic floor by repeated contractions, partially compensating the urethral sphincter insufficiency (Stafford et al., 2016; Hall et al., 2018).

Significance of the study:

The importance of nursing interventions and treatment care of patients after prostatectomy and the high prevalence of urinary incontinence as a serious complication in these patients as well as the lack of research conducted on the effect of pelvic floor muscle exercises on urinary incontinence and quality of life in patients after prostatectomy, the current study was designed and conducted with the purpose of determining the effect of pelvic floor muscle strengthening exercises on urinary incontinence and quality of life in patients after prostatectomy.

Aim of the study

The aim of the study is to:

- Determine the effect of Pelvic Floor Muscles Strengthening Exercise on urinary incontinence and quality of life among patients after prostatectomy.

Research Hypotheses

- Patient after prostatectomy who practice the pelvic floor muscles strengthening exercise exhibit lower degree of urinary incontinence than those who don't receive it.
- Patient after prostatectomy who practice the pelvic floor muscles strengthening exercise have higher quality of life than those who don't receive it.

Materials and Method

Materials:

Research Design:

A quasi-experimental research design was applied in this study.

Setting:

The present study was conducted at urology inpatient unit and urology outpatient clinics affiliated to National Medical Institute in Damanhour, El-Behera Governorate, Egypt.

Subjects:

Sixty patients, from the previously mentioned settings were selected. The study subjects were selected according to the following inclusion criteria; being candidates for suprapubic prostatectomy, between 50 - 75 years of age, having no cognitive problems, having no urinary incontinence for other medical disorders such as diabetes mellitus, or urinary tract infections, having received no training for exercises, not performing such exercises prior to the surgery and willing to participate in the study.

Sampling technique:

- A convenient sample of sixty patients, were selected from the previously mentioned settings at the time of data collection. The total sample size was 290/ year.

- By using the equal allocation method, the sixty patients were divided into control and intervention group, 30 patients each to participate in the research.

Sample size:

The sample size was estimated using Epi info 7 statistical program using the following parameters; population size approximately =290/ year, expected

frequency =50%, maximum error =10%, confidence coefficient =95%, so estimated sample size =60.

Tools of the study:

In order to collect the necessary data for the study, three tools were used:

Tool (I): Socio-demographic and clinical data this tool was developed by the researchers after reviewing related literature to obtain baseline data (**Vidmar et al., 2017; Bray et al., 2018**). It consisted of two parts as follows:

Patients' Socio-demographic and clinical data: include age, educational level, marital status, occupation, nature of daily activities and residence area. Patient's weight, height and body mass index.

Tool (II): The urinary incontinence questionnaire: International Consultation on Incontinence Questionnaire-Urinary Incontinence Short Form (ICIQ-UI SF) is a brief assessment tool used to assess the patients' degree of incontinence and impact of urinary incontinence (UI) on quality of life (QoL) developed by (**Every et al 2004**) and translated and validated by (**Hesham et al 2006**) included 4 items:

1- Frequency of urine leakage (with the score ranging from 0 to 5).

2- Degree of incontinence (with the score ranging from 0 to 6).

3- Timing of urine leakage.

4- Effect of urine leakage on patient's quality of life (with the score ranging from 0 to 10).

Scoring system: The overall score of the questionnaire varied from 0 to 21.

0: < 7 Mild degree of incontinence.

7: <14 Moderate degree of incontinence.

14: 21 Severe degree of incontinence.

Tool (III): The quality of life questionnaire I-QOL: It was developed by (**Wagner et al, 1996**) to evaluate health-related quality of life concerns that affect patients with urinary incontinence. It includes 22 negatively framed items in the 3 dimensions of psychological effects (9 items 5, 6, 7, 9, 15, 16, 17, 21, and 22), avoidance behaviors (8 items 1, 2, 3, 4, 10, 11, 13, and 20) and social embarrassment effects (5 items 8, 12, 14, 18 and 19).

Scoring: Each question was scored on a five-point Likert scale (1 = extremely, 2 = quite a bit, 3 = moderately, 4 = a little, 5 = not at all) with scores ranging of 0–110. Higher scores signified a higher quality of life. Satisfied 88 < 110, Mostly satisfied 66 < 88, Moderate 44 < 66, Mostly dissatisfied 22 < 44, Dissatisfied 1 < 22.

Method:

• Administrative process:

The study protocol was approved by the Ethical Research Committee at the Faculty of Nursing Damanhur University and the permission of the hospital's administration to execute the research, was taken after explanation aim of the study, the date and time of data collection.

• Tools' validity and reliability:

- The study tools were arranged either constructed by the researchers (tool I) or adapted (tool II, and tool III).

- The developed tools were observed for content validity by five experts in Gerontological and Medical-Surgical nursing for its content validity, clarity of the items, appropriateness of Arabic translation and the necessary modifications were done.

- The tools were tested for its reliability by measuring the internal consistency of items using Cronbach's alpha. The value was 0.85 and 0.88 consequently

• Pilot study:

Pilot study was implemented on 6 patients with prostatectomy, not included in the study subjects to judge the applicability, clarity and feasibility of the study tools, and to determine also, the estimated time to complete the study tools. Based on pilot study findings, the needed modifications were done.

• Instructional pamphlet preparation:

Instructional pamphlet was prepared by the researchers based on reviewing of all relevant literature (**Continence Foundation of Australia; Schröder et al., 2010; Thüroff et al., 2011**). It includes information about anatomy and function of the pelvic floor muscles, definition of UI, factors improve muscle strength, definition and benefits of pelvic floor muscles strengthening exercise how to perform it. Moreover, it contains illustrative and simple pictures. Easy, clear and brief language for instruction were considered during the preparation. Thirty pamphlets were printed and given to each adult and older adult in the intervention group, two days after the urinary catheter was removed post-surgery for the patients who were assessed for the presence of urinary incontinence.

• Data collection:

- Data was collected by the researchers during the period from the beginning of January to the end of September 2020.

- Each adult and older adult for prostatectomy was interviewed individually in the waiting area of the outpatient clinics and in total privacy to assure confidentiality of information and its utilization only for the purpose of the research. while sitting comfortably, the researchers explained the purpose of the study in order to gain patients' cooperation, then the necessary data was collected.

Pelvic Floor Muscles Strengthening Exercise:**I. Assessment phase:**

- Each patient in the intervention and control group was interviewed individually pre-operative to collect the baseline patient's data using tool **I**, **II** and **III**. This interview took about 25 to 30 minutes. At the end of assessment phase, the researchers calculated the body mass index for each patient.

Implementation phase:

• The control group was left for routine hospital management

• The teaching and training sessions started before surgery (preoperative care) for all intervention group. The application of the exercise conducted two days after the urinary catheter was removed post-surgery for the patients who were assessed for the presence of urinary incontinence. Other patients, who had no complaints about incontinence two days after the removal of the urinary catheter, were excluded from the intervention.

• The pelvic floor muscles strengthening exercise was implemented individually and privately for men and was applied in 4 session each one took about 25-30 minutes.

• During the first session, the researchers explained the aim of the study for the patients individually and privately. They were used the anatomically exact models and diagrams for teaching the patient about the anatomy and function of the pelvic floor muscles, functions of the bladder and urethra, definition of UI, how to improve the muscles strength, definitionand benefits of pelvic floor muscle exercise. Thisinformation present in previously prepared instructional pamphlet.

• During the second session,

- The patients were taught to practice pelvic floor muscle strengthening exercises in various functional positions, such as lying down and standing upright. These exercises involved a series of pelvic floor muscle contractions in different positions, including, the supine position with bent knees, the sitting position, and the standing position.

- The patients were initially advised to maintain contractions for 3 seconds, followed by 5 seconds of rest, and then to gradually increase the duration of contractions to 10 seconds. These exercises were performed 3 times per day, lasting for 12 consecutive weeks, and gradually increasing to 60 contractions per day.

- Patients were also advised to repeat the exercises every day at home, as well as while performing normal day-to-day activities, including raising objects, squatting on the ground, coughing and sitting down or rising from a chair. Patients performed a home exercise of 60 contractions per day.

- The regular practice of exercises was continued for 3 months after the surgery.

• During the third session, it is concerned with the patient performance and repeating of this exercise to confirm his proper practice.

• During the fourth session, the instructional pamphlet was given to each patient in the intervention group to support the teaching and help for reviewing the exercise performance at home.

Evaluation phase:

- Postoperatively, all 60 patients were routinely followed-up in an outpatient clinic at 1 week, 1month and 3 months after surgery to evaluate the effect of exercise implementation by using tool II and III.

- The researchers were ensure the patients' adherence for the exercise performance and resolve any potential problems, by weekly telephone communication for patient.

Ethical considerations

A written informed consent was obtained from adult and older adults to participate in the study after explanation of the study purpose and its potential benefits. Issues related to privacy/ anonymity and confidentiality of the collected data were maintained. Also ensure their rightto withdraw from the study at any time without any consequences.

Statistical analysis:

After data collection, it was revised, coded and fed to statistical software SPSS version 20. The given graphs were constructed using Microsoft excel software. All statistical analysis was done using two tailed tests and alpha error of 0.05. The level of significance selected for this study was P equal to or less than 0.05.

Results

Table (1): showed that the mean age of both the control group and the intervention group had nearly similar (59.90 ± 5.14 , 59.07 ± 8.12 respectively) and 43.3% of the control group compared to 36.7% of the intervention group had bachelor degree of education. Additionally, (56.7%, 60.0% respectively) of the control and intervention groups were married, the highest percentage of the two groups (73.3%, 76.7% respectively) were working and (43.3%) of the intervention group reported vigorous daily activities. Concerning the BMI, a similar percentage 93.3% of the two groups were obese. Lastly, 36.7% of the intervention group were active smokers.

Table (2): Revealed that less than three quarters (73.3%) of the intervention group had reported their urinary leakage to have occurred several times a day seven days after the surgery. Then, it lessened to 6.7% no longer experienced this problem three months after applying of pelvic floor muscle strengthening exercise with a statistically significant difference between them ($F_r = 76.596$, $P=0.001$) ($\chi^2(p_2) = 50.266$, $MCp=0.001$) ($\chi^2(p_3) = 51.034$, $MCp=0.001$). Whereas, more than half of the intervention group (53.3%) reported a moderate amount of urinary leakage seven days following the surgery and the rest of them (26.7%, 20.0% respectively) had monitored a small and a large amount of urinary leakage. Three months after surgery, two thirds of the intervention group (66.7%) no longer experienced this problem and the rest of them (33.3%) reported a small amount of urinary leakage after applying the pelvic floor muscle strengthening exercise with a statistically significant difference between them ($P=0.001$, $MCp=0.014$ & $MCp=0.001$)

Furthermore, it can be noticed that the urine leakage interferes with everyday life of the control group that had a mean score of (9.20 ± 2.04 , 9.17 ± 0.75 ,

8.97 ± 0.72 respectively) 7 days, first, and third month after surgery with a statistically significant difference between them (, $P=0.001$). While, after management with the intervention group the improvement in everyday life was most pronounced and progressed more gradually that the mean score was (9.80 ± 0.41 , 7.53 ± 1.14 , 1.17 ± 2.23 respectively) 7 days, first, and third month after surgery with a statistically significant difference between them ($P=0.001$, $p=0.001$ and $p=0.001$).

Table (3): Revealed that the vast majority of the control group (93.3%) had experienced sever urinary incontinence seven days, one and three month following the surgery with total mean score (14.57 ± 1.99 , 14.67 ± 1.54 , 14.27 ± 1.39 respectively). While, the intervention group (53.3%, 90.0% respectively) had moderate, and mild urinary incontinence respectively after management one and three month after surgery (the total mean score 11.53 ± 1.91 , 2.17 ± 3.28 , respectively) with a statistically significant difference between the two period ($F = 330.665$, $p = <0.001$). Moreover, statistically significant differences were found between the control and intervention group across the study ($\chi^2 = 15.556$, $p = <0.001$) ($\chi^2 = 63.447$, $p = <0.001$), ($t = 7.004$, $p = <0.001$) ($t = 18.604$, $p = <0.001$).

Table 4: As for the avoidance behavior dimension of quality of life, the table showed that the total mean score of the control group was (12.97 ± 2.47 , 13.80 ± 2.99 , 15.30 ± 4.53 respectively) 7 days, first, and third month after surgery. While, it was greater in the intervention group after the management reach to (18.37 ± 3.30 , 35.87 ± 7.12 respectively).

With respect to the psychological dimension of the quality of life, no statistically significant difference was observed between the two groups seven days after surgery. As for the social embarrassment dimensions of quality of life, showed a statistically significant difference between the control and the intervention group one, and three months after the management ($p = <0.001$) ($p = <0.001$).

Table 5: showed statistically significant differences in the levels of total quality of life between the control and the intervention group whether one or three months after the program ($\chi^2 = 21.156$, $P = <0.001$, $\chi^2 = 61.524$, $P = <0.001$, $t = 6.737$, $P = <0.001$, $t = 10.135$, $P = <0.001$).

Table (1): Distribution of the control and the intervention group according to their socio-demographic and clinical data (n=60)

Socio-demographic characteristics	Control (n = 30)		Intervention (n = 30)		Test of Sig.	p
	No.	%	No.	%		
Age (years)						
50 -	17	56.7	13	43.3		
60 -	11	36.7	12	40.0	$\chi^2 =$	
≥ 70	2	6.7	5	16.7	1.807	^{MC} p= 0.387
Min. – Max.	52.0 – 71.0		48.0 – 74.0			
Mean \pm SD.	59.90 ± 5.14		59.07 ± 8.12		t=	0.637
Median	58.0		60.0		0.475	
Education level						
Illiterate	5	10.0	7	23.3		
Read & write or primary	12	40.0	10	33.3	$\chi^2 =$	
Secondary	2	6.7	2	6.7	6.521	^{MC} p= 0.129
Bachelor	13	43.3	11	36.7		
Marital status						
Single	0	0.0	2	6.7	$\chi^2 =$	
Married	17	56.7	18	60.0	2.059	^{MC} p= 0.352
Widowed	13	43.3	10	33.3		
Area of residence						
Urban	17	56.7	16	53.3	$\chi^2 =$	
Rural	13	43.3	14	46.7	0.067	0.795
Occupation						
Working	22	73.3	23	76.7	$\chi^2 =$	
Not work	8	26.7	7	23.3	0.089	0.766
Type of work						
Technical	11	50.0	10	43.5		
Clerical	7	31.8	8	34.8	$\chi^2 =$	
Professional	4	18.2	5	21.8	6.248	^{MC} p= 0.072
Weight (Kg)						
Min. – Max.	73.0 – 113.0		75.0 – 121.0			
Mean \pm SD.	95.70 ± 11.56		99.73 ± 13.63		t=	0.221
Median	95.0		97.50			
Height						
Min. – Max.	162.0 – 176.0		155.0 – 176.0			
Mean \pm SD.	168.8 ± 3.90		165.3 ± 5.28		t=	0.006*
Median	168.0		165.0		2.864*	
BMI						
Overweight 25-<30	2	6.7	2	6.7	$\chi^2 =$	
Obese ≥ 30	28	93.3	28	93.3	0.00	^{FE} p= 1.000
Min. – Max.	26.81 – 40.64		29.30 – 45.79			
Mean \pm SD.	34.83 ± 3.91		36.48 ± 4.72		t=	0.146
Median	33.42		35.66		1.472	
Nature of daily activities						
Light	4	13.3	5	16.7	$\chi^2 =$	
Moderate	13	43.3	12	40.0	0.225	^{MC} p= 1.000
Vigorous	13	43.3	13	43.3		
Smoking status						
Active	6	20.0	11	36.7	$\chi^2 =$	
Passive	7	23.3	6	20.0	2.081	0.353
Non smoking	17	56.7	13	43.3		

χ^2 : Chi square test

MC: Monte Carlo

FE: Fisher Exact

t: Student t-test

p: p value for comparing between the studied groups

*: Statistically significant at $p \leq 0.05$

Table (2): Distribution of the control and the intervention group according to their degree of urinary incontinence on 7days,1 month and 3months after prostatectomy (n=60)

Urinary incontinence questionnaire	Control (n =30)						Intervention (n =30)						$\chi^2(p_1)$	$\chi^2(p_2)$	$\chi^2(p_3)$
	Day 7	1 month	3 months	Day 7	1 month	3 months	No.	%	No.	%	No.	%			
How often do you leak urine?															
About once a week or less	2	6.7	2	6.7	0	0.0	0	0.0	0	0.0	16	53.3			
2or 3 times a week	4	13.3	2	6.7	2	6.7	5	16.7	12	40.0	12	40.0	6.765	50.266*	51.034*
About once a day	3	10.0	0	0.0	2	6.7	2	6.7	16	53.3	0	0.0	(MC p=0.126)	(MC p<0.001*)	(MC p<0.001*)
Several times a day	15	50.0	24	80.0	26	86.7	22	73.3	2	6.7	2	6.7			
All the time	6	20.0	2	6.7	0	0.0	1	3.3	0	0.0	0	0.0			
Fr (p₀)	0.943(0.815)						76.596*(<0.001*)								
How much urine do you usually leak?															
Non	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	20	66.7			
A small amount	10	33.3	9	30.0	11	36.7	8	26.7	20	66.7	10	33.3	2.254	8.522*	41.285*
A moderate amount	18	60.0	19	63.3	19	63.3	16	53.3	10	33.3	0	0.0	(MC p=0.406)	(MC p=0.014*)	(<0.001*)
A large amount	2	6.7	2	6.47	0	0.0	6	20.0	0	0.0	0	0.0			
Fr (p₀)	4.778(0.189)						63.143* (<0.001*)								
Overall, how much does leaking urine interfere with your everyday life?															
MIN. – MAX.	2.0 – 10.0						8.0 – 10.0								U=31.0*
Mean ± SD.	9.20±2.04						9.17±0.758						U=408 (0.400)	U=115.0* (<0.001*)	
Median	10.0						9.0								
Fr (p₀)	33.892* (<0.001*)						87.699* (<0.001*)								
When does urine leak?															
When you don't leak	6	20.0	0	0.0	0	0.0	12	40.0	10	33.3	20	66.7	2.857(0.091)	12.0* (0.001*)	30.0(<0.001*)
the toilet	23	76.7	20	66.7	20	66.7	28	93.3	27	90.0	6	20.0	3.268 (FE p=0.145)	4.812* (0.028*)	13.30* (<0.001*)
sneeze	28	93.3	28	93.3	28	93.3	23	76.7	23	76.7	10	33.3	3.27(*MC p=0.14)	3.27(*MC p=0.14)	23.25*(<0.001*)
When you are asleep	22	73.3	24	80.0	24	80.0	15	50.0	5	16.7	2	6.7	5.455 (0.063)	24.09*	32.85*
With exercising	20	66.7	22	73.3	20	66.7	15	50.0	10	33.3	2	6.7	1.714(0.190)	9.643*	23.25*
After finished urinating and dressed	14	46.7	16	53.3	16	53.3	8	26.7	0	0.0	0	0.0	2.584(0.108)	21.82*	21.82*
For no obvious reason	4	13.3	2	6.7	2	6.7	1	3.3	0	0.0	0	0.0	1.96(*MC p=0.35)	2.07(*MC p=0.49)	2.07(*MC p=0.49)
All the time	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	-	-	-

χ^2 : Chi square test

MC: Monte Carlo

U: Mann Whitney test

Fr: Friedman test

p₁: p value for comparing between the studied groups in **Day 7**

p₂: p value for comparing between the studied groups in **after 1 month**

p₃: p value for comparing between the studied groups in **after 3 months**

po: p value for comparing between the studied periods in **each group**

*: Statistically significant at p ≤ 0.05

Table (3): Distribution of the control and the intervention group according to their degree of urinary incontinence and the total mean scores after prostatectomy (n=60)

Degree Urinary incontinence	Control (n = 30)						Intervention (n = 30)						Test of sig.(p ₁)	Test of sig. (p ₂)	Test of sig. (p ₃)
	Day 7		1 month		3 months		Day 7		1 month		3 months				
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%			
Mild	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	27	90.0	$\chi^2=2.069$ (0.150)	$\chi^2=15.556^*$ (<0.001*)	$\chi^2=63.447^*$ (<0.001*)
Moderate	2	6.7	2	6.7	2	6.7	0	0.0	16	53.3	2	6.7			
Severe	28	93.3	28	93.3	28	93.3	30	100.0	14	46.7	1	3.3			
Total score	14.57 ± 1.99		14.67 ± 1.54		14.27 ± 1.39		15.37 ± 1.00		11.53 ± 1.91		2.17 ± 3.28		$t=1.964$ (0.056)	$t=7.004^*$ (<0.001*)	$t=18.604^*$ (<0.001*)
F(p ₀)	0.790(0.459)						330.665*(<0.001*)								

χ^2 : Chi square test t: Student t-test

p₁: p value for comparing between the studied groups in Day 7

p₂: p value for comparing between the studied groups in after 1 month

p₃: p value for comparing between the studied groups in after 3 months

p₀: p value for comparing between the studied periods in each group *: Statistically significant at $p \leq 0.05$

Table (4): Distribution of the control and the intervention group according to their mean score incontinence quality of life domains after prostatectomy (n=60)

I-QOL domains	Control (n=30)			Intervention (n=30)			t(p ₁)	t(p ₂)	t(p ₃)
	Day 7	1 month	3 months	Day 7	1 month	3 months			
Avoidance behaviors									
Total score	(8–40)			9.0 – 16.0			0.503	5.623*	13.346*
Min. – Max.	8.0 – 17.0	10.0 – 19.0	10.0 – 23.0	9.0 – 16.0	13.0 – 24.0	12.0 – 40.0			
Mean ± SD.	12.97	$\pm 3.80 \pm 2.99$	15.30 ± 4.53	12.67 ± 2.14	18.37 ± 3.30	35.87 ± 7.12	(0.617)	(<0.001*)	(<0.001*)
Median	12.0	13.0	14.0	12.50	18.0	39.0			
F(p ₀)	2.534(0.062)			212.233*(<0.001*)					
Psychological effects									
Total score	(9–45)			9.0 – 27.0			0.163	5.474*	11.523*
Min. – Max.	9.0 – 29.0	10.0 – 24.0	13.0 – 35.0	9.0 – 27.0	15.0 – 33.0	13.0 – 45.0			
Mean ± SD.	16.37	$\pm 17.27 \pm 4.91$	18.20 ± 7.16	16.13 ± 5.0	24.30 ± 5.05	40.87 ± 8.05	(0.871)	(<0.001*)	(<0.001*)
Median	14.0	17.0	14.0	14.0	25.50	44.0			
F(p ₀)	1.142(0.337)			134.214*(<0.001*)					
Social embarrassment									
Total score	(5–25)			6.0 – 20.0			0.455	6.062*	12.467*
Min. – Max.	5.0 – 13.0	5.0 – 16.0	6.0 – 16.0	6.0 – 15.0	6.0 – 20.0	7.0 – 25.0			
Mean ± SD.	8.20 ± 2.41	8.80 ± 2.68	9.33 ± 3.58	8.50 ± 2.69	14.07 ± 3.93	22.77 ± 4.70	(0.651)	(<0.001*)	(<0.001*)
Median	7.0	9.0	7.0	7.0	14.0	25.0			
F(p ₀)	1.355(0.262)			172.204*(<0.001*)					

t: Student t-test

F: F test (ANOVA) with repeated measures

p₁: p value for comparing between the studied groups in Day 7 p₂: p value for comparing between the studied groups in after 1 month

p₃: p value for comparing between the studied groups in after 3 months

p₀: p value for comparing between the studied periods in each group *: Statistically significant at $p \leq 0.05$

Table (5): Distribution of the control and the intervention group according to the total quality of life questionnaire I-QOL and the total mean scores after prostatectomy (n=60)

Total quality of life	Control (n = 30)						Intervention (n = 30)						Test of sig.(p ₁)	Test of sig. (p ₂)	Test of sig. (p ₃)						
	Day 7	1 month	3 months	Day 7	1 month	3 months	Day 7	1 month	3 months	Day 7	1 month	3 months									
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%									
Satisfied	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	28	93.3									
Mostly satisfied	0	0.0	0	0.0	8	26.7	0	0.0	7	23.3	0	0.0	$\chi^2=2.455$ (0.117)	$\chi^2=21.156^*$ (<0.001*)	$\chi^2=61.524^*$ (<0.001*)						
Moderate	4	13.3	10	33.3	8	26.7	9	30.0	19	63.3	0	0.0									
Mostly dissatisfied	26	86.7	20	66.7	14	46.7	21	70.0	4	13.3	2	6.7									
dissatisfied	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0									
Total mean score	37.53			$\pm 39.87 \pm 7.66$			42.83 ± 13.05			42.83 ± 13.05			$t=0.100$	$t=6.737^*$	$t=10.135^*$						
QOL	9.86						(0.921)														
F(p ₀)	3.341(0.079)						195.046*(<0.001*)														

χ^2 : Chi square test

t: Student t-test

F: F test (ANOVA) with repeated measures

p₁: p value for comparing between the studied groups in **Day 7 1 month**. p₃: p value for comparing between the studied groups in **each group**
 *: Statistically significant at $p \leq 0.05$

Discussion:

Nowadays, prostate cancer is an endemic disease and thus its related complications, especially urinary incontinence, are prevalent phenomena. Although Improvements in anatomical knowledge and surgical techniques have frequently decrease morbidity after radical prostatectomy. Nevertheless, many patients suffer from moderate to severe urinary incontinence after surgery which significantly impairs quality of life (**Lim, 2017**) and leads to physical, social, psychological, and economic burden for patients' families. UI after RP results mainly from urethral sphincter deficiency or detrusor over activity (**Hoyland et al., 2014**). While previous studies have described incontinence problems that may occur post- procedurally in patients undergoing RP and have emphasized the positive effect pelvic floor muscles exercise on these problem. Pelvic floor muscle exercise (PFME) is the most prominent conservative treatment for UI, and it involves repeated contractions to increase the strength and endurance of the striated muscles of the pelvic floor. Partially compensating the urethral sphincter insufficiency. PFME is thought to be an economical and safe therapy for patients. In order to correctly isolate and contract the pelvic floor muscles, patients usually need the guidance of a professional therapist (**Santa Mina et al., 2014; Pedriali et al., 2016**). Therefore, this study was carried out in order to determine the effect the effect of pelvic Floor muscle Strengthening exercise on urinary incontinence and quality of life in Patients after prostatectomy.

The present study revealed that majority of the studied group are obese and reported high BMI which have adverse impact on incontinence this result agrees with Previous studies have reported that increased BMI also increases the risk of cancer and urinary incontinence (**Dickerman et al., 2017**). Also (**Matsushita et al., 2015**) revealed Investigation of urinary incontinence after RP reported that high BMI has a negative effect on urinary incontinence

In the current study, since the difference between the intervention and control groups was not significantly differences, it does not constitute a risk to the credibility of the research. Because being overweight is an important risk factor for incontinence, the presence of subjects with a higher BMI in the intervention group is a useful factor in the evaluation of the PFME training effectiveness this result in line with (**Aydin Saylan & Özbaş, 2018**).

The results indicate clear outcomes of less amount of urine leakage, reduced frequency of leak urine and Significant improvement of urine leaking effect on their life of intervention patients who

. p₂: p value for comparing between the studied groups in **after 3 months**. p₀: p value for comparing between the studied periods in **each group**
 *: Statistically significant at $p \leq 0.05$

received more intensive PFM training, compared to the control group protocol. This may due to the effect of PFM exercise for the intervention group. This finding is consistent with some previous research which indicate that longer PFM training before surgery or higher frequency and / or intensity is more likely to be beneficial (**Patel et al., 2013; Chang et al., 2016**).

As regard assessment of the leakage time showed that seven days and one month after the intervention, most participants in both groups have experienced multiple leaks a day especially before reaching the bathroom. Yet, one months after the intervention, the control group still experienced leakage several times per day while the intervention group about half of them improved to once a day only. Three months after the intervention, the problem still persisted in the control group as severely as it did during the first months while the intervention group didnot seem to be experiencing the urinary leakage problem anymore. This result can be explained by positive effect of PFM training that make pelvic muscles stronger and improve the bladder control. These results consistent with the results obtained by (**Milios et al. (2019)**) who found broader changes in the timing of urine leakage in the intervention group compared with those of the control group.

The results obtained from comparing the degree of post prostatectomy urinary incontinence in patients seven days, and after one month, three months after the training showed both groups to have severe urinary incontinence seven days after the surgery. However, one month after the intervention, about half of the intervention group and a few of the control group had moderate urinary incontinence. The third months after the intervention, however, the majority of intervention group had a mild degree of urinary incontinence while no improvements were observed in the control group compared to the first month. This may be indicated that performing the exercises and sticking to them can lead to even better results in the patients. The results of the present study seem to be in concordance with those of the studies conducted by (**Mungovan et al. (2016), Wu et al. (2019)**) who also emphasize better results can be achieved three months after constant exercise and increased duration and repeating of pelvic floor muscle exercises, and also believe them to be effective in improving the quality of life in patients.

Findings of the present study revealed that, the intervention group had no serious effects on their quality of life from urinary disorders after three months of the program with a statistically significant difference and about half of the control group had quit a bite effect on their quality of life three month following the surgery; this may be due to the improvements in the psychological, social effects and avoidance behaviors

dimensions that had significant improvement in the intervention group after the PFME program. Furthermore, the results have underscored the effectiveness of training and persisting in the exercises in improving the quality of life and reducing numerous psychological and social complications of incontinence such as, shame and embarrassment, lack of pleasure in daily activities and social relations. Urinary incontinence has often been reported to cause embarrassing situations and have a dramatic effect on the patients' social and emotional activities and indicators, thus reducing their personal quality of life (Wang et al., 2014).

It is inconsistent with results of the study by McCaughey et al. (2018) who reported the effect on various social and psychological aspects of an individual's life, limiting their ability to find pleasure in daily activities, trips and personal relationships.

Geraerts et al. (2013) study result found that Pelvic floor muscle exercises made significant improvements in an individual's quality of life and their ability to participate in social activities and reduced the negative effects of urinary incontinence on their life. Compliance with performance of these exercises not only reduce urinary incontinence, additionally improved the patients' quality of life and modified their lifestyle.

Conclusions

From the results of current study we can concluded that applying of pelvic floor muscle strengthening exercise had statistically significant improvement on degree of urinary incontinence and quality of life among post prostatectomy patients.

Patient after prostatectomy who practice the pelvic floor muscles strengthening exercise have higher quality of life than the control group.

Recommendation:

- The nurses should emphasize to provide continuous follow up care for reinforcing the series of the pelvic floor muscle exercises and stimulating the motivation to persist in the urinary incontinence treatment.

- Administrator should plan for periodic teaching program for post prostatectomy patients as one of their policies and procedures.

- Provide accurate information in the newspaper, magazine articles, radio, television programs, and special educational programs in adult and older adult health sectors

- Enhance a manual booklet with simple instructions and illustrations, which can be used as a teaching aid for incontinent patients.

- Further studies need to be conducted to evaluate the incidence, prevalence of urinary incontinence after prostatectomy in Egypt.

Study Limitations:

There is no national study that have discussed the PFME among prostatectomy older adults in Egypt.

References

- Almarkhan, M. H., Sawma, A. I., Alruwaili, F. S., Alsaqabi, Q., Alonazi, M. A., Alruwaili, W. S., Alanazi, N. H., & Alotaibi, H. J. (2018). Prevalence of Benign Prostatic Hyperplasia (BPH) in Saudi Patients above 40 Years Old. *The Egyptian Journal of Hospital Medicine*, 70(7), 1137-1139. <https://doi.org/10.12816/0044539>.**
- Appleton, L., Wyatt, D., Perkins, E., Parker, C., Crane, J., Jones, A., Moorhead, L., Brown, V., Wall, C., & Pagett, M. (2015). The impact of prostate cancer on men's everyday life. *European journal of cancer care*, 24(1), 71-84. <https://doi.org/10.1111/ecc.12233>.**
- Aydin Sayilan, A., & Özbaş, A. (2018). The Effect of Pelvic Floor Muscle Training On Incontinence Problems After Radical Prostatectomy. *American journal of men's health*, 12(4), 1007-1015. <https://doi.org/10.1177/1557988318757242>.**
- Baker, H., Wellman, S., & Lavender, V. (2016). Functional Quality-of-Life Outcomes Reported by Men Treated for Localized Prostate Cancer: A Systematic Literature Review. *Oncology nursing forum*, 43(2), 199-218. <https://doi.org/10.1188/16.onf.199-218>.**
- Bray, F., Ferlay, J., Soerjomataram, I., Siegel, R. L., Torre, L. A., & Jemal, A. (2018). Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: a cancer journal for clinicians*, 68(6), 394-424. <https://doi.org/10.3322/caac.21492>.**
- Chang, J. I., Lam, V., & Patel, M. I. (2016). Preoperative Pelvic Floor Muscle Exercise and Postprostatectomy Incontinence: A Systematic Review and Meta-analysis. *European urology*, 69(3), 460-467. <https://doi.org/10.1016/j.eururo.2015.11.004>.**

Continence Foundation of Australia. Privacy Policy.
<https://www.continence.org.au/privacy-policy>.
 [Accessed in: Dec, 2021]

Dickerman, B. A., Ahearn, T. U., Giovannucci, E., Stampfer, M. J., Nguyen, P. L., Mucci, L. A., & Wilson, K. M. (2017). Weight change, obesity and risk of prostate cancer progression among men with clinically localized prostate cancer. *International journal of cancer*, 141(5), 933-944. <https://doi.org/10.1002/ijc.30803>.

Dijkstra-Eshuis, J., Van den Bos, T. W., Splinter, R., Bevers, R. F., Zonneveld, W. C., Putter, H., Pelger, R. C., & Voorham-van der Zalm, P. J. (2015). Effect of preoperative pelvic floor muscle therapy with biofeedback versus standard care on stress urinary incontinence and quality of life in men undergoing laparoscopic radical prostatectomy: a randomised control trial. *Neurourology and urodynamics*, 34(2), 144-150. <https://doi.org/10.1002/nau.22523>.

Fitzmaurice, C., Allen, C., Barber, R. M., Barregard, L., Bhutta, Z. A., Brenner, H., Dicker, D. J., Chimed-Orchir, O., Dandona, R., Dandona, L., Fleming, T., Forouzanfar, M. H., Hancock, J., Hay, R. J., Hunter-Merrill, R., Huynh, C., Hosgood, H. D., Johnson, C. O., Jonas, J. B., Khubchandani, J., ... (2017). Global, Regional, and National Cancer Incidence, Mortality, Years of Life Lost, Years Lived With Disability, and Disability-Adjusted Life-years for 32 Cancer Groups, 1990 to 2015: A Systematic Analysis for the Global Burden of Disease Study. *JAMA oncology*, 3(4), 524-548. <https://doi.org/10.1001/jamaoncol.2016.5688>.

Gavin, A. T., Drummond, F. J., Donnelly, C., O'Leary, E., Sharp, L., & Kinnear, H. R. (2015). Patient-reported 'ever had' and 'current' long-term physical symptoms after prostate cancer treatments. *BJU international*, 116(3), 397-406. <https://doi.org/10.1111/bju.13036>.

Geraerts, I., Van Poppel, H., Devoogdt, N., Joniau, S., Van Cleynenbreugel, B., De Groef, A., & Van Kampen, M. (2013). Influence of preoperative and postoperative pelvic floor muscle training (PFMT) compared with postoperative PFMT on urinary incontinence after radical prostatectomy: a randomized controlled trial. *European urology*, 64(5), 766-772. <https://doi.org/10.1011/bju.13087>.

Hashim H, Avery K, Mourad MS, Chamssuddin A, Ghoniem G, Abrams P. 2006;The Arabic ICIQ-UI SF: An alternative language version of the English ICIQ-UI SF Neurol Urology. 25:277–82.

Hall, L. M., Aljuraifani, R., & Hodges, P. W. (2018). Design of programs to train pelvic floor muscles in men with urinary dysfunction: Systematic review. *Neurourology and urodynamics*, 37(7), 2053-2087. <https://doi.org/10.1002/nau.23593>.

Hoyland, K., Vasdev, N., Abrof, A., & Boustead, G. (2014). Post-radical prostatectomy incontinence: etiology and prevention. *Reviews in urology*, 16(4), 181-188.

Hsu, L. F., Liao, Y. M., Lai, F. C., & Tsai, P. S. (2016). Beneficial effects of biofeedback-assisted pelvic floor muscle training in patients with urinary incontinence after radical prostatectomy: A systematic review and metaanalysis. *International journal of nursing studies*, 60, 99-111. <https://doi.org/10.1016/j.ijnurstu.2016.03.013>.

Lardas, M., Liew, M., van den Bergh, R. C., De Santis, M., Bellmunt, J., Van den Broeck, T., Cornford, P., Cumberbatch, M. G., Fossati, N., Gross, T., Henry, A. M., Bolla, M., Briers, E., Joniau, S., Lam, T. B., Mason, M. D., Mottet, N., van der Poel, H. G., Rouvière, O., Schoots, I. G., ... (2017). Quality of Life Outcomes after Primary Treatment for Clinically Localised ProstateCancer: A Systematic Review. *European urology*, 72(6), 869-885. <https://doi.org/10.1016/j.eururo.2017.06.035>.

Lim, K. B. (2017). Epidemiology of clinical benign prostatic hyperplasia. *Asian journal of urology*, 4(3), 148-151. <https://doi.org/10.1016/j.ajur.2017.06.004>.

Matsushita, K., Kent, M. T., Vickers, A. J., von Bodman, C., Bernstein, M., Touijer, K. A., Coleman, J. A., Laudone, V. T., Scardino, P. T., Eastham, J. A., Akin, O., & Sandhu, J. S. (2015). Preoperative predictive model of recovery of urinary continence after radical prostatectomy. *BJU international*, 116(4), 577-583. <https://doi.org/10.1111/bju.13087>.

McCaughan, E., Curran, C., Northouse, L., & Parahoo, K. (2018). Evaluating a psychosocial intervention for men with prostate cancer and their partners: Outcomes and lessons learned from a randomized controlled trial. *Applied nursing research : ANR*, 40, 143-151. <https://doi.org/10.1016/j.apnr.2018.01.008>.

Milios, J. E., Ackland, T. R., & Green, D. J. (2019). Pelvic floor muscle training in radical prostatectomy: a randomized controlled trial of the impacts on pelvic floor muscle function and urinary incontinence. *BMC urology*, 19(1), 116. <https://doi.org/10.1186/s12894-019-0546-5>.

- Mohamad Al-Ali, B., Ponholzer, A., Augustin, H., Madersbacher, S., & Pummer, K. (2017).** The Long-Term Effect of Radical Prostatectomy on Erectile Function, Urinary Continence, and Lower Urinary Tract Symptoms: A Comparison to Age-Matched Healthy Controls. *BioMed research international*, 2017, 9615080. <https://doi.org/10.1155/2017/9615080>.
- Mungovan, S. F., Huijbers, B. P., Hirschhorn, A. D., & Patel, M. I. (2016).** What makes men leak? An investigation of objective and self-report measures of urinary incontinence early after radical prostatectomy. *Neurourology and urodynamics*, 35(2), 225-229. <https://doi.org/10.1002/nau.22701>.
- Patel, M. I., Yao, J., Hirschhorn, A. D., & Mungovan, S. F. (2013).** Preoperative pelvic floor physiotherapy improves continence after radical retropubic prostatectomy. *International journal of urology*, 20(10), 986-992. <https://doi.org/10.1111/iju.12099>.
- Pedriali, F. R., Gomes, C. S., Soares, L., Urbano, M. R., Moreira, E. C., Averbeck, M. A., & de Almeida, S. H. (2016).** Is pilates as effective as conventional pelvic floor muscle exercises in the conservative treatment of post-prostatectomy urinary incontinence? A randomised controlled trial. *Neurourology and urodynamics*, 35(5), 615-621. <https://doi.org/10.1002/nau.22761>.
- Rawla, P. (2019).** Epidemiology of Prostate Cancer. *World journal of oncology*, 10(2), 63-89. <https://doi.org/10.14740/wjon1191>.
- Santa Mina, D., Matthew, A. G., Hilton, W. J., Au, D., Awasthi, R., Alibhai, S. M., Clarke, H., Ritvo, P., Trachtenberg, J., Fleshner, N. E., Finelli, A., Wijeyesundara, D., Aprikian, A., Tanguay, S., & Carli, F. (2014).** Prehabilitation for men undergoing radical prostatectomy: a multi-centre, pilot randomized controlled trial. *BMC surgery*, 14, 89. <https://doi.org/10.1186/1471-2482-14-89>.
- Schröder, A., Abrams, P., & Andersson, K. E. (2010).** *EAU guidelines on urinary incontinence*. European Association of Urology.
- Stafford, R. E., Ashton-Miller, J. A., Constantinou, C., Coughlin, G., Lutton, N. J., & Hodges, P. W. (2016).** Pattern of activation of pelvic floor muscles in men differs with verbal instructions. *Neurourology and urodynamics*, 35(4), 457-463. <https://doi.org/10.1002/nau.22745>.
- Thüroff, J. W., Abrams, P., Andersson, K. E., Artibani, W., Chapple, C. R., Drake, M. J., Hampel, C., Neisius, A., Schröder, A., & Tubaro, A. (2011).** EAU guidelines on urinary incontinence. *European urology*, 59(3), 387-400. <https://doi.org/10.1016/j.eururo.2010.11.021>.
- Vidmar, R., Marcq, G., Flamand, V., Fantoni, J. C., Hénon, F., Villers, A., & Ouzzane, A. (2017).** [Salvage radical prostatectomy for recurrent prostate cancer. Morbidity, oncological and functional results]. *Progres en urologie*, 27(8-9), 458-466. <https://doi.org/10.1016/j.purol.2017.05.005>.
- Wagner TH Patrick DL Barendam TG, et al. 1996;** Quality of life of persons with urinary incontinence: development of a new measure. *Urology* 47(1):67-71
- Wang, W., Huang, Q. M., Liu, F. P., & Mao, Q. Q. (2014).** Effectiveness of preoperative pelvic floor muscle training for urinary incontinence after radical prostatectomy: a meta-analysis. *BMC urology*, 14, 99. <https://doi.org/10.1186/1471-2490-14-99>.
- Wu, M. L., Wang, C. S., Xiao, Q., Peng, C. H., & Zeng, T. Y. (2019).** The therapeutic effect of pelvic floor muscle exercise on urinary incontinence after radical prostatectomy: a meta-analysis. *Asian journal of andrology*, 21(2), 170-176. https://doi.org/10.4103/aja.aja_89_18.
- Zaidan, P., & da Silva, E. P. (2014).** Electrostimulation, response of the pelvic floor muscles, and urinary incontinence in elderly patients post prostatectomy. *Fisioterapia em Movimento*, 27(1), 93-10.
- Zhang, A. Y., Bodner, D. R., Fu, A. Z., Gunzler, D. D., Klein, E., Kresevic, D., Moore, S., Ponsky, L., Purdum, M., Strauss, G., & Zhu, H. (2015).** Effects of Patient Centered Interventions on Persistent Urinary Incontinence after Prostate Cancer Treatment: A Randomized, Controlled Trial. *The Journal of urology*, 194(6), 1675-1681. <https://doi.org/10.1016/j.juro.2015.07.090>.