



Systematic Review

Pelvic Floor Muscle Training (PFMT) to Reduce Urinary Incontinence Post Radical Prostatectomy in Patients with Prostate Cancer: A Systematic Review

Dian Retno Pratiwi, Firda Yusniar, Ika Adelia Susanti, Tintin Sukartini

Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

ABSTRACT

Introduction: Pelvic floor muscle training (PFMT) is an important rehabilitative approach as it plays a crucial role in the male urinary mechanism and urinary continence as well as strength. The purpose of this study was to assess the effectiveness of PFMT in the treatment of urinary incontinence post radical prostatectomy in patients with prostate cancer.

Methods: Studies were systematically identified by searching electronic databases with the keywords “pelvic floor muscle training” AND “urinary incontinence” AND “radical prostatectomy” and consisted of 103 articles from Scopus, 60 articles from Science Direct, 34 articles from EBSCO, and 195 articles from Pro Quest. The data sources were limited to articles published from 2011 to 2020 and those published in English.

Results: Fifteen studies were included in this systematic review with inclusion criteria being patients diagnosed with prostate cancer, men with urinary incontinence after radical prostatectomy, types of study: Randomized Controlled Study (RCT) and protocol study, intervention: PFMT and main outcome: continence rate. Twelve of fifteen articles suggest PFMT is significantly more effective than the standard care in improving recovery of continence in patients undergoing radical prostatectomy.

Conclusion: PFMT is effectively carried out with a duration of 10-45 minutes per day with 10 contractions in a lying, sitting, and standing position with three sets, time of contractions 5-10 seconds and relaxation 5-10 seconds. The benefits of this review are that PFMT is suitable, well accepted and achievable for the patients who experience incontinence after radical prostatectomy.

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CONTACT

Dian Retno Pratiwi
✉ dian.retno.pratiwi-2019@fkip.unair.ac.id
📍 Faculty of Nursing, Universitas Airlangga, Surabaya, Indonesia

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INTRODUCTION

Prostate cancer (PCa) is a serious issue in the world and is the second most commonly diagnosed cancer in men (Milios, Ackland, & Green, 2019; Mottet et al., 2018). The new cases of PCa were 358,989 deaths or 3.8% of all mortality caused by cancer in men in 2018 (Bray et al., 2018). This problem may be asymptomatic at an early stage and show common symptoms such as difficult urination, urinary retention, and back pain (Rawla, 2019). The best treatment to remove this disease is radical prostatectomy (RP) which has a success rate of around 97% at least five years after surgery. On the other hand, RP has a negative effect on the patient in

that it can induce urinary incontinence (UI) and this can be provoked by several conditions such as exercise, positional change, lifting, bending, coughing, and sneezing (Mottet et al., 2018).

UI after prostatectomy prevalence one year after surgery, considering continence status as not using pads, ranges from 6.3%-52% (Ficarra V, Novara G, Artibani W, 2009). UI after prostatectomy treatment is a clinical condition that makes patients feel distressed and increases risk of falls, fall-related injuries, skin problems, nursing home admissions, and prolonged hospital admissions (Hu & Wagner, 2005; Lucioni, Nitti, & Stoffel, 2019; Matsumoto & Inoue, 2007). There are three types of UI: Stress UI (SUI), Urge (UUI), and Mixed UI (MUI) wall at

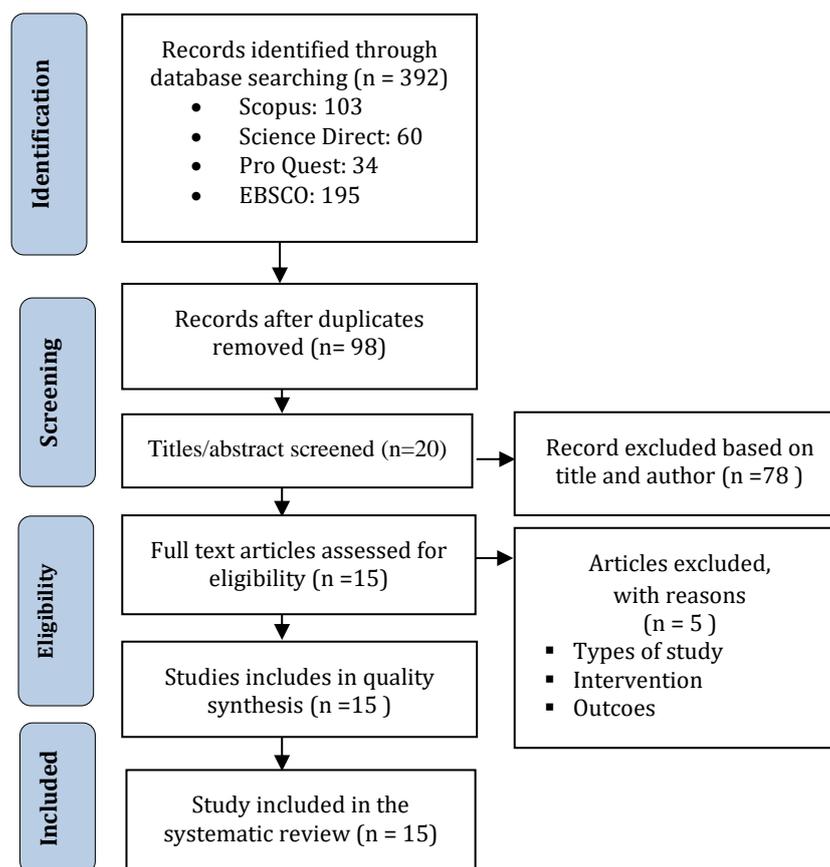


Figure 1 Flow diagram of the study selection process

inappropriate times. The last is MUI and this condition can be interpreted as a mixture of SUI and UUI (Abrams et al., 2018). Based on the pathophysiology of UI, one of the factors is poor urethral support by the pelvic floor muscles and intrinsic sphincter deficiency. SUI is the involuntary leakage of urine during exertion, such as coughing, laughing, or sneezing that increases abdominal pressure and puts stress on the bladder because of urine leakage (Radzimińska et al., 2018). UUI, commonly defined as overactive bladder, is usually caused by involuntary contractions of the detrusor muscles of the bladder. UI after radical prostatectomy may occur due to direct damage to the bladder neck urethral sphincter, and/or pelvic floor muscle during surgery (Centemero et al., 2010).

According to guidelines on prostate cancer from the European Association of Urology, one of the treatments to eliminate UI after radical prostatectomy is PFMT (Mottet et al., 2018). PFMT is a treatment using two concepts: improving urethral resistance and pelvic organ support for muscle strength, tone, and resistance, along with improved neuronal aspects, producing morphologic and other specific changes in the long term and resulting in automatic contraction of that musculature (Krishna Dass, Lo, Khanuengkitkong, & Tan, 2013; Rodas & García-Perdomo, 2018). Using PFMT correctly contributes to better urethral contraction and improves pelvic floor muscle contraction (Radzimińska et al., 2018).

The purpose of this systematic review was to assess the effectiveness of PFMT in the treatment of urinary incontinence post radical prostatectomy in patients with prostate cancer.

MATERIALS AND METHODS

Data Sources

The present study is a systematic review using a randomized controlled trial method. A literature search was performed on the databases Scopus, Science Direct, ProQuest, and Ebsco in order to identify articles published from 2011 to 2020. The keywords to search those journals were “pelvic floor muscle training” AND “urinary incontinence” AND “radical prostatectomy”.

Study Selection

The feasibility of the study was assessed using the PICOT framework. The inclusion criteria were: (i) patient diagnosed with prostate cancer; (ii) men with urinary incontinence; (iii) patient without UI prior to radical prostatectomy (RP) surgery or transurethral resection of the prostate (TURP); (iv) types of study: randomized controlled trials (RCTs) and pilot RCT (excluded studies included quasi-experimental trials); (v) type of intervention: pelvic floor muscle training or pelvic floor muscle exercise; (vi) main outcome: continence rate.

Data Extraction

The following information was extracted from 15 articles: information on demographics, study design, outcome measures, sample size, intervention, control, pre-post-intervention mean, country and year of publication from each study.

Quality Assessment

The systematic review method was based on the PRISMA checklist (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) to strengthen reporting (Figure 1) (Liberati et al., 2009).

RESULTS

Study Selection

A three-step strategy was used and the initial phase of the literature search in four databases with the

Table 1. Summary of selected studies

Author	Design	Sample	Intervention	Result
(Glazener et al., 2011)	RCTs	788 respondents	PFMT Duration of intervention: 12 months Duration PFMT: 10 minutes Frequency: 3 sets per day Evaluation of intervention: 4 times Position: Lying/supine, sitting and standing	PFMT not effective in patients after radical prostatectomy and did not result in better short term or medium term continence rates or QoL.
(Tienforti et al., 2012)	RCTs	32 respondents	Biofeedback and PFMT Duration of intervention: 6 months Duration PFMT: 10 minutes Frequency: 3 sets per day (10 contractions and 10 relaxations) Position: Lying/supine, sitting and standing Evaluation of intervention: 3 times	Combination of PFMT and biofeedback more effective for recovery from UI after RP.
(Geraerts et al., 2013)	RCTs	180 respondents	PFMT Pre and post surgery Duration of intervention: 26 weeks Duration PFMT: 30 minutes Frequency: 3 sets per day with 60 contractions per day Position: Lying/supine, sitting and standing Evaluation of intervention: 4 times	PFMT effective when performed pre surgery and post surgery.
(Santa Mina et al., 2015)	A pilot study randomized trial	88 respondents	PFMT, Pilates and Hypopressives Duration of intervention: 6 months Duration PFMT: 30 minutes Frequency: 2-3 sets per day with 60-180 contractions per day Position: Lying/supine, sitting and standing Evaluation of intervention: 4 times	This trial will provide the foundation of data for a future, large scale trial to definitively describe the effect of these advanced pelvic floor exercise modalities compared to conventional pelvic floor exercise regimen for men PCa undergoing RP.
(Zhang et al., 2015)	RCTs	244 respondents	PFMT, monitoring by telephone and support group Duration of intervention: 3 months Duration PFMT: 30 minutes Frequency: 3 sets per day Position: Lying/supine, sitting and standing	PFMT and monitoring can improve urinary continence and quality of life.

(Pedriali, F.R., Gomes, C.S., Soares, L., Urbano, M.R., Moreira, E.H., Averbeck, M.A.,&Almeida, 2016)	RCTs	85 respondents	PFMT, and Pilates Duration of intervention: 10 weeks Duration PFMT: 10 minutes Frequency: 3 sets per day with 10 contractions per day Position: Lying/supine, sitting and standing	PFMT and Pilates speed up continence recovery in PPUI.
(Zhang et al, 2017)	RCTs	267 respondents	PFMT Duration of intervention: 6 months Duration PFMT: 60 minutes Evaluation of intervention: 3 times Position: Lying/supine, sitting and standing	Offering follow-up care during the survivorship period is essential for stopping or slowing regression of urinary function and QOL in this patient population.
(Crowe et al, 2018)	RCTs	51 respondents	PFMT with video animation Duration of intervention: 3 months Duration PFMT: 10 minutes Frequency: - Evaluation of intervention: 3 times Position: Lying/supine, sitting and standing	The model is a useful supplement to existing methods of instructing participants in PFM exercise techniques.
(Aydın Sayılan & Özbaş, 2018)	RCTs	60 respondents	PFMT Pre and post surgery Duration of intervention: 6 months Duration PFMT: 10 seconds/contraction Frequency: 3 sets per day with 20-60 contractions per day Evaluation of intervention: 4 times Position: Lying/supine, sitting and standing	The decrease was statistically highly significant in the third and sixth months. Pelvic muscle floor exercises are suitable for patients experiencing incontinence after radical prostatectomy.
(Gomes et al, 2018)	RCTs	104 respondents	PFMT and Pilates Duration of intervention: 10 months Duration PFMT: 45 minutes Frequency: 3 sets per day with 10 contractions per day Position: Supine, sitting, and standing Evaluation of intervention: 1 time Position: Lying/supine, sitting and standing	The Pilates method presented potential advantages in the endurance of pelvic floor muscle contraction and in the proportion of fully continent patients 4 months after surgery.
(Miliotis et al, 2019)	RCTs	97 respondents	PFMT Intervention pre-post surgery Duration of intervention: 17 weeks Duration PFMT: 30 minutes Frequency: 2-6 sets per day, 10- 120 contractions. Slow and fast twitch muscle Position: Supine, sitting, and standing Evaluation of intervention: 3 times	PFMT commenced prior to prostate surgery enhanced post- surgical measures of pelvic floor muscle function, reduce UI and improved QoL.
(Tantawy et al, 2019)	RCTs	61 respondents	PFMT and whole body vibration training Duration of intervention: 4 weeks Duration PFMT: 10 second	An effective modality for treating patients with stress urinary incontinence after prostatectomy.

(Heydenreich et al., 2020)	RCTs	184 respondents	<p>contraction and 10 second relaxation Frequency: 3-4 sets per day 15 times (repeated) Slow and fast twitch muscle Position: Supine, sitting, and standing PFMT and relaxing therapy</p> <p>Duration of intervention: 3 weeks Duration PFMT: 30 minutes Frequency: 3-4 sets per day Position: Lying, sitting, and standing Evaluation of intervention: 2 times</p>	<p>More effective than conventional continence training alone and it has a beneficial effect on measured quality of life and greater in patients with more incontinence.</p>
(Laurienzo et al., 2018)	RCTs	123 respondents	<p>PFMT and electrical stimulation Duration of intervention: 6 months Duration PFMT: 30 minutes Frequency: 2-3 sets per day Position: Lying, sitting, and standing Evaluation of intervention: 3 times</p>	<p>PFMT and electrical stimulation did not have an impact on the recovery of urinary continence and erectile function</p>
(Oh et al., 2019)	RCTs	84 respondents	<p>PFMT and Biofeedback. Duration of intervention: 3 months Duration PFMT: 10 minutes Frequency: 4 sets per day, 10 second contraction and 10 second relaxation Position: Lying, sitting, and standing Evaluation of intervention: 3 times</p>	<p>Intervention group showed a significantly smaller volume of urine loss at the 1 month follow up than the control group.</p>

RCTs: Randomized Controlled Trials; PFMT: Pelvic Floor Muscle Training; QoL :Quality of Life

consisted of 103 articles from Scopus, 60 articles from Science Direct, 34 articles from EBSCO, and 195 articles from Pro Quest (Figure 1). The second step was to review the abstract for eligibility criteria. We excluded some articles that did not match inclusion criteria. The third step was to review the full articles. Full article were reviewed with the PICOT framework.

Relevant data regarding inclusion criteria (participants, interventions, and outcomes), risk of bias, and results were extracted. At the end of the process, 15 studies were included in this systematic review. Overall, 14 studies were Randomized Controlled Trials (RCTs) and one study was a pilot study.

Characteristics of the Study

Population

Population characteristics in all studies only included male patients with prostate cancer who had undergone Radical Prostatectomy (RP) and who reported urinary incontinence after surgery. The total sample in this study was 2,448 male patients. The sample size varied from 32 to 788 patients, with a total of 2,448 patients. The ages ranged from 40 to 80 years.

Several studies explained that the characteristic demographic data from all participants showed had no significant differences ($p > 0.05$); this means that the data were homogenous between two or three groups in terms of age, body mass index, pathological state/cancer state (T2 stage) and Gleason score (3-7 score).

Intervention

All research was focused on evaluating the impact of the Pelvic Floor Muscle Training Program on Urinary Incontinence in patients with Radical Prostatectomy separately or in combination. Interventions were given 1-3 weeks pre surgery and 6-12 weeks post-surgery or after catheter removal. Before the intervention was performed, all participants were given verbal, written (leaflet) and video simulation about PFMT instruction by a psychotherapist or urology nurse.

Duration of PFMT was 10-45 minutes per day with 10 contractions in a lying, sitting, and standing position with a frequency of three sets per day, time of contractions: 5-10 seconds and relaxation: 5-10 seconds. The Intervention was for a minimum of 3 weeks (Heydenreich et al., 2020), a maximum of 12 months (Geraerts et al., 2013; Glazener et al., 2011)

and the intervention time most widely used was 6 months (Aydın Sayılan & Özbaş, 2018; Laurienzo et al., 2018; Tienforti et al., 2012; Zhang et al., 2015, 2017). During intervention, the psychotherapist observed and evaluated PFMT with telephone and home visits to patients (Zhang et al., 2015, 2017). An intervention group was compared or combined with other therapy such as biofeedback, electrical stimulation, whole-body vibration training, Pilates, and relaxing therapy (Glazener et al., 2011; Gomes et al., 2018; Heydenreich et al., 2020; Laurienzo et al., 2018; Oh et al., 2019; Pedriali, F.R., Gomes, C.S., Soares, L., Urbano, M.R., Moreira, E.H., Averbek, M.A., & Almeida, 2016; Tantawy, Elgohary, Abdelbasset, & Kamel, 2019; Tienforti et al., 2012). The intervention was evaluated at least one time (Gomes et al., 2018; Zhang et al., 2015) and at most three times (Glazener et al., 2011; Gomes et al., 2018; Milios et al., 2019; Tantawy et al., 2019; Tienforti et al., 2012; Zhang et al., 2017).

Clinical Outcome

DISCUSSION

Prostate cancer is a diagnosis of cancer that occurs in men and the prevalence increases due to age. Typically, men diagnosed with localized prostate cancer requiring treatment are offered two potentially curative treatment options: RP or radiotherapy. The gold standard for the treatment of prostate cancer is RP, but it has a complication post RP which is UI (Aydın Sayılan & Özbaş, 2018; Crowe et al., 2018) which may go on for as long as 1-2 years after RP. Investigators have proved that continence can be achieved faster with PFMT (Geraerts et al., 2013). Conventional pelvic floor muscle exercises are intended to improve urinary control by increasing the strength, endurance and coordination of the pelvic floor muscles and functional activation of the external urethral sphincter (Campbell SE, Glazener CMA, Hunter KF, Cody JD, 2012; MacDonald R, Fink HA, Huckabay C, Monga M, 2007) focused on the repeated maximal contraction of the muscles around the anus (Hodges et al., 2019). In this review study, interventions were given 1- 3 weeks pre surgery and 6-12 weeks post-surgery or after catheter removal. The pre-operative period provides an opportunity to intervene and minimize the impact of UI, with a recommendation for a 6-week period between prostate biopsy and subsequent RP surgery to avoid complications; patients can be referred for pre-operative PFMT (Wang W, Huang QM, Liu FP, 2014). For intervention pre-operatively, the psychotherapist or urology nurse gave pelvic floor muscle instructions and prescribed a daily PFMT program (Milios et al., 2019).

PFMT could be started immediately after removal of the bladder catheter and early intervention (within six months of surgery) yields better results when compared to later intervention (Zermann DH,

Wunderlich H, Reichelt O, 2000). The duration of PFMT should be between 10-45 minutes per day with 10 contractions in a lying or supine, sitting, and standing position with a frequency of three sets per day, time of contractions: 5-10 seconds and relaxation: 5-10 seconds. In Gomes et al., PFMT was measured with the patients lying in a supine position with legs at an angle of 45°. The end anal probe of the perineometer was used for all measurements, and active pelvic floor contraction (without contracting the abdominal, gluteal or adductor muscles) was performed for 15s, followed by 30s of rest, in order to avoid fatigue (Gomes et al., 2018). Milios et al. (2019) in their study, had exercise protocols in the intervention group which targeted the use of slow and fast twitch muscle fibers and the participants performed six sets of pelvic floor muscle exercises per day, with each set comprising 10 fast (1s duration) and 10 slow (10s duration for contractions with an equal rest time, providing a total of 120 contractions per day and all sets were performed in a standing posture, which resulted in improved post-surgical pelvic floor muscle function and decreased UI after 12 weeks. Another study also used the PFMT intervention with slow and fast twitch fibers, performed each day in lying, sitting and standing positions; procedure begin same with intervention review this study, but the contraction and relaxation times were increased by 1 second for every week of training (Tantawy et al., 2019). Moreover, for most of the studies reviewed, PFMT was performed in supine, sitting and standing positions. Contractions and relaxation were performed in coordination with breathing but involved maintenance of intra-abdominal pressure and respiration (Pedriali, F.R., Gomes, C.S., Soares, L., Urbano, M.R., Moreira, E.H., Averbek, M.A., & Almeida, 2016).

The program had to be monitored, evaluated and followed up of training, so that the results could be maximized and psychotherapists or urology nurses had to have professional licenses. Follow up care may reduce the need for hospital or clinical visits. Patient long-term adherence to PFMT is crucial for enhancing positive treatment outcomes and evidence has shown that peer social support is effective. Furthermore, usually psychotherapist or urology nurse uses telephone calls and they follow up with PFMT instructions, advice about consuming 200cc of non-caffeinated fluid with two or fewer caffeinated drinks daily, setting bladder voiding schedules, maintaining a balanced diet and performing daily exercise such as walking (Zhang et al., 2017). Furthermore, the psychotherapist is responsible for evaluating incontinence during the PFMT program. The results of this review study showed that exercises were evaluated 1-3 times and urinary continence was evaluated using 1-hour pad tests and 24-hour pad tests. For the result of the test, continence was defined as a loss of < 2g of urine or the use of one or less pad per day; this suggests that PFMT training strengthens the muscles and that bladder control can thus be acquired (Aydın Sayılan & Özbaş, 2018).

Physiotherapist-guided PFMT may provide better outcomes than non-supervised exercise.

The studies in our review included twelve out of fifteen articles which showed that PFMT is effective in reducing UI post RP. PFMT is suitable for patients experiencing incontinence after radical prostatectomy. Preoperative PFMT is a treatment strategy which is significantly more effective than the standard care in improving recovery of continence in patients who have undergone RP (Aydın Sayılan & Özbaş, 2018). Another intervention is for PFMT to be combined with other therapy (Pilates, relaxing therapy and biofeedback) and this can be more effective than PFMT only. The study on biofeedback and PFMT showed it is effective in improving the recovery of continence after open RP, at 3 and 6 months follow up, the rate of incontinence of patients, pad use and the number of incontinence episodes per patient, using a ICIQ-UI score of zero (zero frequency and no urine) (Tienforti et al., 2012). The Pilates method focuses on breathing and on the activation of deep stabilizing muscles of the trunk, in coordination with the PFM. The Pilates method comprises exercise that are focused on pelvic stability, mobility and body alignment (Aydın Sayılan & Özbaş, 2018). Moreover, rest and relaxing the pelvic floor is as important as the training itself, and it is therefore part of every successful physiotherapeutic/ therapeutic exercise for continence treatment schemes. A patient suffering from post-prostatectomy urinary incontinence needs supervised training and constant monitoring of the pelvic floor muscle exercises (Heydenreich et al., 2020). PFMT is effective when performed correctly according to procedure or protocol

CONCLUSION

Intensive PFMT interventions applied pre-post prostatectomy can strengthen the pelvic floor muscles and activate the function of the external urethral sphincter so it can control bladder and can reduce UI after RP. The advantages of PFMT are that it can perform at home and it is inexpensive. However, PFMT must be controlled by a physiotherapist to evaluate the procedures performed. The benefits of this review are that it shows that PFMT is suitable, well accepted and achievable for patients who experience incontinence after radical prostatectomy.

CONFLICT OF INTEREST

The authors have declared no potential conflicts of interest with respect to the research and authorship.

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