

Effect of Pelvic Floor Muscle Training on Urinary Incontinence in Gynecologic Cancer: A Review

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PURPOSE: The purpose of this study is to investigate the applicability of pelvic floor muscle training to reduce urinary incontinence in gynecologic cancer patients based on positive evidences.

METHODS: This narrative review was conducted by searching terms in title or abstract such as 'pelvic floor muscle training', 'urinary incontinence' and 'gynecologic cancer' in PubMed, Google Scholar, SCOPUS, EBSCOHost, ScienceDirect, Cochrane Library and EMBASE databases which published from 2008 to 2018.

RESULTS: Studies mostly investigated the prevalence of urinary incontinence in cervical, ovarian and endometrial cancer patients. Seventy percent is the highest prevalence of urinary incontinence among gynecologic survivors that has reported so far. Pelvic floor muscle exercise for more than 4 weeks resulted in improved pelvic floor muscle strength. There was also a significant difference in the questionnaire related to improvement of pelvic floor function.

CONCLUSIONS: We suggest that pelvic floor muscle training may help to increase PFM strength and mitigate the symptom of urinary incontinence among patients with gynecologic cancer. However, further clinical research is required to evaluate the effectiveness of the pelvic floor muscle training on urinary incontinence symptoms in gynecologic cancers.

Key words: Gynecologic cancer, Urinary incontinence, Pelvic floor muscle training, Non-gynecologic cancer

INTRODUCTION

Gynecologic cancers, including the cervix, endometrium, fallopian tubes, ovaries, uterus, and vagina refers to the uncontrolled growth and spread of abnormal cells originating in the female reproductive tract. This cancer is one of top ten leading cancer types regarding estimated new cancer cases by sex. Approximately 98,280 (12.1%) new cases were diagnosed as genital cancer in the United States [1] and 6,025 (5.9%) cases were diagnosed as cervical, ovarian and endometrial cancers in South Korea [2] in 2015. According to the International Federation of Gynecology and Obstetrics (FIGO) staging systems, gynecologic cancer consists of four stages and subdivisions. The 5-year survival rate for gynecologic cancers by stage is detected as 89%, 66%, 34%, and 18% respectively for Stage I, II, III, and IV [3]. The proportion of cancer survivors has been

increased due to the advances of modern medicine. According to study the survival rate of gynecologic cancer patients will rise by 118% from 2016 to 2026 [4]. However, gynecologic cancer treatment including surgery, chemotherapy, and radiotherapy can give severe damage to pelvic floor muscles (PFM) that could make adverse effects such as pelvic floor dysfunction (PFD), lower extremity lymphedema, emotional concern and fatigue [5,6]. As a result, it became important to identify the adverse effects that frequently occur in the patient with gynecologic cancer and to find out an effective way to alleviate them.

PFM are located inside the pelvis consist of twelve striated muscles with three-layer muscular plate supporting pelvic organs such as urethra, vagina and rectum. During the cancer treatments, atrophy and length shortening may occur in PFM which may result PFD [7]. The symptoms of PFD are known as urinary incontinence (UI) and urgency, hematuria,

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vaginal and rectal bleeding, dysuria, vaginal dryness and stenosis, dyspareunia and decreased sexual interest [8-11]. Among them, UI is closely related to PFD that can be recovered through pelvic floor muscle training (PFMT). According to the previous studies the PFMT program was effective treatment on women with stress, urge, and mixed urinary incontinence [12]. PFM plays an important role in preventing UI by tightening the urethra. Thus, PFMT may increase the strength of these muscles [13]. The PFMT introduced by Kegel in 1952 for the first time and over time different training protocols have been adopted to improve PFM function [14]. PFMT recognized as the mostly common nonsurgical treatment for UI, which is a physical training program consists of repetitive contraction of the PFM to improve strength and efficacy [15]. In overall, PFMT protocol contains fast contractions of PFM with a 3-second hold to improve strength and few repetitions of longer contractions up to 10 seconds holding with a goal of enhancement in muscle endurance. Though set and repetition of performance are various in studies, more than 3 sets of performance per day and 10 repetitions are often reported in the previous studies [16]. The PFMT program generally consists of contraction of the adductor muscles, sphincter tightening, and pelvic lifting. PFMT is basically doing by weight bearing, but also the resistance band or ball can be used to increase the exercise intensity. One study reported 84% of pa-

tients were cured from UI by doing PFMT [14,17]. Although the effects of the training are well studied in women [18], men with prostate cancer patients [19-21], pregnant and postpartum women [22], yet, it has not been fully studied on gynecologic cancer patients. Therefore, the aim of this study is to identify UI type and incidence rate in the gynecologic cancer patient. Also, review the previous intervention studies that had a kinematics approach to improve UI symptom in non-cancer patients as studies are insufficient for gynecologic cancer. Finally, we investigate some of PFMT studies in the patient with gynecologic cancer to discuss the applicability of PFMT to reduce UI based on positive evidences.

METHODS

In this review article, we investigated studies through searching in the PubMed, Google Scholar, SCOPUS, EBSCOHost, ScienceDirect, Cochrane Library and EMBASE databases. We limited our search based on language (i.e., English), date of publication (i.e., since 2008 till 2018, last 10 years), the type of article (i.e., journal article), text availability (i.e., full text available) and focusing on previous literature which had the terms of “pelvic floor muscle training”, “urinary incontinence” and “gynecologic cancer” in title or abstract. In primary search, those studies which reported

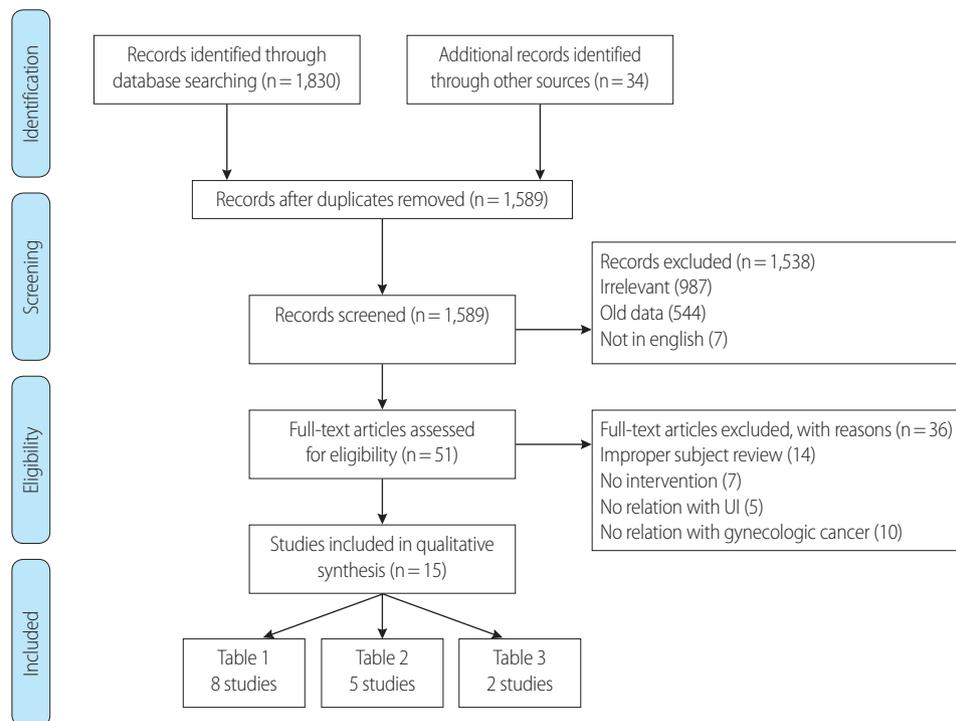


Fig. 1. Flowchart of literature selection.

the UI prevalence in gynecologic cancers such as Cervical, Ovarian, Uterine, Vaginal and Vulvar cancers were selected. The secondary selection of articles was limited to those studies which reported UI changes following PFMT either in gynecologic cancer patients or non-cancer patients. Articles were reviewed by two authors independently. At the end, after removing duplicates and non-relevant articles, a total of 15 articles met the criteria; 8 studies (n=2,799) for investigating the UI prevalence among gynecologic cancer patients; 5 studies (n=444) in non-gynecologic cancer patients and 2 studies (n=64) in gynecologic cancer patients which reported UI outcome after PFMT were selected for ongoing review (Fig. 1). In addition, we used PEDro scale to measure methodological quality of clinical trials.

THE PREVALENCE OF URINARY INCONTINENCE

Eight studies met the criteria for our studies which reported outcomes in association to UI including SUI and UUI. Most studies were designed in cohort and cross-sectional. Except for the two studies [23,24] which reported the prevalence of UI before any treatment and surgery, the rest of studies reported outcomes after or during treatment (e.g., surgery, chemotherapy, radiation). The prevalence of UI in 2,423 survivors of major gynecologic cancers mostly cervical, endometrial and ovarian cancer before and after treatment is summarized in Table 1.

Of eight studies investigating UI, six studies used validated questionnaires. Bretschneider et al. [23] used International Consultation on Incontinence Questionnaire Female Lower Urinary Tract Symptoms Module (ICIQ-FLUTS) while Donovan et al. [25] used ICIQ-FLUTS along with Memorial Symptom Assessment Scale (MSAS). Rutledge et al. [26] and Skjeldestad et al. [27] used Sandvik Incontinence Severity Index. Hazewinkel et al. [10] used a set of a set of validated pelvic-floor-related quality of life questionnaires included the Uro-genital Distress Inventory (UDI) and the Defecatory Distress Inventory (DDI). Segal et al. [28] used Questionnaire for Urinary Incontinence Diagnosis (QUID) and Incontinence Severity Index questionnaire (ISI). Among gynecologic cancer patients SUI and UUI rates ranged from 30.8% [24] to 59.5% [23] and 13.9% [24] to 33.9% [23] before treatment, respectively. Among the gynecologic survivors, range of SUI reported from 24.3% [27] to 76% [25] while UUI reported from 9.3% [27] to 75% [25]. Regarding to type of treatment, Segal et al. investigated the effect of radiation therapy as a risk factor of pelvic floor function and reported 21.0% SUI and 13% UUI prevalent among “radiation therapy” group while 24.1% SUI and 26.4% UUI reported in “No radiation” group which concluded there is no association between radiation

and urinary incontinence ($p > .05$); whereas age (aOR=1.06, 95% CI 1.02-1.10) and BMI (aOR=1.07, 95% CI 1.02-1.11) significantly were observed as risk factors for UI. However, Hazewinkel et al. reported the result for each treatment group and conclude that patients who treated with radiotherapy as primary treatment more suffered of adverse effects on pelvic floor function rather than surgery with adjuvant radiotherapy or radical hysterectomy (57% UUI [OR=3.7, 95% CI 1.5-8.9] and 53% SUI [OR=1.0, 95% CI 0.5-2.4]). In Buchsbaum et al. [29] study that the prevalence of UI was similar among benign and malignant patients.

PELVIC FLOOR MUSCLE TRAINING FOR THE NON-CANCER PATIENT WITH URINARY INCONTINENCE

Five studies were selected to define the effect of PFMT in UI patients with non-gynecologic cancer. Castro et al. [30] reported that the effectiveness of PFMT was similar with other treatment such as electrical stimulation and vaginal cones based on objective and subjective evaluations. The treatments which include PFMT were far superior to no-treatment in women with SUI. However, high costs and the necessity of regular management were mentioned as the major concerns in various types of UI treatment, except for PFMT. In other study, symptoms of UI was significantly decreased in both SUI and UUI groups where home-based PFMT was conducted with no supervision [31]. Thus, PFMT might be a good alternative choice on UI patients. Besides, as the risk of developing gynecologic cancer is getting higher with ageing, PFMT may be an appropriate exercise program for the elderly who are not free to go outdoors, if adequate training is provided [32,33]. Two studies suggest PFMT can be a good therapeutic option for improving UI in elderly women. According to the results that showed the improvement was more prominent in women with SUI, it is concluded that PFMT is necessary especially for gynecologic cancer patients who are more suffering from SUI than UUI as shown in the Table 2. However, qualitative evaluation of UI symptoms by questionnaire might be considered as a limitation of this study. Tosun et al. assessed PFM strength by using vaginal biofeedback and transabdominal ultrasonography and reported significant improvement in muscle strength after training and the pad test for UI showed significantly decreased in PFMT group [34]. Efforts to use the noninvasive and quantitative method to identify the change in pelvic floor muscle after PFMT seems valuable in this study while quantitative assessment tools are deficient.

Table 1. The prevalence of urinary incontinence symptoms among gynecologic cancer patients

Reference	Design	Prevalence/incidence rate of Cancer site (%)	Cancer Stage (%)	Population/ Age (yr) (± SD)	Treatment	Main Outcome	Outcome measurement
Hazewinkel et al. [10]	Cross-sectional matched Cohort study	Cervical (100)	IA-IIA (95) IIB-IVA (27) IVB (8)	RH and LND 146/47 SART 49/50 PRT 47/52	Chemotherapy Surgery Radiation	RH & LND: SUI (60%), UUI (45%) SART: SUI (58%), UUI (76%) PRT: SUI (57%), UUI (53%)	Pelvic-floor-related quality of life Questionnaires Uro-genital Distress Inventory (UDI) Defecatory Distress Inventory (DDI)
Bretschneider et al. [23]	Cross-sectional study	Endometrial (61.8) Ovarian (17.1) Cervical (11.1) Vulvar (5.9) Gynecological, nitric oxide synthase (3) Gastrointestinal (3)	I-II (98) III-IV (46) Un-staged (8)	152/58.1 (±13.3)	Before surgery	SUI (59.5%) UUI (33.90%)	ICIQ-FLUTS
Thomas et al. [24]	NA	Endometrial (49.9), Ovarian (21.0), Cervical (14.4)	II (100)	Benign 201/53.7 (±1.2) Malignant 338/59.6 (±0.9)	Before cancer treatment	Benign: SUI (30.8%), UUI (13.9%) Malignant: SUI (33.1%), UUI (14.2%)	Pelvic Floor Distress Inventory Questionnaire
Donovan et al. [25]	Cross-sectional study	Cervical (31) Endometrial cancer (73)	I (74) II (11) III (16) IV (3)	Survivors 104/56.0 (±12.6) Control 104/56.4 (±11.2)	Chemotherapy Surgery Radiation	Survivors: SUI (76%), UUI (75%) Control: SUI (52%), UUI (51%)	ICIQ-FLUTS MSAS
Rutledge et al. [26]	Cohort study	Ovarian (29) Endometrial (45) Cervical (22) Vulvar (2) Unknown (2)	NA	Survivors 260/57 (±12) Control 108/47 (±10)	Chemotherapy Surgery Radiation	Survivors: UI (70%) Control: UI (56%)	Sandvik Incontinence Severity Index
Skjeldstad et al. [27]	Cross-sectional study	Cervical (41.3) Endometrial (21.3) Ovarian (37.5)	I (83.6) II (10.8) III (4.4) IV (1)	Survivors 160 Control 432 / 30-49 50-59 60-75	Chemotherapy Surgery Radiation	No History of Cancer: UI (65.7%), SUI (24.5%), UUI (0.9%) Previews History of Cancer: UI (65.6%), SUI (22.5%)	Sandvik Incontinence Severity Index
Segal et al. [28]	Retrospective cohort study	Endometrial (100)	I (100)	No radiation 87/58-67 Radiation therapy 62/58-71	Surgery Radiation	Survivors: SUI (43%), UUI (39%) No radiation: SUI (24.1%), UUI (26.4%) Radiation therapy: SUI (21%), UUI (13%)	QUID ISI
Buchsbaum et al. [29]	Retrospective chart review	Endometrial (3.6) Ovarian (13.3) Cervical (9.1) Benign gynecologic (36.6)	NA	549/57.9	NA	Endometrial: SUI (35.4%), UUI (14.3%) Ovarian: SUI (31.5%), UUI (15.1%) Cervical: SUI (28%), UUI (8%) Overall Gynecologic Cancer: SUI (32.3%), UUI (13.8%)	Questionnaire

UI, urinary incontinence; SUI, stress urinary incontinence; UUI, urge urinary incontinence; ICIQ-FLUTS, The International Consultation on Incontinence Questionnaire Female Lower Urinary Tract Symptoms Module; MSAS, Memorial Symptom Assessment Scale; RH, Radical hysterectomy; LND, Pelvic lymph node dissection; SART, Surgery with adjuvant radiotherapy; PRT, Primary radiotherapy; QUID, Questionnaire for Urinary Incontinence Diagnosis; ISI, Incontinence Severity Index questionnaire.

Table 2. A description of pelvic floor muscle training intervention studies with non-gynecologic cancer patient

Reference	Design	Participants/ Age ± SD	UI Types (PFMT, CON)	PFMT Details	Duration	Frequency	Outcomes	PE德罗 scale
Castro et al. [30]	RCT	PFMT-CON (26,24)/ (56.2 ± 12.5, 52.6 ± 11.2)	SUI (26,24)	10 reps 5 sec contraction 5 sec recovery 20 reps 1 sec contraction 1 sec relax each interval 5 reps 10 sec contraction 10 sec relax 5 reps strong contraction	6 months	3/weeks	Pad test ↓, I-QOL ↑, Satisfied after treatment PFMT 58%, CON 21%	8
Cavkaytar et al. [31]	RCT	SUI-MUI (38,34)/ (49.6 ± 8.1, 48.9 ± 8.8)	SUI (38,0) MUI (0,34)	10 sets 10 reps (not well described)	8 weeks	Daily	IIQ-7 ↑, UDI-6 ↑, Self-report improvement SUI: 68.4%, MUI: 41.2%	4
Kim et al. [32]	RCT	PFMT-CON (61,63)/ over 70	SUI (19,18) UUI (22,25) MUI (22,21)	10 reps 3 sec contraction 5 sec interval rest, 8-10 sec contraction with 10 sec rest each in different body position	3 months	2/weeks	Urine leakage cure rates PFMT 44.1% CON 1.6%	9
Lee et al. [33]	RCT	PFMT-CON (40,42)/ (74.5 ± 4.1, 75.6 ± 4.0)	SUI (15, 20) UUI (13, 12) MUI (7, 7) Enuresis(3, 1) Unexplained (2, 2)	NA	12 weeks	6 session. 60 min per session at 2 weeks interval	ICIQ-SF ↑ : (11.8 ± 3.7) UI episodes ↓ : PFMT/CON (-1.6 ± 1.3/-0.5 ± 1.3) Micturition ↓ : PFMT/CON (-2.5 ± 2.8/-0.1 ± 1.4)	6
Tosun et al. [34]	RCT	PFMT-CON (65,51)/ (51.7 ± 9.7, 49.6 ± 7.6)	SUI (27, 21) UUI (23, 17) MUI (15, 13)	2-7 sets Maximal volun- tary contraction (not well described)	12 weeks	2/weeks practiced in 1-3 weeks with physiotherapist & daily	Pad test ↓ : PFMT/CON (-2.9/0.2) Stop test ↓ : PFMT/CON (-11.7/0.3) TAUS ↑ : PFMT/CON (5.1,7.2/-1.5,1.3) PERFECT test ↑ : PFMT/CON (2.7, 31.7, 7.9, 7.1/ 0.2, 0.1, -0.7, -0.1)	7

UI, urinary incontinence; PFMT, pelvic floor muscle training; CON, control; SUI, stress urinary incontinence; UUI, urge urinary incontinence; MUI, mixed urinary incontinence; I-QOL, quality of life questionnaire; IIQ-7, incontinence impact questionnaire; UDI-6, urogenital distress inventory; TAUS, transabdominal ultrasonography; ICIQ-SF, international consultation on incontinence questionnaire-short form.

PELVIC FLOOR MUSCLE TRAINING FOR THE GYNECOLOGIC CANCER PATIENT WITH URINARY INCONTINENCE

Only two PFMT intervention studies on gynecologic cancer patients were found (Table 3). In the study by Yang et al. [35] patients who had radical hysterectomy and pelvic lymph node dissection were recruited to participate in the pelvic floor rehabilitation program once a week for four weeks. Unlike other studies, this study focused on patients who underwent surgery as a cancer treatment. Additional studies should be continued to identify PFMT effects by differentiation cancer treatment methods such as radiotherapy and chemotherapy. Of many variables, only pelvic floor strength and sexual functioning showed significant improvement.

The reason for this result may be influenced by the intervention period which was short to accommodate study feasibility and to verify the effects of exercise. A large scale of intervention with a sufficient study period is necessary. Another pilot study demonstrated PFMT program in combination with behavioral therapy for 12 weeks [36]. Although results did not show the superiority of PFMT on behavioral therapy in the improvement of UI, this study was a rare evidence that PFMT to the gynecologic patient.

RESULT AND DISCUSSION

Through this review, we found that urinary incontinence following gynecologic cancer treatment appeared as a significant adverse effect.

Table 3. A description of pelvic floor muscle training intervention studies for gynecologic cancer patients

Reference	Design	Participants/ Age ± SD	Cancer Types	FIGO Stage	Treatment	PFMT Details	Duration	Frequency	Outcomes	PEDro Scale
Yang et al. [35]	Pilot RCT	PFMT-CON (12, 12) / (52.3 ± 5.2, 52.5 ± 2.9)	Cervical (13,13) Endometrial (1,1)	I-II (10,11) III (4,3)	Surg (1,1) Surg+Radio (4,4) Surg+Chemo (6,5) Surg+Radio+ Chemo (3,4)	40 cycles with 10 sec activity followed by 20 sec relaxation	(post) 4-week	Once a week, 45 min per session	PFM strength ↑, Sexual function ↑,	9
Rutledge et al. [36]	Pilot RCT	PFMT-CON (20, 20) / 57 (range: 37–79)	Uterine (14,10) Ovarian (3,6) Cervical (2,3) Other (1,1)	NA	Surg (19,19) Radio (3,4) Chemo (7,7) Prior incontinence treatment (2,4)	10 pelvic muscle contraction for 5 sec 3 sets	(post) 12-week	Daily	Brink's score ↑ : PFMT/CON (mild6.5, severe-6/ mild2, sever-2) PGI-I ↑ : PFMT/CON (80%/40% "much better")	7

FIGO, international federation of gynecology and obstetrics; PFMT, pelvic floor muscle training; CON, control; PGI-I, patient global impression of improvement.

Among the types of urinary incontinence, SUI was the most common one, followed by UUI. The studies which were covered in this review were based on a questionnaire. Thus, it is a major limitation of current evidence that makes it impossible to compare the outcomes of research statistically. Moreover, there is a lack of studies to figure out what kind of treatment and cancer site specifically might induce urinary incontinence. Future studies should focus on the investigating association of cancer stage, site and type of treatment with UI in gynecologic cancer patients; and, quantitative evaluation of UI such as a pad test should be performed together with a validated questionnaire. So far, the effects of PFMT in SUI and UUI have been proved in many studies in non-gynecologic cancer. To our knowledge, only two pilot studies investigated the effects of PFMT in gynecologic cancer survivors which resulted to alleviate UI. According to evidence, PFMT had a beneficial effect on controlling bladder and improvement of urinary in gynecological cancer patients as well. In order to have a better result of the training, effects of PFMT on specific gynecologic cancer (e.g. cervical, ovarian etc.) should be concerned. Thus, more research on PFMT exercise intervention study is needed to define the proper frequency, intensity, time and type of exercise related to gynecologic cancer patients' characteristics.

CONCLUSION

This present study is the first narrative review study to investigate the prevalence of UI in gynecologic cancer patients and effects of the PFMT to increase control of the bladder which will result alleviate of inconti-

nence. This study provides evidence supporting beneficial effects of the PFMT program on improvement of incontinence in non-gynecological cancer subjects and gynecological cancer patients. Thus, we suggest that as a process of rehabilitation of gynecologic cancer patients, the PFMT might be an effective program to treat UI and enhance control of bladder which may improve the overall quality of life in cancer patients.

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