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A Study to Assess the Effect of Pelvic Floor Muscle Strengthening Exercises on Urinary Incontinence in Patients With Cervical Cancer Undergoing Radiation Therapy at a Tertiary Cancer Center

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Funding: Intra Mural Funding received

Potential competing interests: No potential competing interests to declare.

Abstract

Introduction

Cervical cancer is one of the most common and dreaded diseases of women in India, it accounts for 16 percent of total cervical cancer cases occurring globally. Some of the vital treatments for cervical cancer are radiation therapy external beam radiation and intracavitary radiation therapy. Radiation has a greater effect on the pelvic floor (PF). It causes actinic injuries and shows major symptoms of urinary incontinence (4-76%). So, to control this complication of urinary incontinence, pelvic floor muscle strengthening exercises are the most effective, economical, and feasible interventions. The rationale for the effectiveness of pelvic floor muscle strengthening exercises is they improve muscle strength increase blood flow to pelvic structure and improve the functioning of sphincter muscles. Pelvic floor muscle strengthening is an independent nursing action as it focuses on controlling urinary incontinence and improving the quality of life of patients with cervical cancer undergoing radiation therapy. It helps to gain the self-confidence and self-esteem of participants.

The objective was to analyze the effect of pelvic floor muscle strengthening exercises on urinary incontinence in patients with cervical cancer undergoing radiation therapy at a tertiary cancer center.

Methods

This study included 45 cervical cancer patients undergoing radiation therapy by using a non- probability-convenience sampling technique and a quasi-experimental one-group pre-post design. Intervention- consists of four pelvic floor muscle strengthening exercises including a) Kegel exercise b) Squeeze and release c) Pelvic floor/inner thigh ball Squeezed) Lower trunk rotation / Lying hip rotation was given with the help of a demonstration, and model pamphlet. These exercises were performed four times every day. The total duration of four items was 18-20 minutes for 12 weeks. Daily follow-up was done and a logbook was maintained for compliance. The patient was assessed for urinary incontinence using the ICIQ UI-SF tool and perineometer on the 8^{th} and 12^{th} weeks. The statistical evaluation plan was

the demographic and clinical data summarized with descriptive statistics and primary objectives evaluated with the Wilcoxon sign rank test, Confidence Interval and Paired t test. Secondary objectives were evaluated with frequency distribution and chi-square t-test.

Results of the studies

In this study, 45 women received the intervention however 43 women completed the intervention and follow-up.

The result showed the frequency, and quantity of urinary incontinence significantly reduced from the patient's baseline parameters. Participant's ICIQ UI SF total score was observed that on pre-test mean of 12.56 (±3.74),8^{th}weeks of intervention mean of 11.33 (±3.48), and 12^{th}weeks of intervention mean of 8.86 (±2.97) and 95% Confidence interval 11.41-13.71, Wilcoxon sign rank test result of pre-test and 12th weeks observed that 4.022. P-value was statistically significant ($p < 0.001$). There was a significant ($P < 0.001$) improvement in the quality of life of participants. The research hypothesis was accepted. There was significant ($p < 0.001$) alleviation in urinary incontinence after pelvic floor muscle strengthening exercises in a patient with cervical cancer undergoing radiation therapy. The pelvic floor muscle contractility on perineometer on pre-intervention mean was 21.63 (±2.71), on post-intervention 8 weeks' mean was 22.33(±2.65), and 12 weeks' mean was 23.49 (±2.16). 95% confidence interval 22.82 -24.15 ($P<0.001$).The pelvic floor muscle strengthening exercises were statistically significant ($p < 0.001$) proving the improvement in pelvic floor muscle strength.

Conclusion

The result of this study suggests that pelvic floor muscle strengthening exercises were effective for alleviating urinary incontinence. Pelvic floor muscle strengthening muscle strengthening exercise might be a protective factor for preserving pelvic floor muscle strength and preventing urinary incontinence.

This study also suggests that simple nursing intervention improved the quality of life and comfort of patients with cervical cancer undergoing radiation therapy. It is a feasible and cost-effective intervention.

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Keywords: Cervical cancer, radiation therapy, pelvic floor muscle strengthening exercises.

Introduction

Cervical carcinoma is one of the most common and dreaded diseases of women. it accounts for 16 percent of total cervical cancer cases occurring globally.[1] Cervical cancer is the most common cause of cancer in women's Indian population.[2] GlobocanReport 2020, reported 123907 cervix uteri cases, accounting for 9.4% of incidence. As per the report, cervical cancer ranks third in India. Cervical cancer treatments have increased survival rates and reduced complications. Cervical cancer was the main cause of cancer-related death in women.[2] In 2020, an estimated 570000 women were diagnosed with cervical cancer worldwide and about 311000 women died from the disease. [3] Globally, the average age at diagnosis of cervical cancer was 53 years, ranging from 44 years to 68 years. The global average age at death from cervical cancer was 59 years, ranging from 45 years to 76 years. Cervical cancer ranked in the top three cancers affecting women younger than 45 years in 146 (79%) of 185 countries.[3] Urinary Incontinence (UI) is one of the most common health problems confronting a patient with cervical cancer. The management of cervical cancer is based on NCG guideline 2020. The cervical carcinoma treated with surgery and/or chemo-radiotherapy. [4] Radiation therapy is the treatment of cervical cancer as adjuvant therapy, concurrent therapy also management of the recurrent and metastatic disease. Radiation therapy can be administered as external beam radiation therapy (EBRT), brachytherapy, or combination [2] therapy. [5] Radiation therapy can kill every last tumor cell within a given mass. This outcome is based on the following events: 1) tissue hypoxia; 2) fraction of proliferating cells vs. quiescent cells; 3) the innate radiosensitivity of the tumor cells, and 4) the repair of both sublethal and potentially lethal tumor cell damage.[6] Radical Radiation Therapy consists of external radiotherapy and brachytherapy. Externalbeam pelvic irradiation (40-50 Gy in 4-5 weeks) combined with intracavitary applications, which together deliver the dose of equivalent to 80Gy to point A. Inj. Cisplatin 40 mg/M2 with appropriate hydration weekly during external radiotherapy.[7][8] The radiation therapy external beam radiation and intracavitary radiation have a greater effect on the pelvic floor (PF) than other treatments because it cause actinic injuries.[9][10] Early urinary complications include irritative bladder symptoms, stress incontinence, abnormal voiding function, and radiation cystitis.[11] According to systematic review pelvic floor dysfunction is common in gynecological cancer patients.it includes urinary incontinence (4-76%) Faecal incontinence (2-34%), urinary retention 0.4-39%) Faecal urge (3-49%) dyspareunia (12-58%) and vaginal dryness (15- 58%).[12] Urinary incontinence is the most common problem in gynecological cancer patients. This disorder is defined by the International Continence Society as a complaint of “involuntary loss of urine”. Urinary incontinence can be categorized as follows: a. Urge incontinence, b. Stress incontinence and c. Mixed incontinence.Previous research revealed that potential causes of incontinence, include dysfunction of the detrusor muscle or muscles of the pelvic floor, dysfunction of the neural controls of storage and voiding, and perturbation of the local environment within the bladder.[13] Urinary incontinence is not a life-threatening disease, but the loss of bladder control can affect social, psychological, familial, occupational, physical, and sexual aspects of patients’ lives.[14][15] Also Urinary incontinence leads to reduced quality of life, it causes social isolation and to restriction of lifestyle. The pelvic floor muscles are located inside the pelvis and consist of twelve striated muscles with a three-layer muscular plate supporting pelvic organs such as the urethra, vagina, and rectum. The pelvic floor muscles include the levator ani, striated urogenital sphincter, external anal sphincter, and ischiocavernosus. [16] The pelvic floor muscle strengthening exercise is beneficial for treating urinary incontinence by strengthening the pelvic floor

muscle.[5][17][18][19] The rationale for the effectiveness of pelvic floor muscle strengthening exercises is they improve muscle strength and increase blood flow to pelvic structure and improve the functioning of sphincter muscles.[20] Therefore, pelvic floor muscle strengthening exercises are effective for urinary incontinence also an economic intervention Due to its ease of application, availability, and lack of side effects, pelvic floor muscle strengthening exercises are recommended for preventing, alleviating, and decreasing the incidence of urinary incontinence and its severity in patients receiving radiation therapy. It improves the quality of life of the patient and improves the self-confidence and self-esteem of participants. It proved beneficial with safety considerations it is universally recommended as standard operating practice.

Materials and Methods

The study approach used in this study was a quantitative one-group pre and post-test experimental design. The study was conducted in the Gynac radiation OPD and RT department, at Tata Memorial Hospital, Mumbai. The literature review was conducted using various search engines such as PubMed, Science Direct, CINHALs, and Cochrane. The investigator reviewed various studies and articles on the topic and it helped to gain clarity about the topic under study. The study was conducted after Institutional Ethics Committee approval from Tata Memorial Hospital and CTRI registration**.** For patients with cervical cancer planned radiation therapy (as per NCG guideline) total dose planned was 5 weeks' external beam radiation done, 2-week brachytherapy. A total of 2600 populations were screened and 45 samples were selected based on the selection criteria using the convenience sampling technique.

Criteria for selection of sample

Inclusion criteria

- Age >18 years and ≤ 65 years of cervical cancer.
- Patients underwent radiation therapy as per NCG guidelines (5 weeks of EBRT +2-week brachytherapy patient).
- Patient receiving concurrent therapy.
- Patients who were able to follow and perform pelvic floor muscle strengthening exercises.[21]

Exclusion criteria

- Cervical cancer with stage IIIC and stage IV and involvement of urinary bladder.
- Cervical cancer participant who has undergone surgery of female reproductive organs.
- Cervical cancer participant who was mentally unsound (The Female suffered from mental illness, so she was unable to follow our instructions and unable to perform exercise.)

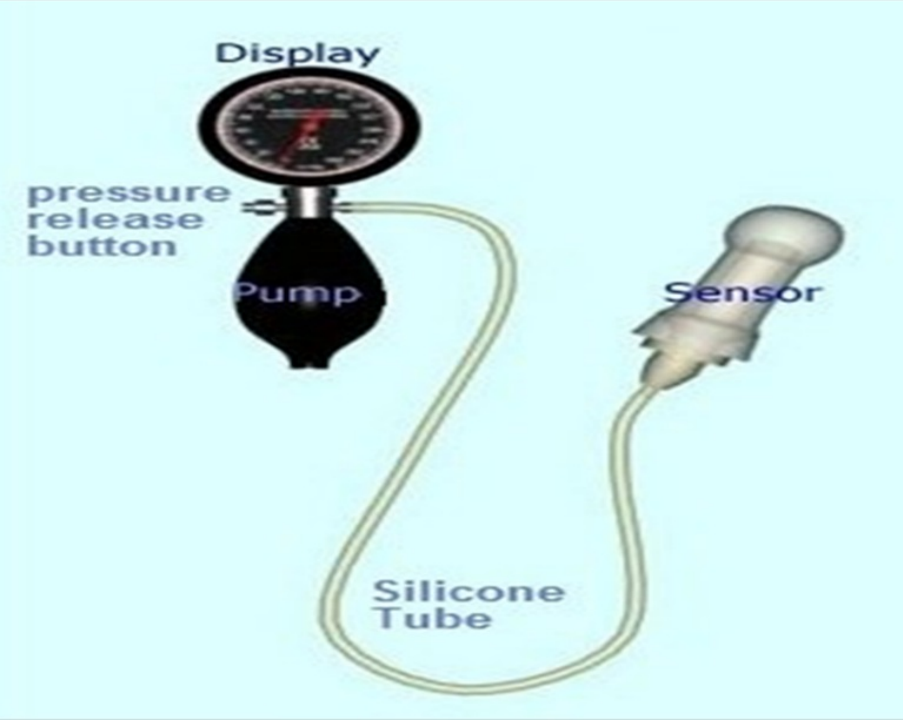
Data collection tool

1. ICIQ-UI short form (International Consultation on Incontinence Questionnaire Urinary Incontinence Short Form (ICIQ-

UI SF) [5][22][23][24][25]. The ICIQ-UI Short Form provides a brief and robust measure for this purpose, as well as in epidemiological surveys, particularly when more than one measure is being used. Number of items:

- 4 Question Frequency of urinary incontinence
- Amount of leakage
- The overall impact of urinary incontinence
- Self-diagnostic item Interpretation of tool was the total score of 21
- Score ranges
- 1-5 (slightly)
- 6-12 (moderate)
- 13-18 (severe)
- 19-21 (very severe).
- Validity and reliability of ICIQ SF checked - it is a standardized tool.

2. **Perineometer** A Perineometer or vaginal manometer is an instrument for measuring the strength of voluntary contractions of the pelvic floor muscles. [25][26]



The perineometer is a simple pneumatic device consisting of a vaginal sensor (vaginal probe) that recorded the contraction in mm of Hg. The resistance chamber (vaginal sensor) measured about 2.5cm in diameter and 8cm in length and is made of silicon. The vaginal sensor was covered with the condom before it was used for the assessment. The perineometer was inserted into the vaginal canal until the full extent of the compressible portion of the device was above the level of the hymen ring. An intentional pressure of 5 mm Hg was maintained before inserting the sensor into the

vagina for each woman. Once the sensor was inserted into the vagina, the digital reading was set to zero before recording the compression pressure. The women were instructed to undertake three maximal pelvic floor muscle contractions sustained for 5 seconds with an interval of 30 seconds. Three squeezes were recorded with a 30-sec rest between efforts, the best of the three readings was considered. Only contractions with visible inward movement of the perineum were considered to be valid. [27] The mean pelvic floor muscle squeeze pressure in nulliparous women was 31.58 mm Hg, primiparous women were 31.25 mm Hg and multiparous women was 26.28 mm Hg. [27][28][29][30]

Relibility of perineometer A reliability analysis scale (alpha) was used.

Reliability analysis of 10 samples with two variances excellent (Alpha = 0.9606). Cronbach's $\alpha = (K/K-1)[1 - \Sigma\sigma^2y/ \sigma^2x]$ k= total items $\Sigma\sigma^2y$ = Sum of item variances σ^2x=variance of total scores.

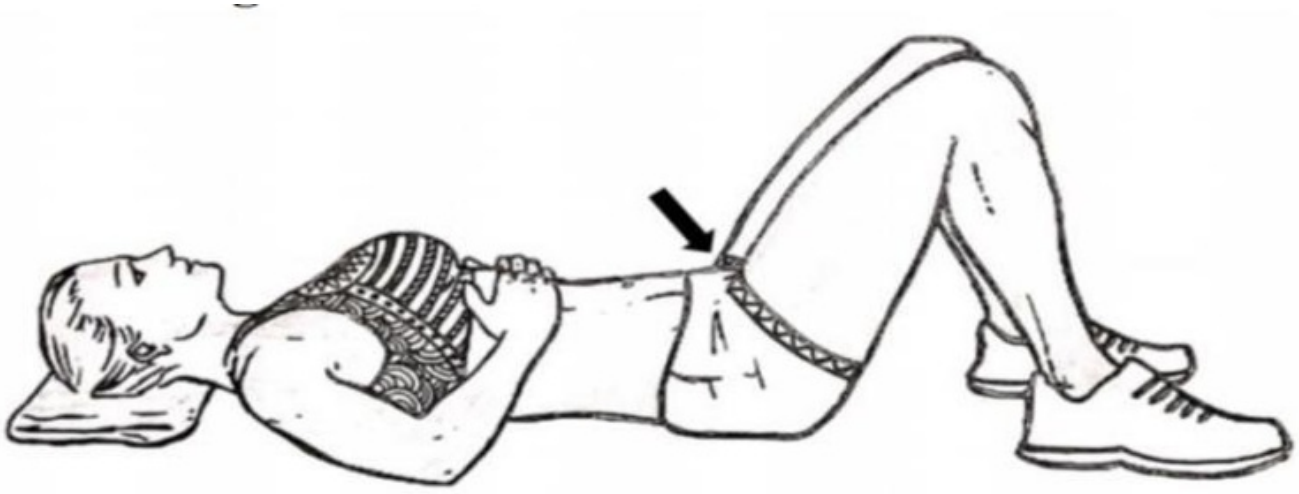
Intervention

Participants were instructed with the help of a pelvic model showing the pelvic floor muscles contraction. Demonstrated and return demonstrations are provided. A pamphlet is also issued as per the choice of the patients.

- The participant had received 4 pelvic floor muscle straightening exercises including a) Kegel exercise b) Squeeze and release c) Pelvic Floor/Inner Thigh Ball Squeezed) Lower trunk rotation / Lying hip rotation.

1. Kegel exercise [17][18][31][32][33]

- Lie in the supine position.
- Close your eyes and visualize muscles that can stop urine flow.
- Tighten the muscles as much as possible.
- Hold this position for 6 sec.
- Release the muscles and rest for 6 seconds.
- Repeat this exercise 10 times per session.
- time of each session 1 minute.

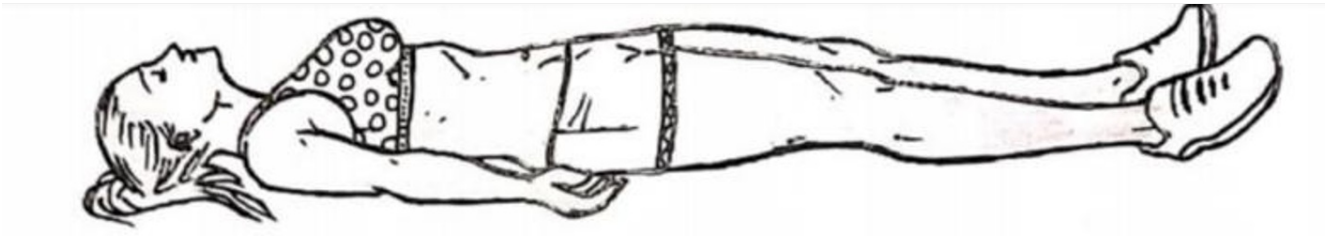


2. Squeeze and release [17][33]. This exercise rapid squeeze and release of perineal muscles.

- Empty the bladder
- Sit in a comfortable position [34]
- Picture the pelvic floor muscle
- Squeeze the perineal muscle as quickly as possible and release without attempting to sustain a contraction
- Rest for 5 seconds, repeat movement 10-20 times (in 5min=15 cycles) of squeeze and release
- Repeat it 4 times a day

a. Supine position

- The same exercise is performed in the supine position (rapid squeeze and release, rest for 5 sec, repeat movement 10-20 times, {in 5min=15 cycle} repeat it 4 times a day



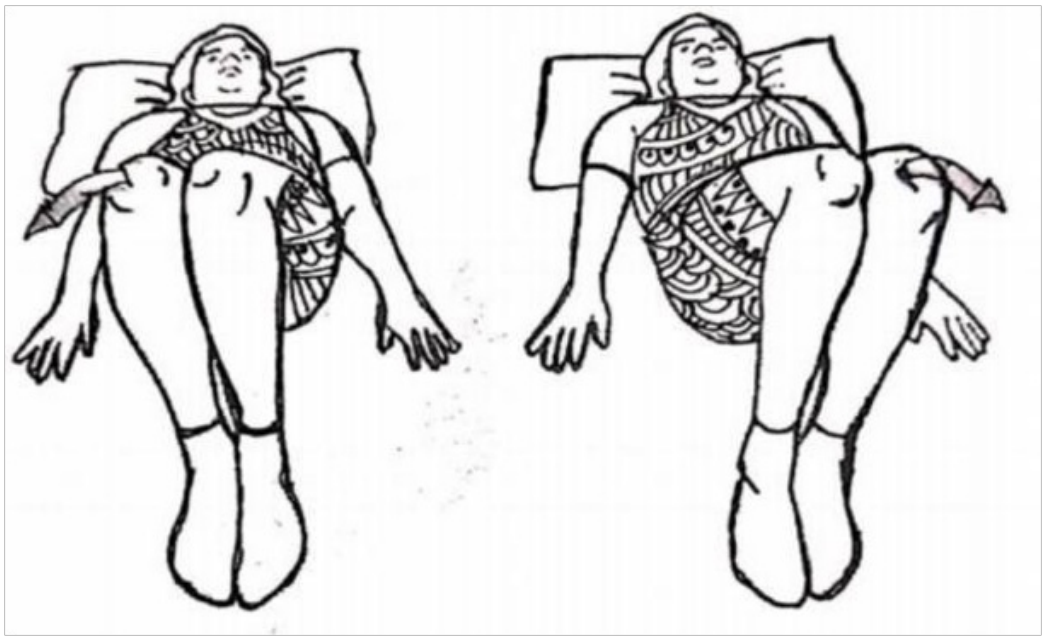
b. Lateral position

- The same exercise is performed in a lateral position (rapid squeeze and release, rest for 5 seconds, repeat movement 10-20 times, {5 min =15 cycles} total time duration 15 minutes. Perform exercise 4 times a day.

3. Pelvic Floor/Inner Thigh Ball Squeeze [31][32][23].

- This is exercise can be done with a 25-30 cm sized ball
- Lie down on the back with knees bent and feet flat on the floor.
- Place a ball between knees, supporting it so it doesn't slip or fall. Inhale relaxing pelvic floor muscles. (for 5 seconds)
- Exhale--during exhalation draw pelvic floor muscles up and in, gently squeeze the ball.
- Place the coccyx bone (tailbone) firmly in contact with the ground.
- Contract pelvic floor muscles for 10 seconds and release the contraction.
- Repeat the exercise 4 times per session 4 times a day.

4. Lower trunk rotation / Lying hip rotation [35][36]



- Lie on your back with knees bent and feet flat on the ground.
- Keep the body firmly on the floor.
- Gently roll both bent knees over to the right side.
- Contract perineal and anal muscles.
- Hold for 10 seconds.
- Relax muscles.
- Return to the starting position.
- Then gently roll the bent knees over to the left side.
- Contract perineal and anal muscles.
- Hold for 10 sec, and then return to the starting position.
- Repeat the exercise 5 times per session for 4 times every day.
- Total time 1.5-2 minutes per session.
- ϖ All exercises should be performed 4 times every day.
- ϖ The total duration of the 4 items is 18-20 minutes.

Participants were followed up daily for 8 weeks. all participant was evaluated on 8th week and 12 weeks by using the ICIQ-of tool, and perineometer.

- A daily logbook was maintained to record compliance.
- Compliance of exercise as a percentage will be calculated based on the logbook.
- 80-100% will be assumed as compliance by the investigator.
- Non-compliance to exercise is less than 80% by a logbook.
- Perineometer is used on a day zero (0) day, and 12 weeks to assess the strength of perineal muscle contraction.

Data Analysis and Interpretation

Table I.		
Demographic Variables	**n**	**%**
a. Age Group (yrs)		
≤ 40	6	13.3
41 – 62	35	77.8
≥ 63	4	8.9
Total	45	100.0
b. Educational Level		
Basic complete	8	17.8
Basic incomplete	29	64.4
Medium complete	2	4.4
Medium incomplete	5	11.1
University	1	2.2
c. Parity		
Nulliparous	0	0.0
Multiparous	45	100.0
d. Mode of Delivery (labor)		
Normal vaginal delivery	44	97.8
Forceps delivery & LSCS	1	2.2
e. BMI		
Underweight (<18.5)	7	15.6
Normal (18.5 – 24.9)	25	55.6
Overweight (25.0 – 29.9)	8	17.8
Obese (≥30.0)	5	11.1
f. Associated risk behavior		
Constipation	13	28.9

1. Demographic data

The table I showed the 77.8% of participants were the age of 41-62 years, education level heterogeneous but a maximum of 64.4% were having basic incomplete.

The result showed the 100% of participants were multiparous and a Maximum of 95.6% of participants had a normal vaginal delivery. 56.6% of participants were normal BMI, whereas 17.8% of participants were overweight, 15.6% of participants were underweighting and 11.1% participants were obese. Constipation was more prevalent (28.9%).13.3% of participants have had Diabetes, 8.9% had hypertension and 13.3% of the participant had a habit of smoking whereas 35.6% of the participant were no above comorbidities. The incidence of urinary incontinence more in stage IIIB Cervical

cancer.

Table II. Effect of pelvic floor muscle strengthening exercises on urinary incontinence on ICIQUI SF (comparative week wise). N=43

Parameter	Pre Test		8th week		12th week		95% CI	Wilcoxon Sign rank test	P-Value	Sig. at 5% level
	Mean ±SD	Median	Mean ±SD	Median	Mean ±SD	Median	Pre test	Pretest & 8th week		
							8th week	Pre-test & 12th week		
							12th week	8th & 12th weeks		
Average frequency of urinary incontinence	2.88 ±1.24	3.0	2.56 ±1.14	3.0	1.88 ±0.85	2.0	2.50 - 3.26	2.414*	<0.001	Yes
							2.21 -2.91	3.759**		
							1.62-2.15	3.467*		
Amount of urineleak	3.30 ±1.44	4.0	2.84 ±1.25	2.0	2.23 ±0.97	2.0	2.86-3.75	2.640*	<0.001	Yes
							2.45 -3.22	3.834**		
							1.93-2.53	2.731*		
Impact of urinary incontinence on qualityof life	6.37 ±1.56	6.0	5.93 ±1.62	6.0	4.74 ±1.84	5.0	5.89-6.85	2.546*	<0.001	Yes
							5.43-6.43	4.034*		
							4.18-5.31	3.610**		
Total Score	12.56 ±3.74	12.0	11.33 ±3.48	11.0	8.86 ±2.97	10.0	11.41-13,.71	2.943*	<0.001	Yes
							10.25-12.40	4.022**		
							7.95-9.78	3.672**		

* *Statistically Significant at 5% level i.e. P<0.05*

** *Statistically highly Significant at 0.1% level i.e. P<0.001 CI- Confidence Interval, SD -standard deviation*

In this study 45 participants were included but 2 patients died after the pre-test as the patient went in because the patient refers to the palliative stage.

43 patients completed 12 weeks of study.

The study results revealed that the frequency of urinary incontinence on the ICIQ UI -SF tool observed in a participant on pre-test mean was2.88 (SD ±1.24) and 8 weeks mean was 2.56 (SD±1.14) and 12 weeks mean was1.88 (SD±0.85). The P-value was found statistically significant (p-value <0.001). The quantity of urinary incontinence observed in a participant on the pre-test mean was 3.30 (SD ±1.44) 8 weeks' mean was 2.84 (SD ±1.25) and 12 weeks' mean was 2.23(SD ±0.97) p-value was found statistically significant (<0.001). The quality of life of participants was significantly (P <0.001) improved. We accepted the research hypothesis there was significantly (p <0.001) controlled urinary incontinence after pelvic floor muscle strengthening exercises in a patient with cervical cancer undergoing radiation therapy.

Table III. Analysis of pelvic floor muscle strengthening on Perineometer. N=43

Parameter	Pre Test	8th week	12th week	95% CI	Paired t-test	P-Value	Sig. at 5% level
	Mean ±SD	Mean ±SD	Mean ±SD	Pre-test	Pre-test & 8th week		
				8th week	Pre-test & 12th week		
				12th week	8th & 12th weeks		
Perineiometer	21.63 ±2.71	22.33 ±2.65	23.49 ±2.16	20.79-22.46	3.995**	<0.001	Yes
				21.51-23.14	5.156**	<0.001	Yes
				22.82-24.15	3.478*	0.001	Yes

* *Statistically Significant at 5% level i.e. P<0.05*

** *Statistically highly Significant at 0.1% level i.e. P<0.001 CI-Confident Interval, SD- Standard deviation*

According to Table III pelvic floor muscle strengthening at preintervention, 8- and 12-week mean were 21.63 (SD±2.71), 22.33 (SD±2.65), and 23.49 (SD±2.16) respectively. The confidence interval on the 12th week was 22.82-24.15.The p-value was found <0.001. The pelvic floor strength is statistically significantly improved after pelvic floor exercises.

Hence Perineometer was conducted as highly significant.

Table IV. Correlation between pelvic floor muscle strength (perineometer) and urinary incontinence. N=43

Variables	Value	Urinary Incontinence Total Score		
Perineometer		Pre-Test	8th weeks	12th weeks
Pre-Test	r	-0.127		
	P-Value	0.416		
8th weeks	r		0.058	
	P-Value		0.713	
12th weeks	r			-0.476*
	P-Value			0.001

* *Statistically Significant at 5% level i.e. P<0.05 r= Correlation Coefficient*

Table IV illustrated that the correlation coefficient between urinary incontinence ICIQUI SF total score and pelvic floor muscle strength -perineometer on the 8thweek of intervention was 0.058 so there was a positive correlation and the 12thweek of intervention -0.476 so negative correlation. So perineometers contractility was proven on the 12th week by the pelvic floor muscle strengthening.

Table V. Incidence of Urinary Incontinence on ICIQ UI SF Tool. N=45

ICIQ UI SF SCORE (Total score 21)	Frequency	Percentages
1-5	0	00
6-12	30	66.67
13-18	9	20
19-21	6	13.33

Table V showed that 30 (66.67%) participants were moderate urinary incontinence, Nine (20%) participants were severe urinary incontinence whereas six (13.33%) participants were very severe urinary incontinence.

Table VI. Self-Diagnosis of Urine Leak - ICIQ UI SF Tool. N=45

Types of urinary incontinence	Frequency	Percentage
No urinary incontinence	00	00
Stress urinary incontinence	03	6.6
Urge urinary incontinence	05	12
Mixed urinary incontinence	37	82

Table VI revealed that 37 (82.2%) of participants had mixed urinary, five (12%) participants had urge urinary incontinence and three (6.6%) participants had stress urinary incontinence.

Table VII A. Association Between Urinary Incontinence and Demographic Data. N=43

Demographic Variables	Urinary Incontinence					Chi- square Test	P-Value	Sig. at 5% level
Age Group (yrs.)	**Slightly (1 – 5)**	**Moderate (6 – 12)**	**Severe (13 – 18)**	**Very Severe (19 – 21)**	**Total**			
≤ 40	0	5	0	1	6	4.588	0.332	Not
41 – 62	0	23	8	4	35			
≥ 63	0	1	2	1	4			
Total	0	29	10	6	45			
Educational Level								
Basic complete	0	5	2	1	8	6.406	0.602	Not
Basic incomplete	0	17	8	4	29			
Medium complete	0	1	0	1	2			
Medium incomplete	0	5	0	0	5			
University	0	1	0	0	1			

According to the table, VIIA observed that there was no significant association between the age of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence (P-value 0.332).Also, there was no significant association between the educational level of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence (P-value 0.602)

Table VII B. Association Between Urinary Incontinence and Clinical Data. N=43

Demographic Variables	Urinary Incontinence					Chi- square Test	P-Value	Sig. at 5% level
Parity	**Slightly (1 – 5)**	**Moderate (6 – 12)**	**Severe (13 – 18)**	**Very Severe (19 – 21)**	**Total**			
Nulliparous	0	0	0	0	0	-	-	-
Multiparous	0	29	10	6	45			
Mode of Delivery (labor)								
Normal vaginal delivery	0	29	10	5	43	2.643	0.267	Not
Forceps delivery & LSCS	0	1	0	1	2			
BMI								
Underweight	0	3	3	1	7	5.520	0.479	Not
Normal	0	16	6	3	25			
Overweight	0	6	0	2	8			
Obese	0	4	1	0	5			
Stage of Disease								
IA	0	1	0	1	2	9.658	0.140	Not
IIA	0	0	0	1	1			
IIB	0	12	4	2	18			
IIIB	0	16	6	2	24			
Total	0	29	10	6	45			

Above the table, VII B reveals that there was no association of parity of cervical cancer patients undergoing radiation therapy and degree of urinary incontinence. There was no significant association betweenthe mode of labor of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence. No significant association betweenthe body mass index of a cervical cancer patient undergoing radiation therapy and the degree of urinary incontinence.

There was no association between the stage of disease and degree of urinary incontinence (P-value 0.140).

Discussion

Urinary incontinence following cervical cancer treatment such as radiation therapy appeared as a significant adverse effect. This quasi-experimental study was aimed to assess the effect of pelvic floor muscle strengthening exercises on urinary incontinence in patients with cervical cancer undergoing radiation therapy. Forty-five samples were selected through the convenience sampling method from and two samples died during intervention because of aggravation of disease and non-treatment and follow-up. In our study intervention consisted of four types of pelvic floor exercises i.e., Kegel, squeeze and release, Pelvic Floor/Inner Thigh Ball Squeeze, Lower trunk rotation / Lying hip rotationfor 18 -20 min for four-time daily and daily follow-up to 12 weeks, and assessment on 8 th weeks and 12th weeks done with international consultation incontinence questionnaire on urinary incontinence -short form and perineometer.

Cinara Sacomori (2020) showed that there was no significant change from baseline to post-radiation therapy in muscle strength, EMG records, and incontinence ($p > 0.05$). The median of PFM strength was equal at baseline and after intervention (median = 2; IQR = 1). Pre-rehabilitation teaching PFMEs might be a protective factor for preserving PFM strength and preventing incontinence 1 month after radiation therapy. It is a feasible intervention.[5] According to Sirls LT (2019) recommended minimal important differences for ICIQ-UI SF 4 at 24 months.[83] In our study participants' ICIQ UI SF total score observed that on pre-test mean was 12.56 (SD±3.74),8weeks mean was 11.33 (SD±3.48) and 12 weeks mean was 8.86 (SD±2.97). There was a significant ($p <0.001$) reduction of urinary incontinence after 12 weeks of PFMSE.

According to the previous study of Andrea Marques (2010), pelvic floor muscle exercises were effective in improving pelvic muscle strength, endurance, and coordination.[84] In our study pelvic floor contractibility significantly ($P<0.001$) improved after 12 weeks of the strength of pelvic floor muscles strengthening exercises.According to a Lancet report by Marc Arbyn (2018) globally, the average age at diagnosis of cervical cancer was 53 years, ranging from 44 years to 68 years.[2] Our study result showed that 77.8% of women's age were ranges of age 41-62 years. According to Cinara Sacomori (2020), Most of the women were married or living with partners (42.8%). Only 17.9% were nulliparous.[5] In our study, 100% of participants were married. There was heterogenicity regarding education levels. A maximum 64.4% of participants had basic incomplete education. 95.6% were normal vaginal delivery.55.6% of women were normal body mass index.

Ramaseshan AS (2018) found that pre-treatment prevalence of stress UI and urgency UI to be 24– 29% and 8-18% respectively, and the post-treatment prevalence to be 4-76% and 4-59% respectively.[12] In our study 82.2% of participants had mixed urinary,11.11% participants had urge urinary incontinence and 6.6% participants had stress urinary incontinence. 66.67% of participants were moderate urinary incontinence; 20% of participants had severe urinary incontinence whereas 13.33% of participants had very severe urinary incontinence.

According to Kristine A. Donovan (2014), 36.5% survival reported constipation in a patient with cervical and endometrial cancer. [86] In our study constipation was more prevalent (28.9%). 53% of the participants were III B and 40% of participants were IIB stage of the disease. 97.8% of the participants had received concurrent therapy.Parivash Jamrasi (2018) suggested that seventy percent is the highest prevalence of urinary incontinence among gynaecologics.[17] Pelvic floor muscle exercise for more than 4 weeks resulted in improved pelvic floor muscle strength and mitigated the symptoms of urinary incontinence among patients with gynecologic cancer.

This study showed that the maximum number of participants complained of mixed urinary incontinence followed by urge UI and stress UI.In this present study, none of the participants experienced pain, tiredness, etc related to exercise as well as pain, discomfort, or bleeding related to the perineometer.

Sirls LT, (2015) The recommended minimal important differences for ICIQ-UI SF 4 at 24 months. Our study showed that significance for ICIQ -UI SF at 8 weeks and 12 weeks.[83]

According to a previously systematic review by Agnieszka Radziminska (2018) on the impact of pelvic floor muscle training on the quality of life of women with urinary incontinence, the result was PFMT is an effective treatment for UI in

women.[85] PFMT significantly improves the QoL of women with UI, which is an important determinant of their physical, mental, and social functioning.

In the previous study of Price N, Dawood R (2010) there is evidence of benefits in using pelvic floor muscle exercises (PFMEs) to prevent UI as an international recommendation.

Rutledge TL (2014), Yang EJ (2012) few studies tested PFMEs in cervical cancer survivors after radiation treatment, including only women with PFD. They showed that PFMEs are useful to improve PFD and the quality of life of cervical cancer patients. [37][38]

Our study showed improved quality of life of participants with cervical cancer such as social, psychological, familial, occupational, physical, and sexual aspects on patients' lives.

There was no association between urinary incontinence and demographic data and clinical characteristics.

According to Cinara Sacomori(2020), the attrition rate was more than 42.8%, but our study attrition rate is 4.5%.[5]

The barrier related to this intervention was difficulty in following -up with participants they need reinforcement of the importance of continuing daily exercise and follow up during the covid 19 pandemic. Some participants having difficulty performing PFMSEs while received chemotherapy. All participants not performed PFMSEs while received brachytherapy. But complaints are above 80%. Future studies should explore the randomized control trial.

Delimitations and directions for future study

The current study had several limitations. We selected only One group quasi-experimental design.

No control group was present. Participants were not randomized. The COVID-19 Pandemic made the situation difficult to enroll the participants in the study and collect data from them. Because of the non-availability of tools in the Bengali language, enrolment was difficult.

We can do this in future randomized controlled trials. The study will help to recommend a standardized operative procedure for patients with cervical cancer undergoing radiation therapy which has not yet been implemented. The above-mentioned exercise regimen can be followed by all patients with urinary incontinence even in nonmalignant conditions. The study will help to view an individual perspective on nursing care of urinary incontinence.

Conclusion

This study was undertaken to assess the effect of pelvic floor muscle strengthening exercises on urinary incontinence in patients with cervical cancer undergoing radiation therapy. Patient's quality of life and comfort are important in nursing and the findings of this study suggest that pelvic floor muscle-strengthening exercises could effectively reduce urinary incontinence in a patient with cervical cancer undergoing radiation therapy. This study suggests that simple nursing

intervention in reducing patient urinary incontinence and strengthening of pelvic floor muscles can be clinically effective and cost-effective.

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