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Research Article

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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Introduction

Cervical cancer is one of the most common and dreaded diseases among women in India, accounting for 16 percent of the 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 that they improve muscle strength, increase blood flow to the 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. The intervention consists of four pelvic floor muscle strengthening exercises including a) Kegel exercise, b) Squeeze and release, c) Pelvic floor/inner thigh ball squeeze, and d) Lower trunk rotation / Lying hip rotation, which were given with the help of a demonstration and a model pamphlet. These exercises were performed four

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times every day. The total duration of the 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 a perineometer on the 8th and 12th weeks. The statistical evaluation plan included summarizing the demographic and clinical data with descriptive statistics and evaluating the primary objectives with the Wilcoxon signed-rank test, Confidence Interval, and Paired t-test. Secondary objectives were evaluated with frequency distribution and the chi-square test.

Results of the studies

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

The results showed that the frequency and quantity of urinary incontinence significantly reduced from the patient's baseline parameters. The participants' ICIQ UI SF total score was observed as follows: on the pre-test, the mean was 12.56 (±3.74), on the 8th week of intervention, the mean was 11.33 (±3.48), and on the 12th week of intervention, the mean was 8.86 (±2.97), with a 95% Confidence Interval of 11.41-13.71. The Wilcoxon signed-rank test result of the pre-test and 12th week observed was 4.022. The 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 of urinary incontinence after pelvic floor muscle strengthening exercises in patients with cervical cancer undergoing radiation therapy. The pelvic floor muscle contractility on the perineometer on pre-intervention had a mean of 21.63 (±2.71), on post-intervention at 8 weeks had a mean of 22.33 (±2.65), and at 12 weeks had a mean of 23.49 (±2.16), with a 95% confidence interval of 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 results of this study suggest that pelvic floor muscle strengthening exercises were effective in alleviating urinary incontinence. Pelvic floor muscle strengthening exercises might be a protective factor for preserving pelvic floor muscle strength and preventing urinary incontinence.

This study also suggests that a 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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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 the Indian female population.[2] Globocan Report 2020 reported 123,907 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 570,000 women were diagnosed with cervical cancer worldwide, and about 311,000 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 the NCG guideline 2020. Cervical carcinoma is treated with surgery and/or chemo-radiotherapy. [4] Radiation therapy is the treatment of cervical cancer as adjuvant therapy, concurrent therapy, and also for the management of recurrent and metastatic disease. Radiation therapy can be administered as external beam radiation therapy (EBRT), brachytherapy, or a 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. External beam pelvic irradiation (40-50 Gy in 4-5 weeks) combined with intracavitary applications, which together deliver a dose equivalent to 80 Gy 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 they cause actinic injuries.[9][10] Early urinary complications include irritative bladder symptoms, stress incontinence, abnormal voiding function, and radiation cystitis. [11] According to a 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 a reduced quality of life; it causes social isolation and 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] Pelvic floor muscle strengthening exercises are beneficial for treating urinary incontinence by strengthening the pelvic floor muscles. [5][17][18][19] The rationale for the effectiveness of pelvic floor muscle strengthening exercises is that they improve muscle strength, increase blood flow to pelvic structures, and improve the functioning of sphincter muscles.[20] Therefore, pelvic floor muscle strengthening exercises are effective for urinary incontinence and are also an economic intervention. Due to their 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. They improve the quality of life of the patient and enhance the self-confidence and self-esteem of participants. They have proven beneficial with safety considerations and are 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, which 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 for radiation therapy (as per NCG guideline), the total dose planned was 5 weeks of external beam radiation, followed by 2 weeks of 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 with cervical cancer.
- Patients who underwent radiation therapy as per NCG guidelines (5 weeks of EBRT + 2 weeks of

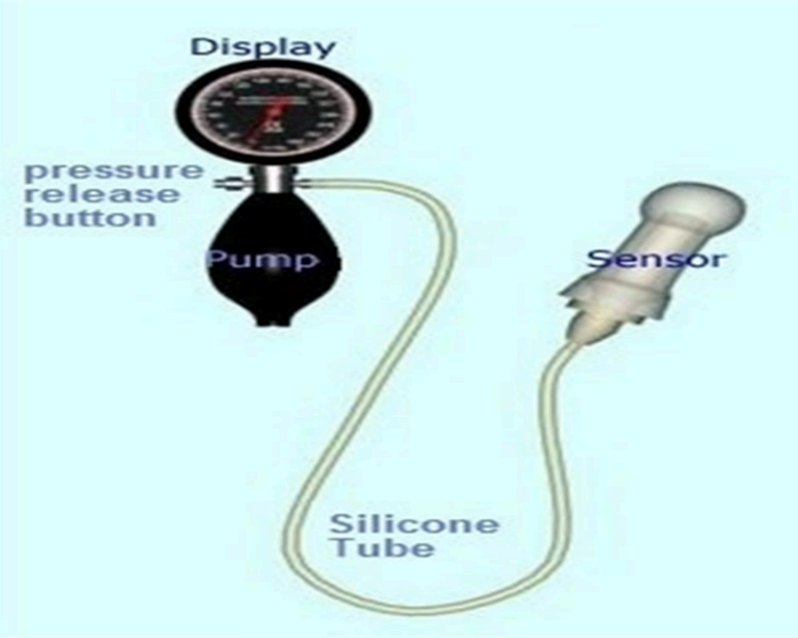
brachytherapy).
- Patients receiving concurrent therapy.
- Patients who were able to follow and perform pelvic floor muscle strengthening exercises. [21]

Exclusion criteria

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

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 Questions on the frequency of urinary incontinence
   - Amount of leakage
   - The overall impact of urinary incontinence
   - Self-diagnostic item Interpretation of the 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 records the contraction in mm of Hg. The resistance chamber (vaginal sensor) measures about 2.5 cm in diameter and 8 cm in length and is made of silicon. The vaginal sensor is covered with a condom before it is used for the assessment. The perineometer is inserted into the vaginal canal until the full extent of the compressible portion of the device is above the level of the hymen ring. An intentional pressure of 5 mm Hg is maintained before inserting the sensor into the vagina for each woman. Once the sensor is inserted into the vagina, the digital reading is set to zero before recording the compression pressure. The women are instructed to undertake three maximal pelvic floor muscle contractions sustained for 5 seconds with an interval of 30 seconds. Three squeezes are recorded with a 30-second rest between efforts; the best of the three readings is considered. Only contractions with visible inward movement of the perineum are considered to be valid. [27] The mean pelvic floor muscle squeeze pressure in nulliparous women was 31.58 mm Hg, in primiparous women was 31.25 mm Hg, and in multiparous women was 26.28 mm Hg. [27][28][29][30]

Reliability of the perineometer: A reliability analysis scale (alpha) was used.

Reliability analysis of 10 samples with two variances was excellent (Alpha = 0.9606). Cronbach's α = (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.

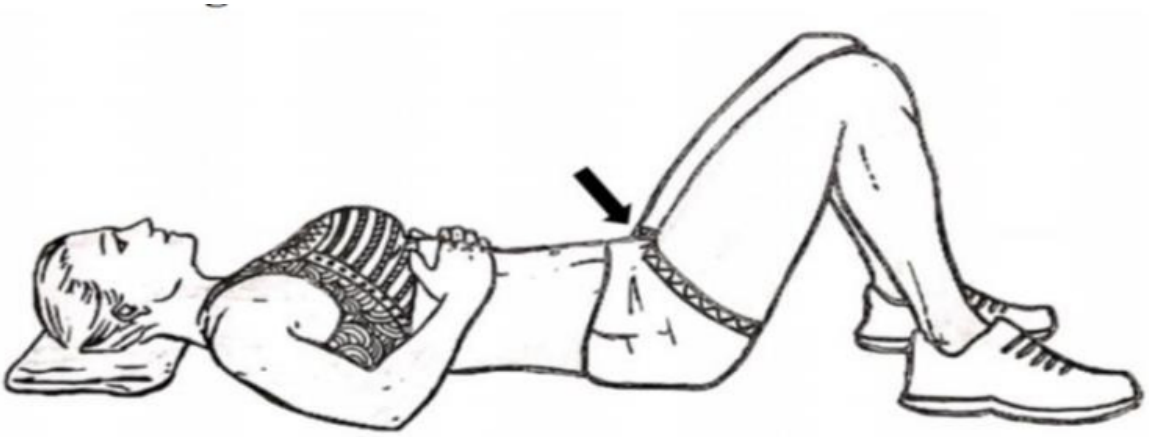
Intervention

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

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

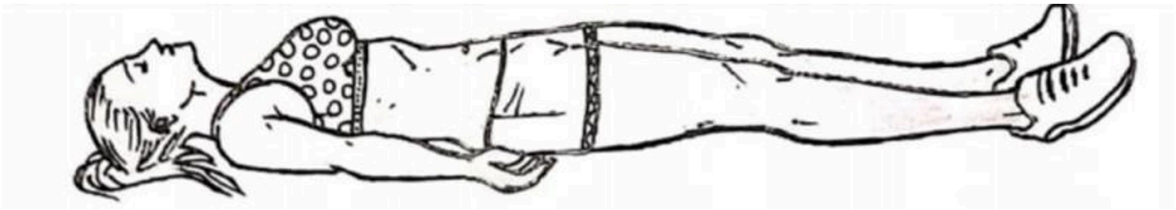
1. Kegel exercise [17][18][31][32][33]

- Lie in the supine position.
- Close your eyes and visualize the muscles that can stop urine flow.
- Tighten the muscles as much as possible.
- Hold this position for 6 seconds.
- 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 involves 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 the movement 10-20 times (in 5 min = 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 5 min = 15 cycles} 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.

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

- This 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]

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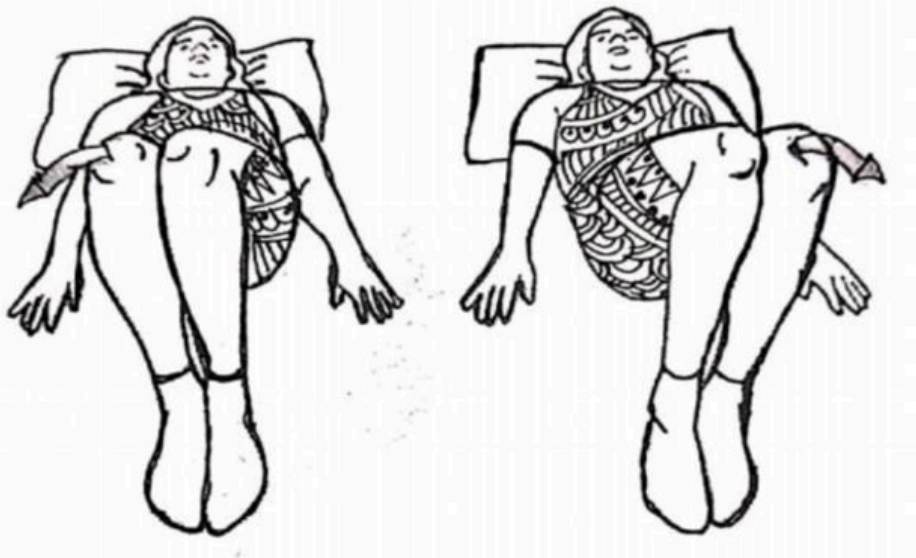

- Lie on your back with knees bent and feet flat on the ground.
- Keep the body firmly on the floor.
- Gently roll both bent knees over to the right side.
- Contract perineal and anal muscles.
- Hold for 10 seconds.
- Relax muscles.
- Return to the starting position.
- Then gently roll the bent knees 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, 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 participants were evaluated on the 8th week and 12th week by using the ICIQ-of tool and perineometer.

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

Data Analysis and Interpretation

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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

Table I.

1. Demographic data

Table I showed that 77.8% of participants were in the age group of 41-62 years. The education level was heterogeneous, but a maximum of 64.4% had basic incomplete education.

The results showed that 100% of participants were multiparous, and a maximum of 95.6% of participants had a normal vaginal delivery. 55.6% of participants had a normal BMI, whereas 17.8% were overweight, 15.6% were underweight, and 11.1% were obese. Constipation was more prevalent (28.9%). 13.3% of participants had diabetes, 8.9% had hypertension, and 13.3% of the participants had a habit of smoking, whereas 35.6% of the participants had none of the above comorbidities. The incidence of urinary incontinence was higher in stage IIIB cervical cancer.

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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**		

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

[*] *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 was 2.88 (SD ±1.24) and 8 weeks mean was 2.56 (SD±1.14) and 12 weeks mean was 1.88 (SD±0.85). The P-value was found statistically

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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); the 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 that there was significantly (p <0.001) controlled urinary incontinence after pelvic floor muscle strengthening exercises in a patient with cervical cancer undergoing radiation therapy.

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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

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

* *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 means 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 to be <0.001. The pelvic floor strength is statistically significantly improved after pelvic floor exercises.

Hence, the Perineometer results were conducted as highly significant.

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

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

* *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 8^{th} week of intervention was 0.058, so there was a positive correlation, and on the 12^{th} week of intervention, it was -0.476, so a negative correlation. So, the perineometer's contractility was proven on the 12^{th} week by the pelvic floor muscle strengthening.

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

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

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

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

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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			

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

According to Table VIIA, it was 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).

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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			

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

Above the table, VII B reveals that there was no association between the parity of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence. There was no significant association between the mode of labor of cervical cancer patients undergoing radiation therapy and the degree of urinary incontinence. No significant association was found between the 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 the 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 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, and two samples died during the intervention because of aggravation of disease and non-treatment and follow-up. In our study, the intervention consisted of four types of pelvic floor exercises, i.e., Kegel, squeeze and release, Pelvic Floor/Inner Thigh Ball Squeeze, and Lower trunk rotation / Lying hip rotation, for 18-20 minutes, four

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times daily, with daily follow-up for 12 weeks. Assessment on the 8th and 12th weeks was done with the International Consultation on Incontinence Questionnaire on Urinary Incontinence - Short Form and a 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 of 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), the recommended minimal important difference for ICIQ-UI SF is 4 at 24 months.[83] In our study, participants' ICIQ UI SF total scores observed that the pre-test mean was 12.56 (SD±3.74), the 8-week mean was 11.33 (SD±3.48), and the 12-week mean was 8.86 (SD±2.97). There was a significant ($p <0.001$) reduction in urinary incontinence after 12 weeks of PFMSE.

According to the previous study by 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 pelvic floor muscle 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 results showed that 77.8% of women's ages ranged from 41 to 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 heterogeneity regarding education levels. A maximum of 64.4% of participants had incomplete basic education. 95.6% had normal vaginal delivery. 55.6% of women had a normal body mass index.

Ramaseshan AS (2018) found that the pre-treatment prevalence of stress UI and urgency UI was 24–29% and 8-18%, respectively, and the post-treatment prevalence was 4-76% and 4-59%, respectively.[12] In our study, 82.2% of participants had mixed urinary incontinence, 11.11% of participants had urge urinary incontinence, and 6.6% of participants had stress urinary incontinence. 66.67% of participants had 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% of survivors reported constipation in patients with cervical and endometrial cancer. [86] In our study, constipation was more prevalent (28.9%). Fifty-three percent of the participants were at stage IIIB, and 40% were at stage IIB of the disease. Ninety-seven point eight percent of the participants had received concurrent therapy. Parivash Jamrasi (2018) suggested that seventy percent is the highest prevalence of urinary incontinence among gynecological patients. [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, or other issues related to exercise, nor pain, discomfort, or bleeding related to the perineometer.

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

According to a previous 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 that 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 by Price N and 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) and Yang EJ (2012) conducted a few studies that 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 in social, psychological, familial, occupational, physical, and sexual aspects of patients' lives.

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

According to Cinara Sacomori (2020), the attrition rate was more than 42.8%, but our study's 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 had difficulty performing PFMSEs while receiving chemotherapy. None of the participants performed PFMSEs while receiving brachytherapy. But complaints are above 80%. Future studies should explore a randomized control trial.

Delimitations and directions for future study

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

No control group was present. Participants were not randomized. The COVID-19 pandemic made the situation difficult to enroll participants in the study and collect data from them. Because of the non-availability of tools in the Bengali language, enrollment 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 the 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. The 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 patients with cervical cancer undergoing radiation therapy. This study suggests that simple nursing interventions in reducing patient urinary incontinence and strengthening of pelvic floor muscles can be clinically effective and cost-effective.

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