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Non-Invasive Pelvic Floor Rehabilitation in Cancer Population

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Background

The pelvic floor (PF) is a complex network of muscles and ligaments that serves as a crucial structural support for various pelvic organs, including the bladder, urethra, prostate, vagina, uterus, anus, and rectum, while also indirectly supporting intra-abdominal contents. It forms a hammock-like supportive layer embedded from the pubic bone to the sacrum/coccyx and ischial tuberosities. Among its key functions are facilitating voluntary control of urine and feces dynamics, as well as contributing to sexual arousal and orgasm [1]. The proper functioning of the PF relies on the integrity of its muscular structures, blood supply (predominantly from parietal branches of the internal iliac artery), and nerve supply (primarily from sacral nerves S3-S4 and the pudendal nerve) [2].

Pelvic floor dysfunction (PFD) refers to the inability to correctly relax-contract and coordinate the PF musculature. This can manifest itself as chronic pelvic and perineal pain and a range of urological, gynecological, sexual, or colorectal symptoms, based on hypotonicity, hypertonicity, and improper muscle coordination. Urological dysfunctions may include incontinence, painful urination, frequent urination, urgency, and nocturia, [3,4] while colorectal symptoms might involve difficulty passing stools, sensation of incomplete bowel movements, urge to defecate, painful bowel movements, and incontinence [5]. Sexual symptoms related to PFD encompass painful intercourse, vulvovaginal discomfort, erectile dysfunction, and premature ejaculation in males [6,7] (**Figure 1, Table 1**).

In the general population, pregnancy, childbirth, prostate pathology, obesity, and chronic constipation have been linked to pelvic floor dysfunction. Whereas, in cancer patients, pelvic anatomical disruption from malignancies of pelvic organs, along with treatments like chemotherapy, radiation, and surgery, combined with inflammatory changes in visceral, urological, colorectal, and gynecological systems. Such coupling can lead to neuromuscular, neurological, and vascular impairment affecting the pelvic harmonic integrity [8-10]. This contributes to a heightened incidence of pelvic floor dysfunction, adversely impacting the quality of life in individuals undergoing treatment for pelvic cancer. The negative impact on this population is unmeasurable, manifesting as increased physical and emotional burdens, elevated cost of care, additional morbidity, and escalation of challenges in managing inadequately treated patients.

Despite the broad spectrum of symptoms associated with PFD in cancer patients and survivors, pain emerges as the most disruptive aspect, frequently leading to the use of polypharmacy and even high opioid doses. As such, many patients within our cancer cohorts experience uncontrolled chronic pelvic pain attributable to pelvic floor dysfunction. Encouragingly, non-invasive interventions targeting the pelvic floor rehabilitation (PFR) have shown efficacy in pain control and improvement in the quality of life for survivors of

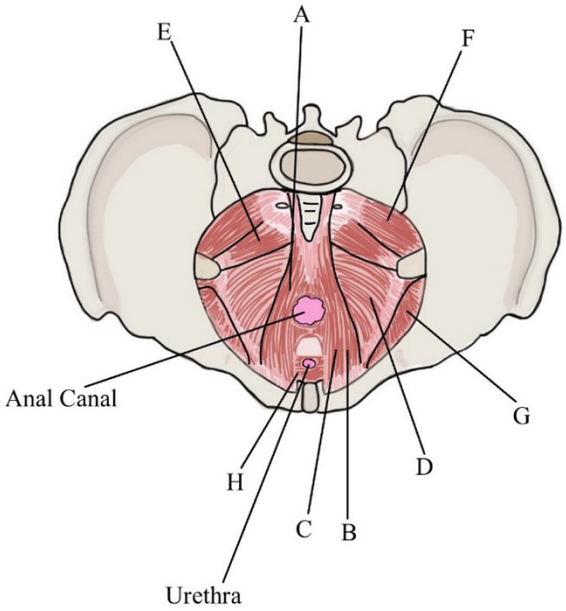

Figure 1. Basic muscle distribution of the pelvic floor.

Table 1. Clinical presentation of individual pelvic muscle and associated dysfunction.

	Pelvic Floor Muscle	Hypertonic Dysfunction	Hypotonic Dysfunction
A	**Levator Ani** *Supports and raises the pelvic visceral structures.*	Pelvic discoordination Rectal pain Painful urination Painful bowel movements Pain while sitting Sensation of urge to defecate. Sensation of incomplete defecation Dyspareunia	Pelvic discoordination Fecal incontinence Urinary incontinence Rectal prolapse. Chronic sensation of constipation
B	**Pubococcygeus** *Controls urine flow and contracts during orgasm as well as assisting in male ejaculation.*	Frequent urination Sensation of urge to defecate. Straining during defecation Painful ejaculation Dyspareunia	Stress urinary incontinence Incomplete urination Incomplete defecation Delayed defecation Vaginal prolapse Anejaculation Anorgasmia
C	**Puborectalis** *It acts in association with the internal and external anal sphincter in the process of defecation.*	Sensation of urge to urinate. Painful urination Painful defecation Painful erection Vulvodynia	Urinary incontinence Labored defecation Erectile dysfunction Vaginal prolapse
D	**Iliococcygeus** *Elevates the recto-anal junction; supports pelvic viscera; increases intra-abdominal pressure; activates in normal quiet inspiration.*	Pelvic discoordination Pelvic pain	Vaginal prolapse.

E	**Coccygeus** *Flexes the coccyx; aids the puborectalis to control urination and defecation especially during an increase in intra-abdominal pressure.*	Coccygodynia Pain while sitting Painful defecation	Fecal incontinence
F	**Piriformis** *It helps rotate the hip in an outward direction; allows the thigh and knee to rotate or move away from the body.*	Pain at hip, buttock, and upper leg Sciatic like pain Pain with prolonged sitting	Unbalanced gait Propensity to falls
G	**Obturator internus** *Externally rotate the femur when the hip is extended and abduct the femur when the hip is flexed.*	Pain in the buttock region Pudendal Neuralgia Anorectal pain Urinary frequency	Pelvic coordination deficit Unstable gait Propensity to falls
H	**Urogenital diaphragm** *Supports the urethra and maintains the urethrovesical junction.*	Painful urination Frequent need to urinate. Urinary hesitancy Painful erection Painful ejaculation	Urinary incontinence Erectile dysfunction

pelvic cancer [11]. Therefore, in this article we aim to explore the potential relationship between PFR and the alleviation of pain and associated symptoms in this population and in a subgroup of cancer patients. Pain was assessed using a numeric rating scale (NRS) of pain that ranged from 0 (no pain) to 10 (extreme pain). Average values were measured before, and only after at least three sessions of PFR.

Discussion

The estimated prevalence of PFD worldwide ranges from 1.9% to 46.50% [12]. While very rare in males, pelvic floor disorders are up to 25% in otherwise healthy non-pregnant women [13]. Moreover, pelvic floor disorders might be underreported due to embarrassment of sharing very private conversations, thus leading to a lack of treatment and therefore to social isolation, loss of personal and intimate relationships, and reduced participation in leisure activities [14]. In the cancer population, more data has been collected on female patients. A systematic review and meta-analysis reported 45.0% sexual dysfunction, 34.1% urinary incontinence, and 11.1% fecal incontinence in cervical cancer survivors [15]. However, there was great heterogenicity of the population and the treatments used.

In a retrospective study of 49 cancer patients diagnosed with pelvic floor dysfunction, the majority treated for colorectal cancer (**Table 2**); chronic pelvic pain was the most prominent symptom; most patients (n=47) have at least one or combined

Table 2. Patient demographics and treatment information (N = 49).

Variable	Category	Count	(%)
Age (years)	<60	34	69
	>60	15	31
Gender	Female	42	86
	Male	7	14
Cancer diagnosis	Vulva	5	10.2
	Breast	10	20.8
	Leukemia	2	4.1
	Cervix	2	4.1
	Colorectal	20	40.8
	Endometrial	1	2.0
	Lymphoma	3	6.1

	Mandible	1	2.0
	Melanoma	1	2.0
	Ovary	3	6.1
	Sarcoma	1	2.0
Therapy	Surgery	35	71.4
	Chemotherapy	34	69.4
	Radiation therapy	31	63.3
	Hormone therapy	4	8.2

symptoms of PFD and pain. After pelvic floor rehabilitation, most symptoms namely bladder dysfunction, dyspareunia, erectile dysfunction, and rectal dysfunction resolved [16] and the median pain score reduction was 2 with a range of (max-min = 2 – (-7) = 9) (P<0.0001) (**Figure 2**).

Our analysis has revealed the efficacy of PFR in significantly reducing self-reported pain levels among individuals with active cancer. The proper convergence of visceral and somatic sensations seems to be disrupted by pelvic pain, and the wide array of issues stemming from PFD. Unfortunately, the study did not include questionaries using variables of patient-reported outcome measures (PROMs); this could have provided clinicians and researchers access to reliable, valid, and flexible measures of health status that assess physical, mental, and social well–being from the patient perspective while undergoing PFR interventions.

Anatomical differences among patients coupled with visceral disturbances cause this pain to be unique to each patient, focal or diffuse and may present as proctalgia, coccygodynia, sacroiliitis, orchialgia, vulvodynia, or interstitial cystitis [21-26]. In addition to pain, individuals with PFD often face challenges with urination and defecation, compounded by ineffective evacuation techniques and avoidance behaviors influenced by lifestyle factors [27,28]. Postural abnormalities, gait issues, and skeletal misalignment prevalent in oncology patients further exacerbate pelvic muscular pain [29,30]. While the precise etiology and functional mechanisms of PFD-related conditions remain incompletely understood, certain factors

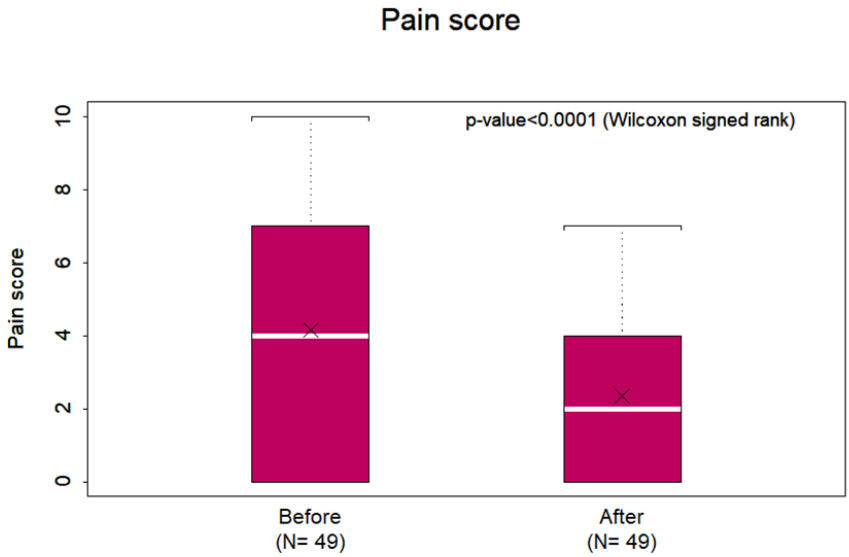

Figure 2. Self-reported pain scores before and after pelvic floor rehabilitation. Bar graphs show the mean ± standard error along with the median ("X" symbol) of the pain score reduction. A p-value of <0.0001 from the Wilcoxon signed rank test indicates that the change in the pain score from before to after treatment was significantly different from zero.

like levator hiatus widening and PF laxity have been associated with increased intra-abdominal pressure during defecation straining [31,32]. It is also known that defecation and urination require a sound anorectal sensation and proprioception for the harmonious coordination of increased intra-abdominal pressure and the relaxation of the PF and sphincter system [33].

The success and sustainability of PFR is based on a multidisciplinary collaboration; that includes education of providers to adequately identify patients in need for PFR; core members of the team include surgeons with an interest in pelvic floor disorders such the treatment of middle compartment prolapse and urinary disorders. Hands-on providers are commonly physical therapists and rehabilitation personnel able to perform external therapy techniques such nerve release, trigger point therapy, deep tissue massage, skin rolling and joint mobilization [34].

Successful management of PFR typically involves non-invasive approaches such as dietary adjustments, weight management, and specific exercises targeting the core and PF muscles to improve functional movement and strengthen antagonist muscles [35]. Additionally, conservative interventions like heat or ice therapy, electrical stimulation (e.g.Transcutaneous Electrical Nerve Stimulation), yoga, meditation, and mindfulness-based stress reduction techniques can be beneficial [36-38]. Manual therapy, including patient-assisted techniques and the use of pessaries for stress urinary incontinence, plays a vital role in a comprehensive treatment plan. Physical therapists specializing in PF disorders deliver interventions such as trigger point massage, myofascial release, strain-counterstrain techniques, and joint mobilization to enhance efficacy [39,40]. Biofeedback, a cornerstone in PFD treatment, offers neuromuscular training for proper contraction-relaxation of the PF muscles, often combined with strengthening and relaxation exercises and feedback through visual or auditory cues [41,42].

PFR should be performed only by providers who received specialized training. In general, internal manipulation for intended PFR should be avoided during pregnancy, after recent pelvic surgery including vaginal or cesarean delivery, similarly in those patients with atrophic vaginitis, tissue fragility, and active pelvic, rectal and vulvovaginal infection. Ethical and legal advice arise if invasive PFR is planned on children and presexual adolescents. Informed consent should always be obtained in all patients.

Although invasive procedures like intravesical injection of botulinum toxin A or sacral nerve stimulation have shown promise in symptom alleviation, they were not utilized in the mentioned study [43-45]. It is important to note contraindications for PFR, which include patient inability to follow instructions and the presence of persistent wounds in the treatment area. A digital examination intravaginally or intrarectally to assess muscle tone is pivotal in tailoring a personalized treatment plan, with caution exercised in severely immunocompromised patients to avoid potential complications such as the release of bacterial agents to the general blood circulation [46,47].

Although, the long-term effects and sustainability of PFR interventions in cancer patients has not been evaluated, some authors have concluded that PFR, at least for urinary incontinence remains highly effective for up to five years in older women, patients have continued to perform exercises after completing their physiotherapy education sessions [48,49].

Conclusion

Pelvic floor rehabilitation is an effective tool for treating the pain associated with pelvic floor dysfunction and its related pelvic organ dysfunction in cancer patients. This conservative approach can contribute to reducing pain and lowering the use of opiate analgesics.

Standardized protocols and guidelines for implementing PFR in cancer patients are essential tools, unfortunately not consistently available for this population. Specific techniques, indications for invasive procedural interventions, duration, frequency, and intensity of the PFR are tailored based on the patient's clinical condition, cancer type, treatment history and the resource available.

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