

REVIEW

Bibliographic review on the relationship between endometrial cancer and pelvic floor dysfunction

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Abstract

This Narrative review examines the relationship between endometrial cancer (EC) and pelvic floor dysfunction (PFD), which includes urinary and fecal incontinence, pelvic organ prolapse, and related treatment needs. A comprehensive search of medical databases and peer-reviewed journals was carried out to identify studies published from 2010 to 2025, focusing on the latest evidence. While oncologic outcomes for EC have improved thanks to advances in diagnosis, molecular classification and treatment, the effect of EC and its therapies on pelvic floor health is still not fully addressed in clinical practice. This review shows that PFD is highly prevalent in EC survivors and highlights the importance of early detection, patient education, personalized rehabilitation and good teamwork among specialists. Future research should clarify the long-term impact of EC treatments on pelvic floor function and look for innovative tools, such as biomarkers like microRNAs, to support prevention and tailored care. Integrating pelvic floor health into follow-up plans can help protect function and improve quality of life for women after EC.

Keywords

Endometrial cancer; Pelvic floor disorders; Pelvic floor dysfunction; Urinary incontinence; Fecal incontinence; Pelvic organ prolapse

1. Introduction

Endometrial cancer (EC) is the most common gynecologic malignancy in developed countries and its incidence has increased significantly over recent decades, mainly due to the rise in obesity and metabolic syndrome, which are the main risk factors associated with its development [1, 2]. EC represents the sixth most frequent cancer in women worldwide, with more than 417,000 new cases and 97,000 deaths estimated globally in 2020, according to GLOBOCAN data [3]. Traditionally, EC was classified into two histological types proposed by Bokhman: Type I tumors, which are estrogen-dependent, generally endometrioid histology and associated with good prognosis; and Type II tumors, which are estrogen-independent, more aggressive and with poor prognosis [4]. However, this dualistic model has limitations, as tumors of different biological behaviors can share histological features. In this context, The Cancer Genome Atlas (TCGA) proposed a new molecular classification, dividing EC into four subgroups: DNA polymerase epsilon (POLE)-ultramutated, microsatellite instability-high (MSI-H), copy-number low and copy-number high (serous-like) tumors, which provide more accurate prognostic and therapeutic guidance [5, 6]. Recent clinical guidelines recommend incorporating molecular classification into routine EC management, allowing more personalized treatment strategies [7].

Obesity is the most important modifiable risk factor for EC. The risk of developing EC increases by 1.6 times for every 5 units of increase in body mass index (BMI) [8]. Other risk factors include unopposed estrogen exposure, diabetes mellitus, hypertension, early menarche, late menopause, nulliparity, polycystic ovary syndrome (PCOS) and genetic predisposition such as Lynch syndrome [9, 10].

Although EC is classically diagnosed in postmenopausal women, around 15–25% of cases occur in premenopausal women, and approximately 4–10% in women under 40 years old [11]. For these patients, fertility-sparing treatment strategies have gained increasing importance and acceptance in recent years, allowing selected patients with early-stage, low-grade EC to preserve reproductive potential [12]. The standard fertility-sparing approach consists of high-dose oral progestins (medroxyprogesterone acetate or megestrol acetate) and/or levonorgestrel-releasing intrauterine device (LNG-IUD) [13, 14]. Recent meta-analyses show complete response rates of 80–85% with fertility-sparing treatments, although recurrence rates can reach 30% [15]. Assisted reproductive techniques improve pregnancy rates after complete response [16]. Importantly, the incorporation of molecular classification into fertility-sparing treatment protocols is a topic of growing interest, as recent studies suggest that patients with MSI-H or POLE-mutated tumors may have different response rates or recurrence risks [17, 18].

Lynch syndrome is the most frequent hereditary syndrome associated with EC, with a lifetime risk of developing EC ranging from 27% to 71% depending on the gene involved [10]. Genetic counseling, screening and risk-reducing strategies are essential in this population. Hormone replacement therapy (HRT) after risk-reducing surgery in these patients remains controversial, although recent evidence suggests that it may be safe in selected cases and can improve quality of life [19].

Beyond oncological outcomes, EC and its treatment can have a significant impact on patients' quality of life, especially in aspects related to pelvic floor function. Pelvic floor dysfunction (PFD) is a broad term that includes urinary incontinence (UI), fecal incontinence (FI), pelvic organ prolapse (POP) and sexual dysfunction, conditions that are already highly prevalent in the general female population and may be exacerbated by cancer treatments [20, 21]. While the oncological treatment of EC has evolved considerably, its impact on pelvic floor function and rehabilitation strategies remains underexplored in the literature. Addressing this gap is essential to improve survivorship care. Bridging this gap is essential as it could improve treatment decisions, guide personalized rehabilitation strategies, and ultimately enhance the quality of life of endometrial cancer survivors.

This review aims to explore the current evidence regarding the relationship between EC and PFD, analyzing the prevalence, risk factors, pathophysiological mechanisms and impact of different treatment modalities on pelvic floor function. In addition, the review will discuss rehabilitation strategies and recommendations for clinical practice to optimize quality of life in EC survivors.

2. Methodology

We conducted a bibliographic review using the PubMed, Scopus, Web of Science and Cochrane Library databases to identify relevant articles addressing the relationship between endometrial cancer (EC) and pelvic floor dysfunction (PFD). The search strategy included combinations of the following keywords: “endometrial cancer”, “pelvic floor dysfunction”, “urinary incontinence”, “fecal incontinence”, “pelvic organ prolapse”, “pelvic floor rehabilitation”, “quality of life”, “survivorship”, “fertility-sparing treatment”, “menopause” and “microRNA”.

We focused on articles published from January 2010 to February 2025, giving special priority to studies from the last three years (2022–2025) in line with the recommendations of the European Journal of Gynaecological Oncology for updated references. Only peer-reviewed articles written in English were included. Studies were excluded if they were case reports, conference abstracts or publications without full-text availability.

In total, 85 articles were selected for detailed analysis after screening titles and abstracts, applying inclusion and exclusion criteria, and reviewing full texts. The selected studies include systematic reviews, meta-analyses, randomized controlled trials, cohort studies and high-quality observational studies, providing a comprehensive overview of the topic. The data extracted focused on prevalence of PFD in EC patients, treatment modalities influencing pelvic floor function, reha-

bilitation strategies and patient-reported outcomes.

Particular attention was paid to study design, population characteristics, data synthesis and potential sources of bias. The studies were analyzed thematically according to the specific PFD categories (urinary incontinence, fecal incontinence, pelvic organ prolapse) and their association with EC treatments.

3. Endometrial cancer overview

Endometrial cancer (EC) is the most common gynecologic malignancy in developed countries, with a growing incidence mainly due to increasing rates of obesity and metabolic syndrome [1, 2]. According to recent epidemiological data, more than 417,000 new cases of EC were diagnosed worldwide in 2020, with the highest incidence in North America and Europe [3]. EC is typically diagnosed in postmenopausal women; however, a significant proportion of cases also occur in premenopausal women, including about 4–10% in women under 40 years old [4, 5].

The most frequent symptom leading to diagnosis is abnormal uterine bleeding, which often allows for early-stage detection [6]. Standard treatment for EC consists of total hysterectomy with bilateral salpingo-oophorectomy, associated or not with sentinel lymph node biopsy or lymphadenectomy, depending on tumor risk factors [7]. A detailed understanding of pelvic surgical anatomy is essential to perform these oncologic procedures safely and effectively. Critical pelvic spaces such as the paravesical, pararectal, and retroperitoneal compartments must be clearly identified and developed to allow optimal dissection. Precise knowledge of the ureters, vascular structures, pelvic nerves, and lymphatic drainage pathways is fundamental for minimizing intraoperative complications and achieving adequate oncologic resection [22]. The introduction of sentinel lymph node mapping has significantly reduced surgical morbidity, minimizing risks such as lymphedema and nerve damage compared to systematic lymphadenectomy [8, 9]. Current evidence supports minimally invasive surgery as the preferred approach for EC due to lower morbidity and comparable oncologic outcomes, with sentinel lymph node biopsy increasingly used to guide adjuvant therapy decisions [23].

In selected patients with early-stage, low-grade EC who wish to preserve fertility, conservative treatment is considered feasible. Fertility-sparing management consists mainly of hormonal therapy using high-dose progestins, sometimes associated with hysteroscopic resection and/or levonorgestrel intrauterine device (LNG-IUD) [10, 11]. Recent meta-analyses report complete response rates of 80–85% and pregnancy rates over 50% after conservative treatment, although recurrence rates remain around 30% [12, 13]. Moreover, molecular classification is starting to guide fertility-sparing treatment selection, as some subtypes (such as MSI-H or POLE-mutated tumors) may present differential responses and prognoses [14, 15].

EC management has evolved with the integration of The Cancer Genome Atlas (TCGA) molecular classification, which divides tumors into four subgroups: POLE-ultramutated, MSI-H, copy-number low and copy-number high (serous-like),

each with specific therapeutic implications [5, 16]. This classification has been incorporated into recent clinical guidelines and allows for a more individualized approach [7, 17]. Recent molecular research has also highlighted that the pathogenesis of endometrial cancer overlaps with mechanisms involved in endometriosis, sharing genetic, epigenetic, hormonal, and immunological pathways. Terzic *et al.* [24] describe how aberrant estrogen signaling, progesterone resistance, chronic inflammation, and mutations in genes such as phosphatase and *tensin homolog (PTEN)*, *AT-rich interactive domain-containing protein 1A (ARID1A)*, and *phosphatidylinositol-4,5-bisphosphate 3-kinase catalytic subunit alpha (PIK3CA)* illustrate this overlap and underscore the need for improved molecular understanding to guide future diagnostic and therapeutic strategies.

Advanced or high-risk EC cases require multimodal treatment, including radiotherapy and/or chemotherapy. Additionally, immunotherapy has emerged as a promising therapeutic option, especially for patients with MSI-H or mismatch repair-deficient tumors, who may benefit from immune checkpoint inhibitors such as pembrolizumab or dostarlimab [18, 19]. Hormonal therapy remains an important strategy for hormone receptor-positive tumors, particularly in low-grade or metastatic disease [20].

The management of endometrial cancer (EC) also involves addressing survivorship issues, including menopausal symptoms and overall quality of life. Hormone replacement therapy (HRT) after surgical menopause in EC survivors remains controversial; however, recent evidence indicates that HRT may be safe in low-risk patients and can significantly improve urogenital and vasomotor symptoms [21, 25]. In cases of hereditary EC, such as those associated with Lynch syndrome, risk-reducing strategies, genetic counseling, and personalized follow-up protocols are essential components of care [10, 26].

4. Pelvic floor dysfunction overview

Pelvic floor dysfunction (PFD) encompasses a broad spectrum of disorders that result from impairment of the pelvic floor muscles, connective tissue and nerves, which provide support to the pelvic organs. PFD includes urinary incontinence (UI), fecal incontinence (FI), pelvic organ prolapse (POP) and sexual dysfunction. These conditions have a high prevalence in the general female population and are associated with significant morbidity and deterioration in quality of life [20].

A recent cross-sectional study conducted in Spain reported that the prevalence of UI was 30%, POP symptoms were present in 7%, and FI in 5% of women, with higher rates in older age groups and in those with higher body mass index (BMI) [27]. Several other epidemiological studies have reported that the prevalence of at least one PFD symptom in women ranges from 20% to 46% worldwide, increasing with age, multiparity, obesity, menopause and previous pelvic surgery [28]. In Ethiopia, for example, 31.4% of women were found to suffer from at least one PFD symptom, highlighting the global relevance of this problem [28].

A recent systematic review and meta-analysis by Sadri *et al.* [29] reported a pooled prevalence of overactive bladder in women of 15% (95% Confidence Interval (CI): 12–18%), with

a subanalysis showing 12% (95% CI: 9–16%). In women over 60 years, the estimated prevalence of nonobstructive urinary retention is 9.3–20%. These figures highlight that urinary incontinence and related lower urinary tract symptoms remain under-reported and underdiagnosed, reinforcing the need for improved detection and management [29].

The pathophysiology of PFD is multifactorial. Vaginal delivery, chronic increases in intra-abdominal pressure, hormonal changes associated with menopause, and surgical procedures such as hysterectomy can weaken or damage the pelvic floor support structures [30]. In the oncologic setting, treatments for gynecologic cancers, particularly EC, may increase the risk of PFD due to surgical injury, radiation-induced fibrosis and chemotherapy-associated menopause [11, 12, 31]. Notably, although radiation therapy in EC survivors is not consistently associated with increased rates of urinary or fecal incontinence, it has been linked to decreased sexual function [32].

The impact of PFD on quality of life is profound. UI and FI are associated with social embarrassment, depression, sexual dysfunction and reduced physical activity [33, 34]. POP can cause discomfort, vaginal bulging and urinary or fecal obstruction symptoms. According to the International Urogynecological Association and the International Continence Society, pelvic organ prolapse is defined as the descent of one or more of the anterior vaginal wall (cystocele), posterior vaginal wall (rectocele or enterocele), uterus (cervix) or vaginal vault beyond their normal anatomical position, staged using the Pelvic Organ Prolapse Quantification (POP-Q) system from 0 (no prolapse) to IV (complete vaginal eversion). Symptomatic prolapse is diagnosed when the descent causes characteristic symptoms, typically a sensation of vaginal bulge or functional compromise [35]. Sexual dysfunction, including dyspareunia and decreased libido, is frequently reported among women with PFD, especially in cancer survivors [36]. However, community-based data suggest that the presence of PFD alone does not independently predict sexual inactivity or dissatisfaction, highlighting the complexity of this relationship [37]. Recent evidence highlights that vaginal symptoms such as dryness, atrophy, dyspareunia and sexual dysfunction are highly prevalent in gynecologic cancer survivors due to both shared risk factors and treatment sequelae [38]. Routine screening for vulvovaginal symptoms and sexual pain is recommended, with first-line management including vaginal moisturizers, lubricants and pelvic floor physical therapy [38]. Prospective data confirm that gynecologic cancer survivors experience significantly higher prevalence and severity of pelvic floor symptoms than women without cancer, with urge incontinence and fecal incontinence being especially common and strongly associated with measurable reductions in quality of life, as assessed by validated instruments such as the Pelvic Floor Distress Inventory (PFDI)-20 and Pelvic Floor Impact Questionnaire (PFIQ)-7 [39].

Management strategies for pelvic floor dysfunction (PFD) are diverse and depend on the type and severity of symptoms. First-line approaches include lifestyle modifications such as weight loss and smoking cessation, behavioral therapy, pelvic floor muscle training (PFMT), and pharmacologic treatment for specific conditions like urgency urinary

incontinence (UI) [18, 30]. In cases of pelvic organ prolapse (POP), pessaries provide an effective non-surgical option [40]. According to Tunn *et al.* [41], pelvic floor physiotherapy is an evidence-based first-line intervention for the management of urinary incontinence and pelvic organ prolapse, with demonstrated efficacy during pregnancy and in the postpartum period. Additional conservative measures include the use of pessaries and local estrogen therapy. For urgency urinary incontinence, pharmacologic options such as anticholinergics and β -sympathomimetics are available, while serotonin–noradrenaline reuptake inhibitors may be considered in selected cases of stress urinary incontinence [41].

When conservative strategies are insufficient, surgical interventions may be indicated. The midurethral sling is the primary surgical option for stress urinary incontinence, with short-term symptom improvement rates ranging from 62% to 98% and long-term success rates exceeding 43% to 92%. Mesh-related complications are rare (<5%), and patient satisfaction rates remain high, between 85% and 90% [42]. Wu also highlights that first-line management should focus on pelvic floor muscle training and weight loss, reserving surgical treatment such as the midurethral sling for women with persistent bothersome symptoms, with shared decision-making regarding the risks and benefits of mesh-based procedures [43].

For fecal incontinence, conservative physiotherapy approaches such as biofeedback, anal sphincter muscle exercises, PFMT, and electrostimulation are the most effective options. Biofeedback has the highest level of evidence (level A), while PFMT and electrostimulation have level B evidence for improving muscle strength, endurance, and anal sensation. These interventions can be used alone or as adjuncts before or after surgery and have been shown to significantly enhance quality of life [44]. In addition, a patient-centered framework developed by Sung *et al.* [45] emphasizes that women with anal incontinence value a broad range of symptom outcomes beyond leakage frequency alone, including predictability, awareness, emptying disorders, wiping issues, and discomfort, highlighting the importance of comprehensive assessment and individualized treatment goals.

A robust body of evidence, including recent Cochrane reviews, confirms that pelvic floor muscle training is the most effective first-line conservative intervention for urinary incontinence in women, with high-certainty evidence supporting its benefit across all types of incontinence (stress, urgency, and mixed). High-quality Cochrane meta-analyses show that for women with stress urinary incontinence, PFMT increases the likelihood of cure or improvement by a factor of 6 to 8 compared to controls (risk ratio for cure or improvement: 6.33; 95% CI, 3.88–10.33). For all types of urinary incontinence, the benefit remains substantial (risk ratio: 2.39; 95% CI, 1.64–3.47) [46]. Pelvic floor muscle training (PFMT) is widely recognized as the first-line conservative treatment for stress urinary incontinence in women, with strong evidence supporting its effectiveness compared to no treatment or inactive controls [47]. A recent collaborative review by Moris *et al.* [48] confirms these findings and emphasizes that outcomes improve when PFMT is delivered with appropriate instruction and supervision. For women with persistent or complex symptoms, surgical options such as midurethral slings, col-

posuspension, and autologous fascial slings are considered, though concerns about mesh-related complications underscore the importance of individualized treatment decisions. Further evidence from a 2024 Cochrane review by Hay-Smith *et al.* [49] supports this approach, highlighting the superiority of structured and supervised PFMT protocols compared to less intensive strategies and reinforcing its recommendation as first-line treatment across different types of urinary incontinence. PFMT consists of repeated, isolated pelvic floor contractions, usually performed in sets of 8–12 contractions, three times daily, for at least three months, with supervision or e-health delivery as effective approaches to improve outcomes and adherence. Weight loss is another key component of conservative management, supported by high-quality randomized trial evidence from Subak *et al.* [50], which showed that intensive behavioral weight loss interventions in overweight and obese women significantly reduce urinary incontinence episodes, particularly stress incontinence, with sustained benefits from modest weight reduction (5–10%).

Supervised antenatal PFMT also plays an important preventive role. Evidence from Reilly *et al.* [51] demonstrates that structured pelvic floor exercises started during pregnancy significantly lower the risk of postpartum stress incontinence, especially in primigravidae with increased bladder neck mobility.

Recent evidence from a systematic review and meta-analysis by Hao *et al.* [52] supports the use of telerehabilitation to deliver pelvic floor muscle training, showing significant improvements in urinary incontinence severity, pelvic floor muscle strength, and quality of life, with high patient compliance and satisfaction. This aligns with recent advances that have incorporated telehealth-delivered PFMT programs and non-hormonal therapies for managing genitourinary syndrome of menopause, particularly in cancer survivors where systemic hormonal therapy may be contraindicated [27, 53]. Additionally, new research suggests that vitamin D deficiency may be associated with impaired muscle strength, including pelvic floor muscles, and that supplementation may benefit selected patients [54].

Together, these findings support a comprehensive, stepped approach to PFD management that prioritizes conservative measures such as PFMT, weight loss, and behavioral modifications as first-line strategies before escalating to pharmacologic or surgical options.

In addition to established clinical management strategies, emerging evidence highlights the role of microRNAs (miRNAs) as potential diagnostic and therapeutic tools for rare gynecological cancers (RGCs), including malignant germ-cell tumors, sex-cord-stromal tumors, uterine sarcomas, carcinosarcomas, gestational trophoblastic neoplasia, vulvar carcinoma, and melanoma of the female genital tract. Although aberrant miRNA expression profiles have been linked to tumorigenesis, progression, and chemoresistance in various gynecological malignancies, their clinical application in RGCs remains investigational and requires further validation in prospective studies [55].

5. Urinary incontinence in EC patients

Urinary incontinence (UI) is the most prevalent type of pelvic floor dysfunction (PFD) in women with endometrial cancer (EC) and can occur both prior to diagnosis and as a consequence of cancer treatment. Risk factors such as obesity, advanced age, multiparity and metabolic syndrome, which are frequent among EC patients, also contribute to baseline UI [1, 2, 4]. However, surgical treatment and adjuvant therapies such as radiotherapy and chemotherapy significantly increase the risk of developing or exacerbating UI symptoms [11–14, 31].

Surgical treatment for EC, mainly total hysterectomy with or without lymphadenectomy, can affect the integrity of the pelvic floor by disrupting the supportive ligaments and innervation around the bladder and urethra [11]. Although minimally invasive techniques and sentinel lymph node mapping have reduced postoperative morbidity, stress urinary incontinence (SUI) and voiding dysfunction remain common, particularly in patients undergoing radical or extensive procedures [9, 11]. Recent evidence by Brennen *et al.* confirms that PFD prevalence remains high both before and after hysterectomy, with adjuvant therapy (radiation and/or chemotherapy) significantly increasing the risk of moderate-to-severe UI, while surgical approach and cancer stage have no significant impact [56].

Radiotherapy is another key factor contributing to UI in EC patients. Pelvic radiotherapy induces fibrosis, vascular damage, and neuropathy, leading to bladder dysfunction, reduced compliance, urgency, frequency and mixed urinary incontinence [13, 14]. In some studies, UI rates after radiotherapy for EC have reached up to 80% of patients, especially when combined with surgery [13]. A recent prospective cohort study demonstrated that although radiotherapy may improve pre-existing stress UI in some cases by inducing fibrotic support, overall pelvic floor function worsens due to increased urgency, frequency and nocturia [14].

Chemotherapy may indirectly contribute to UI through peripheral neuropathy, premature ovarian failure and genitourinary syndrome of menopause [15]. Early menopause caused by chemotherapy or surgical oophorectomy leads to estrogen deficiency, which affects the mucosal and muscular quality of the lower urinary tract, exacerbating urgency and SUI [15, 30].

Management of UI in EC patients requires a multidisciplinary approach and individualized assessment. According to current recommendations, the evaluation of UI should include annual screening, validated questionnaires, a three-day voiding diary, a cough stress test, measurement of postvoid residual, urinalysis and pelvic examination to assess for pelvic organ prolapse and pelvic floor muscle function [57]. Lukacz *et al.* [42] emphasize that the initial assessment should also evaluate the impact of incontinence on quality of life, patient goals, prior treatments and the presence of advanced pelvic organ prolapse that may require referral. Urinalysis is essential to rule out infection or hematuria. Objective measurement of pelvic floor muscle strength should preferably be performed using manometry or dynamometry, as these methods have shown high interrater reliability and better accuracy than digital palpation or surface electromyography [58]. According to

Bø *et al.* [59], vaginal palpation remains the standard initial clinical assessment to confirm a woman's ability to contract the pelvic floor muscles and provide immediate feedback. However, it is subjective and has limited interrater reliability, especially in women with pelvic floor dysfunction or after gynecologic cancer treatment. Manometry and dynamometry provide more objective and reliable quantification and are preferred for monitoring changes over time. Electromyography (EMG) measures muscle activation but correlates only weakly with actual muscle strength and should not be used as a surrogate, while ultrasound and Magnetic Resonance Imaging (MRI) offer complementary visualization of pelvic floor anatomy and function but require further validation for routine use [59].

Additionally, Cyr *et al.* [60] demonstrated that combining pelvic floor muscle training with education-based therapies is more effective than single-modality approaches for improving pelvic, sexual, and functional outcomes in gynecologic cancer survivors.

Pharmacological treatments, including anticholinergic drugs and beta-3 adrenergic agonists, are useful for urgency UI but should be prescribed with caution in cancer survivors, considering potential drug interactions and side effects [18]. Vaginal estrogen therapy is considered safe in EC survivors for the management of genitourinary syndrome of menopause, as systemic absorption is minimal and recent studies support its use even in patients with a history of hormone-dependent cancer [8, 30].

In selected cases, surgical treatment for SUI, such as mid-urethral sling placement, may be considered, particularly when performed concomitantly with oncological surgery in patients with severe symptoms and after careful multidisciplinary evaluation [17].

Early identification, patient education, and integration of pelvic floor rehabilitation programs into survivorship care pathways are essential strategies to improve UI outcomes and quality of life in EC survivors.

5.1 EC and PFD: interrelationships and rehabilitation

Endometrial cancer (EC) survivors commonly experience pelvic floor dysfunction (PFD), which includes urinary or fecal incontinence, pelvic organ prolapse (POP) and sexual dysfunction, all of which can significantly impair quality of life. Multiple studies have documented a high prevalence of PFD in gynecologic cancer survivor populations. For example, a systematic review found PFDs to be prevalent in gynecologic cancer survivors, with post-treatment rates of urinary incontinence (UI) reported as high as 70–80% in some cohorts. In a recent study of uterine cancer patients, over three-quarters (76%) of respondents reported at least one pelvic floor symptom following treatment. Notably, many EC patients already have risk factors for PFD at diagnosis—such as obesity, older age and prior vaginal childbirth—and a substantial proportion present with pre-existing incontinence. Robison *et al.* [54] observed that over half of early-stage EC patients in their cohort had stress urinary incontinence (SUI) symptoms at the time of cancer diagnosis. This overlap of

risk factors means that cancer and PFD often co-exist, and cancer therapies may further exacerbate underlying pelvic floor issues.

5.2 Impact of cancer treatment on pelvic health

The treatments for EC—primarily surgery (hysterectomy +/- oophorectomy) with or without radiotherapy, and less commonly chemotherapy—can adversely affect pelvic floor function. Surgical removal of the uterus, even via minimally invasive approaches, can alter pelvic anatomy and nerve supply, leading to bladder or bowel dysfunction and prolapse over time. In a retrospective study of 74 early-stage EC patients who underwent robot-assisted hysterectomy, 71% of women with no preoperative urinary leakage developed new-onset UI after surgery. Overall, the post-operative incontinence rate in that cohort reached 74%, despite the use of a modern minimally invasive technique. This finding underlines that even relatively nerve-sparing cancer surgeries can precipitate PFD symptoms. On the other hand, a large multicenter trial (LACE) comparing open vs. laparoscopic hysterectomy for EC found no significant difference in long-term pelvic floor outcomes between surgical techniques. Both groups experienced some pelvic floor function changes relative to baseline, but rates of symptomatic prolapse did not differ.

Adjuvant radiotherapy can also impact pelvic health. Pelvic radiation is known to induce tissue fibrosis, neuropathy, and vascular changes that may manifest as bladder, bowel and sexual dysfunction. Some reports have shown extremely high incontinence rates after EC radiotherapy—Bernard *et al.* [26] noted post-radiation UI in over 80% of treated women. However, evidence on radiation's effect is somewhat mixed. Segal *et al.* [32] found that EC survivors who received pelvic radiation did not have significantly higher rates of UI, fecal incontinence, or prolapse than those managed with surgery alone. Similarly, a recent survey study of 309 uterine cancer survivors reported high overall PFD symptom prevalence (~76%) regardless of whether patients had surgery alone, surgery plus brachytherapy, or surgery plus external beam radiation. In that analysis, treatment modality did not independently predict PFD after adjusting for confounders. These findings suggest that baseline patient characteristics (like age, obesity and parity) may play a larger role in post-treatment PFD risk than the addition of radiation *per se*. It is worth noting, though, that pelvic radiation may have nuanced effects: one recent prospective study observed that while radiotherapy was associated with a lower incidence of SUI (possibly by reducing urethral hypermobility via fibrosis), it concomitantly led to worse overall pelvic floor function scores and shorter vaginal length, indicating negative impacts on global pelvic health. In summary, the relationship between radiation and PFD is complex, and careful follow-up is needed to identify and manage symptoms in all EC survivors, not only those who received radiotherapy.

Data on chemotherapy and pelvic floor function are limited. Cytotoxic chemotherapy for EC (typically carboplatin/paclitaxel) is not thought to directly damage pelvic support structures, but it may contribute to neuropathy

or premature menopause that can exacerbate bladder and sexual symptoms. A small study by Strauchon and colleagues hinted at a possible correlation between platinum/taxane chemotherapy and new or worsened UI in women treated for gynecologic cancers. However, no definitive link specific to EC has been established, and this remains an area for future research. Likewise, hormonal treatments (*e.g.*, progestin therapy for EC) have not been studied in depth for PFD outcomes, though iatrogenic menopause from surgical or radiologic oophorectomy can certainly contribute to vaginal atrophy, dryness, and resultant dyspareunia or urinary urgency.

Given the multifactorial nature of PFD in EC survivors—involving baseline predisposition, cancer treatment effects, and menopausal changes—the clinical relevance of pelvic floor rehabilitation in this population is paramount. Attention to pelvic floor health is increasingly recognized as an integral part of survivorship care for gynecologic cancers. Historically, pelvic floor symptoms have often been underreported or overlooked in oncology follow-up, but emerging evidence underscores that proactive management of PFD can markedly improve survivors' quality of life. Pelvic floor rehabilitation encompasses a range of non-invasive interventions, chiefly pelvic floor muscle training (PFMT), along with biofeedback, electrical stimulation, behavioral modification and adjunct therapies. According to a recent comprehensive review, there is strong evidence to recommend PFMT as a first-line treatment for urinary incontinence and mild POP, including in cancer survivors. Supervised PFMT programs (Kegel exercises guided by a specialist) can strengthen the levator ani muscles and improve urethral support. In fact, a randomized controlled trial by Yang *et al.* [30] demonstrated that a 4-week structured PFMT program in gynecologic cancer survivors led to significantly improved pelvic muscle strength and sexual function compared to standard care. Accurate assessment of pelvic floor muscle strength is essential for monitoring response to PFMT and tailoring rehabilitation strategies, especially in gynecologic cancer survivors [58].

Beyond muscle training, pelvic floor rehabilitation is tailored to the specific dysfunctions each survivor faces. For instance, bladder training and urge suppression techniques may help those with urgency or overactive bladder symptoms, while specialized biofeedback or electrical stimulation can be added to PFMT to enhance muscle control and nerve recovery. For fecal incontinence, a focused program to strengthen anal sphincter control and bowel habit retraining has shown benefit. Sexual rehabilitation is another key component: vaginal dilator therapy, lubricants and topical estrogen are often recommended to address vaginal stenosis, dryness and dyspareunia following pelvic radiation or menopause. These interventions can improve comfort with intercourse and intimate functioning, which is an important aspect of survivorship. Adjunct therapies such as physical therapy modalities (trigger-point release, pelvic floor relaxation exercises for hypertonic pelvic floor pain, *etc.*), as well as lifestyle modifications, are also valuable. Weight loss and core strengthening may relieve excess pressure on the pelvic floor in obese survivors, thereby reducing incontinence severity. Overall, the rehabilitation plan should be individualized—one patient may primarily need

strengthening exercises for SUI, while another needs scar tissue massage and stretching for pelvic pain, illustrating the need for tailored strategies.

Crucially, a multidisciplinary follow-up approach is recommended to effectively implement pelvic floor rehabilitation for EC survivors. Gynecologic oncologists, urogynecologists, physiotherapists specialized in pelvic health, radiation oncologists and primary care providers should collaborate to screen for PFD symptoms and institute early interventions. Provider education is important so that issues like incontinence or sexual dysfunction are proactively queried at follow-up visits rather than waiting for the patient to volunteer them. When PFD is identified, timely referral to pelvic floor physical therapy or a continence clinic can significantly improve outcomes. For example, Robison *et al.* [54] showed that when SUI is surgically corrected at the time of EC surgery, patients report better post-operative quality of life than those whose incontinence is left unaddressed. This finding supports a paradigm of concurrent management of pelvic floor issues alongside cancer treatment. Even outside of the operative setting, integrating rehabilitation during survivorship can ameliorate symptoms. As summarized by a 2023 review, there are now evidence-based algorithms for first-line management of PFD in gynecologic cancer survivors, and most interventions are conservative and low-risk. In light of this, survivorship guidelines for EC are increasingly advocating for PFD assessment and therapy.

6. Summary of key findings

The interrelationship between EC and pelvic floor dysfunction is evident—shared risk factors and cancer treatments together result in a high burden of PFD among survivors. Importantly, this burden can be alleviated through appropriate rehabilitation. The clinical evidence supports a multidisciplinary approach to EC survivorship: gynecologic oncology teams should work in tandem with urogynecologists, pelvic floor physiotherapists, and other specialists to ensure early identification of PFD and delivery of tailored rehabilitation strategies. By integrating pelvic floor rehabilitation into routine follow-up, healthcare providers can significantly improve post-cancer quality of life, addressing not only the cancer cure but also the restoration of function and well-being for EC survivors. The need for such comprehensive care is increasingly recognized as a priority in modern oncologic practice, warranting further research and implementation of pelvic health programs for women with endometrial cancer.

7. Discussion

Pelvic floor dysfunction (PFD) is a common but often underestimated complication in patients with endometrial cancer (EC). While oncologic outcomes have significantly improved due to advances in early diagnosis, molecular classification and individualized treatment strategies, the impact of cancer treatment on pelvic floor health remains a relevant issue that requires greater attention in clinical practice. As shown in Table 1 (Ref. [19, 20, 26, 30, 34, 40, 53, 54]), multiple studies have consistently reported a high prevalence of pelvic floor dysfunction in EC survivors, reinforcing the importance of

early screening and targeted interventions.

Multiple studies have shown that EC patients are particularly vulnerable to PFD due to both tumor-related factors and treatment-associated consequences. Obesity, metabolic syndrome, and older age—common characteristics among EC patients—are also well-known risk factors for urinary incontinence (UI), fecal incontinence (FI) and pelvic organ prolapse (POP) in the general population. These predisposing factors, combined with surgical and adjuvant treatments, increase the likelihood of developing PFD symptoms, which can significantly impair quality of life. Recent evidence suggests that vitamin imbalances and nutraceutical supplementation may play a role in women's health, particularly in cancer prevention and overall well-being. Additionally, management strategies should consider menopause-related symptoms, pelvic organ prolapse (POP), urinary incontinence therapies, and fertility-sparing options in reproductive-aged women, to provide personalized and comprehensive care.

Surgical management, particularly hysterectomy, remains the cornerstone of EC treatment. Despite the adoption of minimally invasive techniques and sentinel lymph node mapping, surgical disruption of pelvic anatomy and nerve supply can lead to PFD. Several studies have shown that even in patients treated with robot-assisted hysterectomy, a high percentage of women develop new-onset UI after surgery. However, it is important to note that recent evidence suggests that patient-specific factors—such as BMI, age and parity—have a greater impact on the development of PFD than the type of surgical approach used.

Radiotherapy is another key factor associated with PFD in EC survivors. Although the addition of pelvic radiation therapy does not always correlate with worse pelvic floor outcomes when compared to surgery alone, several studies have documented a higher incidence of urgency symptoms, frequency, vaginal atrophy and sexual dysfunction in patients receiving radiotherapy. The dual effect of radiotherapy—potentially improving stress UI by reducing urethral hypermobility through fibrosis, but worsening global pelvic floor function—highlights the need for careful follow-up and individualized rehabilitation strategies.

Chemotherapy has a less direct effect on pelvic floor function but may exacerbate PFD symptoms through premature menopause, estrogen deprivation and peripheral neuropathy.

Given the growing number of EC survivors and the increasing recognition of PFD as a survivorship issue, there is a need to integrate pelvic floor rehabilitation into routine clinical practice. Pelvic floor muscle training (PFMT) is supported by strong evidence as a first-line treatment for UI and POP, including in cancer survivors. Early referral to pelvic floor physiotherapy, multidisciplinary collaboration and patient education are essential to improve symptom control and enhance quality of life.

Future research should focus on developing standardized guidelines for the assessment and management of PFD in EC survivors, evaluating the cost-effectiveness of rehabilitation programs, and exploring the role of emerging biomarkers, such as microRNAs, in predicting PFD risk and treatment response. Longitudinal studies assessing the long-term impact of different EC treatment modalities on pelvic floor health are

TABLE 1. Summary of key studies evaluating pelvic floor dysfunction in endometrial cancer survivors.

Author (Year)	Study Design	Population	Key Findings	Clinical Relevance
Ye AL <i>et al.</i> [19] (2024)	Narrative review	Gynecologic cancer survivors with PFD	PFMT is first-line therapy; early referral recommended; effective and safe.	Reinforces best practices and need for integrating PFMT in survivorship care.
Ramaseshan <i>et al.</i> [20] (2018)	Systematic review	Women with gynecologic malignancies	PFD common after cancer treatment; UI up to 76%, FI up to 34%.	Confirms high burden of PFD after gynecologic cancers, highlighting survivorship care needs.
Bernard <i>et al.</i> [26] (2017)	Cross-sectional study	EC survivors post-radiotherapy	>80% had UI; pelvic muscle weakness and reduced elasticity.	Supports need for pelvic floor rehabilitation to address functional deficits.
Yang <i>et al.</i> [30] (2012)	Randomized controlled trial	34 survivors with PFD	PFMT improved muscle strength, sexual function, and QoL after 4 weeks.	Level I evidence supporting PFMT for cancer-related PFD.
Theodoulidis <i>et al.</i> [34] (2022)	Literature review	1849 EC patients across 10 studies	UI rose from 8% to 20–75% post-treatment; POP up to 14%, FI up to 21%.	Confirms high prevalence of PFD after EC treatment; supports routine pelvic health monitoring.
Lipetskaia <i>et al.</i> [40] (2019)	Retrospective cohort	74 EC patients post-robotic surgery	UI increased from 28% pre-op to 74% post-op despite minimally invasive technique.	Highlights risk of new-onset UI after EC surgery, underscoring need for surveillance.
Lakomy <i>et al.</i> [53] (2022)	Cross-sectional comparison	309 uterine cancer survivors	76% had ≥ 1 PFD symptom; age, BMI, parity predicted PFD more than treatment type.	Suggests patient factors outweigh treatment modality in PFD risk; guides individualized follow-up.
Robison <i>et al.</i> [54] (2023)	Prospective cohort (multi-site)	1322 EC or EIN patients	Combined EC + anti-incontinence surgery slightly improved QoL vs. EC surgery alone.	Supports multidisciplinary surgical approach to manage cancer and SUI simultaneously.

Summary of key studies. EC: Endometrial cancer; PFD: pelvic floor dysfunction; UI: urinary incontinence; PFMT: pelvic floor muscle training; BMI: body mass index; POP: pelvic organ prolapse; FI: fecal incontinence; SUI: stress urinary incontinence; EIN: Endometrial intraepithelial neoplasia; QoL: Quality of life.

also needed.

In conclusion, addressing pelvic floor health in EC survivors is essential to providing comprehensive oncologic care. Beyond improving survival rates, ensuring the functional well-being and quality of life of these patients should be a priority in modern gynecologic oncology.

8. Limitations

This review has some limitations. The literature search was restricted to English-language publications, which may have led to the exclusion of relevant studies published in other languages. Additionally, the current body of literature on the relationship between endometrial cancer and pelvic floor dysfunction remains limited and methodologically heterogeneous, which complicates the ability to draw firm conclusions. Time constraints and the predominance of observational studies may also introduce bias. Further high-quality, multilingual and prospective research is needed to strengthen the evidence base

and inform clinical practice.

9. Conclusion

Incorporating pelvic floor assessment and rehabilitation into the routine care of women surviving endometrial cancer (EC) is crucial to ensure that treatment goes beyond oncologic control and also supports functional recovery and overall well-being. Recognizing pelvic floor dysfunction (PFD) early, educating patients, and working in close collaboration with different specialists can help address these issues proactively and improve long-term quality of life. Looking ahead, further research should clarify how different EC treatments affect pelvic floor health over time, determine whether structured rehabilitation is cost-effective, and explore new tools such as microRNAs that might help personalize prevention and therapy. Raising awareness among gynecologic oncology teams and developing clear follow-up pathways will be key to truly integrating pelvic floor care into everyday clinical practice.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

AUTHOR CONTRIBUTIONS

MAAC—conducted the literature review, synthesized the findings, and drafted the manuscript. GG—contributed to the conceptual development of the study, provided academic supervision, and reviewed the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This article is a bibliographic review of previously published studies. Therefore, ethical approval and informed consent were not required.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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