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The Influence of Sport and Structured Exercise in Prostate Cancer Management: Recommended Modalities and Narrative Review

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Abstract

Prostate cancer is one of the most common malignancies among men, with a steadily increasing global incidence. Over recent decades, major advances in imaging techniques and therapeutic strategies have significantly improved diagnostic accuracy and survival outcomes. Nevertheless, treatment-related adverse effects remain a substantial clinical challenge and frequently impair patients' quality of life. This review summarizes current diagnostic approaches and treatment modalities for prostate cancer, with a particular emphasis on the influence of sport and structured exercise recommendations as supportive interventions. Exercise has been shown to improve physical function, reduce fatigue, and enhance quality of life during and after treatment.

In the setting of radical prostatectomy, both preoperative and postoperative exercise interventions, particularly pelvic floor muscle training, accelerate functional recovery and reduce urinary incontinence. In patients undergoing androgen deprivation therapy, physical activity, especially resistance training, effectively counteracts treatment-related adverse effects, including loss of muscle mass, increased adiposity, fatigue, and psychological disturbances. Although current evidence regarding the association between physical activity and reduced prostate cancer risk remains inconclusive, emerging data suggest that exercise may positively influence disease progression and survival outcomes. Physical activity should therefore be considered an integral component of comprehensive prostate cancer care. Further studies are required to establish standardized and evidence-based exercise guidelines for this patient population.

Purpose

This study reviews currently available diagnostic and treatment methods of prostate cancer. The main objective is to analyze the role of physical activity in the process of treatment, as well as its relationship with risk of development of the disease.

Materials and methods

A review of current literature was conducted, focusing on modern treatment options, showing possibilities of introducing physical activity as a complement to every part of therapy. Literature available in the PubMed databases was searched using keywords.

Results

Physical activity should be considered as a supportive tool for patients with prostate cancer. Almost every protocol of treatment can be supplemented with a properly selected set of exercises if the patient' s condition allows it. Further studies are needed to improve effectiveness of combining standard therapy with physical activity.

Keywords: Prostate cancer, Physical activity in treatment, Radical prostatectomy, Pelvic floor muscles training, Androgen deprivation therapy

1. Introduction

Prostatic cancer (PCa) is one of the most frequently diagnosed cancer in men in whole western world. The disease affects middle-aged men between the ages of 55 and 75 remaining the major cause of cancer-associated mortalities. Approximately 1.5 million new cases of prostate cancer are diagnosed annually worldwide. The first symptoms are usually non-specific urinary system disorders, which is why the PSA test and biopsy are most valuable in diagnosis, followed by histopathological examination. The localized tumor is the most common condition at the time of diagnosis [2]. Treatment options available for prostate cancer are active surveillance, chemotherapy, radiation therapy, hormonal therapy, surgery, and cryotherapy. Methods delivered to a patient depend on the nature of the tumor, PSA level, grade and stage, and possible recurrence [3].

Radical treatment for prostate cancer can negatively impact quality of life. Side effects such as erectile dysvision, incontinence or radiation proctitis can occur. Androgen Deprivation Therapy can provoke loss of muscle mass, fatigue, psychological disorders, higher risk of cardiovascular disease and bone fracture). Direct symptoms for advanced or metastatic cancer (eg. pain, hypercalcaemia, spinal cord compression, pathological fractures) can also adversely affect health.

Regular physical activity has long been recognized as an important factor supporting prevention and treatment of many diseases, including cancer. Many patients also require appropriate rehabilitation after a demanding treatment accompanied by many side effects. Research has shown that exercise improves cardiorespiratory fitness, physical functioning, body composition, fatigue, and quality of life during and after prostate cancer treatments [4,5]. Over the last decade, a large number of studies have investigated the effects of physical activity on prostate cancer risk, treatment effectiveness and survivorship outcomes. The main target of this review was to provide a holistic overview of prostate cancer, summarize the influence of sport and specific exercise prescriptions in this context, and identify areas where further research is required.

2. Diagnostic methods

Traditionally, diagnosis relied on prostate-specific antigen (PSA) testing, digital rectal examination, and systematic transrectal ultrasound-guided biopsy (TRUS-Bx). However, this approach was associated with limitations, including missed clinically significant cancers and overdiagnosis [6]. A cornerstone of modern diagnostics is multiparametric magnetic resonance imaging (mpMRI). This modality combines anatomical and functional imaging, enabling identification of suspicious lesions and improving risk stratification. mpMRI demonstrates high sensitivity and negative predictive value for clinically significant prostate cancer and is now recommended prior to biopsy in many clinical guidelines. Importantly, MRI-targeted biopsy techniques have reduced unnecessary biopsies, although systematic sampling is still often combined due to a residual false-negative rate of approximately 15–20% [6,7]. Another rapidly developing modality is prostate-specific membrane antigen positron emission tomography/computed tomography (PSMA PET/CT). This molecular imaging technique targets PSMA expression on prostate cancer cells and offers high diagnostic accuracy. A recent systematic review reported pooled sensitivity of about 80% and specificity of 90% for PSMA PET/CT in detecting prostate cancer [8]. Emerging imaging approaches include micro-ultrasound (microUS) and multiparametric ultrasound. MicroUS provides higher resolution imaging compared to conventional ultrasound and has demonstrated diagnostic performance comparable to mpMRI in early studies [6].

3. Methods of treatment

The treatment of prostate cancer demand a personalized approach combining local and systemic therapies. Management depends on disease stage, risk stratification, and patient characteristics, with options ranging from active surveillance to advanced targeted therapies. For localized, low-risk disease, active surveillance has become a standard strategy, aiming to avoid overtreatment and preserve quality of life while maintaining oncological safety. In patients requiring curative treatment, radical prostatectomy (open radical prostatectomy, laparoscopic surgery or robot-assisted radical prostatectomy) and radiotherapy (including external beam radiotherapy and brachytherapy) remain the mainstay options, with comparable oncological outcomes [9]. Technological advances such as stereotactic body radiotherapy (SBRT) and image-guided radiotherapy have improved precision and reduced treatment-related toxicity. Systemic treatment plays a central role in advanced disease. Androgen deprivation therapy (ADT) remains the standard of treatment, as prostate cancer growth is largely hormone-dependent. In recent years, new androgen receptor–targeted agents (ARTAs), such as abiraterone and enzalutamide, have significantly improved survival outcomes when combined with ADT [10]. Chemotherapy, particularly docetaxel, is also widely used in metastatic settings, often in combination with hormonal therapy. A major breakthrough in modern therapy is the introduction of targeted and molecular treatments. Poly(ADP-ribose) polymerase (PARP) inhibitors have shown efficacy in patients with homologous recombination repair gene mutations. Additionally, PSMA-targeted radioligand therapy has emerged as a promising option for metastatic castration-resistant prostate cancer, delivering

radiation directly to cancer cells [11]. Minimally invasive focal therapies, such as high-intensity focused ultrasound (HIFU) and cryotherapy, are increasingly investigated as alternatives for selected patients, aiming to treat only tumor-bearing areas while preserving surrounding tissue. Furthermore, ongoing research into combination therapies and personalized treatment sequencing continues to refine therapeutic strategies.

4. Physical activity in prostate cancer

Physical activity is increasingly recognized as a key component of comprehensive prostate cancer care. Beyond its general health benefits, exercise plays a significant role in supporting patients undergoing surgical and systemic treatments particularly in reducing complications and improving recovery. This part discusses the current evidence on the relationship between physical activity and prostate cancer risk as well as its role in perioperative management and during androgen deprivation therapy.

4.1. Physical activity and prostate cancer risk

Although there is evidence that habitual physical activity is associated with a 12– 25% reduced risk of seven cancer types, there is no convincing confirmation of an inverse association between a physically active lifestyle and risk of developing prostate cancer [12] A systematic review and meta-analysis of forty-eight cohort studies and twenty-four case-control studies also reported no clear association between habitual physical activity and prostate cancer risk, with point estimates for individual studies indicating risk reductions and increased risk. However, supplementary data from this meta-analysis showed that long-term (>10 years), occupational physical activity significantly reduced total prostate cancer incidence by 17 % and long-term recreational physical activity significantly reduced the risk of advanced prostate cancer by 25 % [13,14]. As these results were based on a relatively low number of studies, more research is needed to consolidate these findings.

4.2. Radical prostatectomy - perioperative physical activity

Physical activity has emerged as an important supportive factor in the management of prostate cancer, particularly in patients undergoing radical prostatectomy. Increasing evidence from the last years indicates that both preoperative and postoperative exercise interventions contribute to improved functional outcomes, reduced complications and enhanced quality of life after the surgery. Exercise before prostatectomy have a positive impact on muscle strength and physical function and reduces fatigue in patients with prostate cancer. If exercise before surgery is not possible starting supervised training shortly after prostatectomy may recoup losses of enhance muscle function, physical efficiency and potentially body composition [15,16]. It may well be that exercising both before and after surgery may provide the most significant physical enhancement. Clinicians should encourage patients to engage in exercise either before or as soon as possible after the acute post-operative phase to assist with their recovery. In the preoperative setting, prehabilitation defined as structured physical activity before surgery has gained increasing attention. Exercise programs focusing on aerobic fitness and pelvic floor muscle training (PFMT) can improve baseline physical condition and facilitate postoperative recovery [16,17] Methods of PFMT encompass a range of structured techniques designed to ensure correct muscle identification, activation and progressive

strengthening. Initial training focuses on patient education and verbal instruction to facilitate selective contraction of the pelvic floor muscles while avoiding substitution patterns involving the abdominal, gluteal or hip adductor musculature. Digital rectal examination or real-time ultrasound imaging may be used to confirm correct muscle engagement. Supervised training programs commonly incorporate individualized exercise prescriptions consisting of repeated voluntary contractions including both slow-twitch (sustained holds) and fast-twitch (quick contractions) muscle fibers performed in various positions (supine, sitting, standing) to enhance functional integration. Adjunctive modalities include biofeedback which provides visual or auditory cues to improve motor control and adherence and electrical stimulation which may be applied in patients with difficulty initiating voluntary contractions. Progressive overload principles are applied by increasing contraction duration, intensity and frequency over time with emphasis on consistency and long-term adherence to optimize functional outcomes. One of the most significant complications of surgery is urinary incontinence. PFMT remains the cornerstone of preventing this condition. Studies confirm that early initiation of pelvic floor muscle exercises significantly accelerates the return of continence after radical prostatectomy. Additionally, preoperative PFMT may contribute to improved continence outcomes after surgery [16].

4.3. Physical activity for patients on Androgen Deprivation Therapy

Androgen deprivation therapy remains the fundamental part of the treatment of localized high-risk, locally advanced and metastatic prostate cancer. Approximately half of all patients with PCa will be treated with ADT [18]. The process of treatment is based on reducing androgen levels to castration level. This therapy essentially improves survival, however has many adverse effects including the loss of lean body mass and increase of fat tissue mass and negative impact on mental health. Physical activity constitutes a key supportive intervention in patients undergoing androgen deprivation therapy targeting both treatment-related adverse effects and overall functional outcomes. ADT is associated with significant metabolic changes, sarcopenia, fatigue and generally reduced quality of life. Exercise interventions have been shown to mitigate these effects. Supervised exercise programs combining resistance and aerobic activities lead to significant improvement in emotional well-being and physical performance [18,19]. Resistance training appears especially effective in counteracting adverse body composition changes. An adequately planned exercise training program during the treatment can result in positive effects on fat mass, muscle mass and muscle strength compared to usual care only [18]. A critical but often under-addressed side effect of ADT is the accelerated loss of bone mineral density (BMD), which increases the risk of fragility fractures [20]. While resistance training preserves muscle mass, it may be insufficient to protect bone health unless combined with impact-loading or multidirectional weight-bearing exercises. Clinical trials have demonstrated that a multimodal program incorporating impact (e.g., skipping or hopping) alongside high-load resistance training can attenuate bone loss at the lumbar spine and hip in men on long-term ADT [21]. These findings suggest that exercise prescriptions must include specific mechanical loading protocols to counteract the osteoporotic effects of profound androgen suppression. Beyond physical benefits, exercise also exerts positive mental health. The research shown that physical activity taken by patients

with PCa on ADT induces physiological effects which impact mood and cognitive function [22].

4.4. General influence on oncological outcomes and psychological well-being

Physical activity also positively influences psychological well-being. Patients after surgery often experience decreased quality of life and cancer-related fatigue. Exercise interventions have been shown to be beneficial, with findings that exercise improves physical function and quality of life in men with prostate cancer [4]. Emerging evidence suggests that physical activity may also influence oncological outcomes. Although mechanisms are not fully understood, exercise is believed to modulate systemic inflammation, hormonal levels, and immune function. According to recent findings, higher levels of physical activity are associated with reduced risk of disease progression and prostate cancer-specific mortality [23].

4.5. Exercise prescription and training modalities

The effectiveness of physical activity in prostate cancer management depends largely on the type, intensity and structure of the exercise program. Current evidence supports the use of combined aerobic and resistance training as the most beneficial approach for improving physical function, body composition, and treatment-related outcomes. Exercise prescription is commonly based on the FITT principle (Frequency, Intensity, Time, Type). Clinical guidelines recommend at least 150 minutes of moderate-intensity aerobic exercise per week, combined with 2– 3 sessions of resistance training targeting major muscle groups [24]. Aerobic exercise, such as walking, cycling, or swimming, improves cardiovascular fitness and reduces fatigue, while resistance training is particularly effective in counteracting muscle loss and sarcopenia. In patients undergoing radical prostatectomy, exercise programs should be individualized and progressively adapted. Early postoperative rehabilitation often begins with low-intensity activities, gradually progressing to more structured training. Supervised programs have been shown to be more effective than unsupervised ones, particularly in ensuring correct technique and adherence [16]. For patients receiving androgen deprivation therapy, resistance training plays a critical role in mitigating adverse effects such as loss of lean body mass and increased adiposity. High-intensity resistance training, when appropriately supervised, has been demonstrated to significantly improve muscle strength and functional capacity without increasing the risk of adverse events [25]. Safety considerations are essential when prescribing exercise. Factors such as disease stage, comorbidities, treatment type, and baseline fitness level must be taken into account. Proper assessment and monitoring are necessary to minimize risks and optimize outcomes. Overall, structured and individualized exercise programs should be integrated into standard prostate cancer care to maximize therapeutic benefits.

Clinical Setting / Patient Subpopulation	Recommended Exercise Modalities (Type)	Prescription & Structural Guidelines (FITT)	Targeted Clinical Benefits & Adverse Effects Counteracted	Key References (from Bibliography)
Radical Prostatectomy (Perioperative Phase)	• Pelvic Floor Muscle Training (PFMT) incorporating slow-twitch (sustained holds) and fast-twitch (quick contractions) fibers. • Aerobic fitness training.	• Individualized prescription initiated either preoperatively (prehabilitation) or as soon as possible post-surgery. • Supervised programs applying progressive overload (increasing contraction duration, intensity, and frequency over time). • Optional integration of biofeedback or electrical stimulation.	• Accelerates the return of urinary continence. • Improves baseline physical condition, muscle strength, and muscle function. • Reductions in post-operative fatigue.	• Singh et al., 2023 • Baumann et al., 2022 • Milios et al., 2019
Androgen Deprivation Therapy (ADT)	• Combined resistance training (including high-intensity/high-load protocols) and aerobic exercise (e.g., walking, cycling, or swimming). • Multimodal	• At least 150 minutes of moderate-intensity aerobic exercise per week. • 2–3 sessions of resistance training per week targeting major muscle groups.	• Counteracts sarcopenia (loss of lean body mass) and increases muscle mass and strength. • Reduces fat tissue mass and mitigates adverse	• Houben et al., 2023 • Rantaniemi et al., 2025 • Galvão et al., 2010 • Lam et al., 2020 • Campbell et al., 2019 • Galvão et al.,

	impact-loading or multidirectional weight-bearing exercises (e.g., skipping or hopping).	• Adequately planned, supervised programs to ensure correct technique and adherence.	metabolic changes. • Attenuates bone mineral density (BMD) loss at the lumbar spine and hip to minimize fracture risk. • Mitigates cancer-related fatigue and improves emotional well-being, mood, and cognitive function.	2018

Table 1. Summary of the recommended exercise modalities, their structured parameters, and targeted clinical benefits.

5. Barriers and adherence to physical activity

While the therapeutic benefits of physical activity for prostate cancer patients are well-documented, long-term adherence remains a significant clinical challenge. Research indicates that participation rates often decline following the transition from supervised clinical interventions to self-managed home programs [26,27]. Understanding the multi-level barriers is essential for developing effective, personalized exercise prescriptions.

5.1. Patient-Related Barriers

The most prevalent obstacles reported by patients are directly linked to treatment side effects. Cancer-related fatigue is a primary deterrent, affecting up to 50–90% of patients and creating a paradox where patients feel too exhausted to engage in the activity that could alleviate their fatigue in the future [26,28]. For those undergoing Androgen Deprivation Therapy (ADT), metabolic shifts such as muscle weakness, joint stiffness, and increased body fat significantly hinder motivation [28]. Additionally, patients after radical prostatectomy frequently cite urinary incontinence and the associated fear of leakage in public or group settings as a major psychological and social barrier to aerobic or community-based exercise [27].

5.2 Psychosocial and Environmental Factors

Beyond physical symptoms, psychological factors such as a perceived lack of time, decreased self-efficacy, and pre-existing comorbidities (e.g. cardiovascular disease or osteoarthritis) contribute to non-adherence [27]. Interestingly, qualitative data suggest that perceptions of

masculinity play a role; some men struggle with the loss of physical capability and feel discouraged by "standard" gym environments that do not account for their specific oncology-related needs [24]. Furthermore, a lack of proximity to specialized facilities and the financial burden of supervised exercise physiology sessions represent significant environmental hurdles [27,29].

5.4. Systemic Barriers and the Role of Clinicians

A critical systemic barrier is the lack of clear, consistent counseling from the treating urologist or oncologist. Surveys show that while most clinicians agree exercise is beneficial, only a minority provide formal referrals or specific guidelines during consultations [28]. Patients are significantly more likely to adhere to an exercise regimen when it is presented as a "medical prescription" rather than a vague lifestyle suggestion [29].

5.3. Strategies for Improving Adherence

To optimize engagement, interventions should move toward a hybrid model. This involves initial supervised training to build confidence and ensure safety, followed by a transition to home-based programs supported by digital health technology, such as wearable fitness trackers and mobile applications. Incorporating social support, whether through peer-based walking groups or spouse involvement, has also been shown to improve retention by addressing the psychological isolation often felt during treatment [30].

6. Conclusion

Physical activity can be an important factor in the treatment of prostate cancer, supporting patients across all stages of the disease from perioperative care to advanced systemic treatment. Although current evidence does not provide a consistent association between physical activity and the overall risk of developing prostate cancer, long-term engagement in physical activity may contribute to a reduced risk of advanced disease and improved survivorship outcomes. The most compelling evidence relates to the supportive role of exercise during and after treatment. In patients undergoing radical prostatectomy, both prehabilitation and early postoperative exercise interventions, particularly pelvic floor muscle training, significantly improve functional recovery including earlier return of urinary continence and enhanced physical performance. Similarly, in patients receiving androgen deprivation therapy, structured exercise programs, especially those combining resistance and aerobic training, effectively counteract treatment-related adverse effects such as sarcopenia, increased adiposity, fatigue and psychological decline. Beyond its physical benefits, exercise also contributes to improved mental health and overall quality of life, addressing key challenges faced by prostate cancer patients. Emerging data further suggest that physical activity may positively influence oncological outcomes, including disease progression and prostate cancer–specific mortality, although the underlying biological mechanisms require further clarification. In conclusion, physical activity should be considered an essential component of prostate cancer care. Clinicians should promote and integrate individualized, supervised exercise programs into standard treatment pathways. Future research should focus on establishing precise exercise prescriptions tailored to disease stage, treatment modality and

patient characteristics, as well as on clarifying the long-term impact of physical activity on oncological outcomes.

Disclosure

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