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Prostate Cancer Screening and Current Treatment: A Brief Updated Review

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ABSTRACT

Prostate cancer is the second most incident malignant tumor among men worldwide and the leading urological neoplasm in developed countries. In Brazil, estimates from the National Cancer Institute point to approximately 65,840 new cases in 2020, corresponding to 29.2% of all male neoplasms. Systematic screening primarily based on prostate specific antigen (PSA) testing and digital rectal examination aims to reduce mortality through early diagnosis. However, survival benefits are counterbalanced by risks of overdiagnosis, unnecessary biopsies, and complications from invasive treatments. Advances in imaging techniques, such as multiparametric magnetic resonance imaging (mpMRI), have improved candidate selection for biopsy, reducing superfluous procedures. In the therapeutic landscape, developments include robotic radical prostatectomy, advanced conformal radiotherapy, androgen deprivation therapy, and next generation agents (abiraterone and enzalutamide), alongside the consolidation of active surveillance for low risk tumors. This review integrates recent evidence on prostate cancer screening and management, analyzing benefits, limitations, and current gaps. It concludes that despite technological and therapeutic progress, the challenge of personalizing decisions to maximize benefit and minimize harm remains, highlighting the need for research validating individualized risk tools and new treatment modalities.

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Introduction

Prostate cancer originates in the glandular cells of the prostate and exhibits highly variable clinical behavior, ranging from indolent forms to aggressive, potentially metastatic disease [1]. Globally, an estimated 1.4 million new cases were diagnosed in 2020, with approximately 375,000 deaths, underscoring its public health significance [1]. In Brazil, data from the National Cancer Institute indicate an incidence of around 65,840 cases in 2020, with regional variations influenced by socioeconomic factors and access to healthcare services [2]. The pathophysiology of prostate cancer involves genetic, environmental, and hormonal alterations, with advanced age, positive family history, and African ancestry as the main established risk factors [3]. Early detection traditionally relies on serum PSA measurement and digital rectal examination (DRE). Although PSA is sensitive, it lacks specificity for malignancy, as levels can rise in prostatitis or benign prostatic hyperplasia, leading to overdiagnosis and unnecessary biopsies [4].

The principal randomized screening trials the European Randomized Study of Screening for Prostate Cancer (ERSPC) and the Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial (PLCO) yielded divergent results: ERSPC demonstrated a 20% mortality reduction, whereas PLCO showed no significant benefit, possibly due to contamination in the control group [3,5]. These discrepancies have led to heterogeneous recommendations: the European Association of Urology advocates individualized screening between ages 50 and 70 with PSA every 2–4 years [6]. While INCA recommends a risk focused strategy starting at age 45 for men with risk factors [2].

In recent years, mpMRI combined with targeted biopsies has increased diagnostic accuracy, reducing complications and detection of low risk disease [7,8]. Moreover, emerging biomarkers and clinicomolecular scores are under investigation for risk stratification, potentially refining patient selection for intervention [9].

Concurrently with screening, prostate cancer treatment encompasses multiple modalities tailored to stage, risk, and patient preferences. For low risk tumors, active surveillance demonstrates survival rates comparable to immediate treatment, with fewer adverse effects [10]. For localized intermediate to high risk disease, radical prostatectomy especially via robotic approach and advanced conformal radiotherapy are therapeutic mainstays, yielding similar oncological outcomes [11,12]. In advanced or

metastatic disease, androgen deprivation therapy remains the cornerstone, supplemented by next generation hormonal agents such as abiraterone and enzalutamide, which have significantly extended progression free survival [13,14].

Objectives

This review aims to synthesize the most recent evidence regarding prostate cancer screening and therapeutic options, highlighting advances, controversies, and knowledge gaps to guide clinical practice and future research.

Materials And Methods

A literature review was conducted using the PubMed, SciELO, Google Scholar, and ScienceDirect databases.

Discussion

The ERSPC and PLCO trials form the foundation of current debate. In ERSPC, with over 180,000 participants, PSA screening every four years resulted in a 20% reduction in disease specific mortality at 13 years of follow up, albeit with a 50% overdiagnosis rate (SCHRÖDER et al., 2009). In contrast, the U.S. based PLCO trial did not show a significant mortality reduction, but its interpretation was limited by a high (up to 52%) PSA usage rate in the "unscreened" control arm (ANDRIOLE et al., 2009). These findings support individualized screening approaches that consider life expectancy, comorbidities, and risk level. European guidelines recommend PSA every 2–4 years between ages 50 and 70, emphasizing shared decision making [6]. In Brazil, INCA suggests screening men with elevated risk (family history or African ancestry) from age 45, with annual PSA in the first two years and biennial thereafter if normal [2].

Advanced diagnostic methods such as mpMRI with targeted biopsy have proven superior to systematic transrectal biopsy, increasing detection of clinically significant tumors and reducing identification of indolent disease by up to 30% [7,8]. This precision arises from the ability to differentiate suspicious zones based on functional parameters (diffusion, perfusion), refining sampling targets [7].

In low risk tumor management, active surveillance combining semiannual PSA, physical exam, and control biopsies preserves quality of life without compromising oncology outcomes, with disease specific survival rates exceeding 95% at 10 years [10]. For intermediate to high risk localized disease, robotic radical prostatectomy offers safe surgical margins and optimized functional recovery, with urinary continence rates near 90% at one year [11]. Conformal radiotherapy and brachytherapy achieve comparable local control, with acceptable gastrointestinal and genitourinary toxicity [12]. Androgen deprivation therapy (ADT) remains the backbone of systemic treatment; however, the advent of abiraterone and enzalutamide has prolonged median survival by 4–6 months in castration resistant metastatic settings [13,14,15].

Despite screening advances, the benefit harm trade off persists. Risk stratification tools clinicomolecular scores are under investigation and promise to personalize decisions [9]. Emerging focal therapies aim to treat only neoplastic areas, reducing complications but lacking long term follow up [8].

Conclusion

Prostate cancer remains a public health challenge due to its high incidence and varied tumor aggressiveness. The ERSPC and PLCO trials laid the groundwork for screening, yet their conflicting results reinforce the necessity of individualized approaches that account for risk, life expectancy, and patient preferences (SCHRÖDER et al., 2009; ANDRIOLE et al., 2009). Current guidelines nationally and internationally converge on emphasizing shared decision making and risk focused screening [6,2]. Diagnostically, the widespread adoption of mpMRI and targeted biopsies has improved detection of clinically significant tumors, reducing overdiagnosis and optimizing patient selection for treatment [7,8].

Therapeutically, active surveillance consolidates its role in low risk disease, minimizing morbidity without compromising survival, while robotic radical prostatectomy and conformal radiotherapy demonstrate equivalent oncological outcomes with distinct adverse effect profiles [10,11,12].

For advanced disease, combining ADT with next generation agents has significantly extended survival, underscoring the urgent need for predictive biomarkers to optimize treatment sequencing [13,14]. Future studies should focus on individualized risk strategies, integration of genomic tools and artificial intelligence to guide both screening and treatment, and cost effectiveness evaluations across diverse socioeconomic contexts.

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