Medical Science

To Cite:
Gręda J, Kowalska A, Kędzierska M, Biernacki M, Wójcicki M. Modern methods of prostate cancer treatment – current state of knowledge and prospects for development. *Medical Science* 2026; 30: e2ms3760
doi: https://doi.org/10.54905/disssi.v30i167.e2ms3760

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Peer-Review History
Received: 07 September 2025
Reviewed & Revised: 16/September/2025 to 27/December/2025
Accepted: 03 January 2026
Published: 07 January 2026

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

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Modern methods of prostate cancer treatment – current state of knowledge and prospects for development

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ABSTRACT

Introduction: Prostate cancer is the most common type of cancer in men around the world. It can be treated in various ways, but this approach may change over time. Precision oncology, molecular biology and innovative technologies have changed how we detect and treat disease from early to advanced stages. Results: Using multiparametric MRI (mpMRI) and prostate-specific membrane antigen positron emission tomography (PSMA PET) together has made it easier to spot prostate cancer early, find precisely where the cancer is and work out how risky it is. Tests like the Prostate Health Index (PHI) and 4K Score help to reduce the number of unnecessary biopsies and allow for a more personalised approach to treatment. Robotic-assisted surgery and minimally invasive focal therapies improve functional outcomes and decrease morbidity. Systemic treatments have extended survival in metastatic castration-resistant prostate cancer (mCRPC). Immunotherapy is currently working well for certain groups of patients, but it is becoming more common to use it in combination with other treatments that target different parts of cancer. Although we have made significant progress, challenges such as tumour heterogeneity, resistance to therapy and access to advanced care still exist. Research, biomarker development and technological innovation are critical to personalised treatment and improving outcomes for diverse prostate cancer populations.

Keywords: prostate cancer treatment, precision medicine, targeted therapy, immunotherapy, radioligand therapy

1. INTRODUCTION

Recent progress in cancer research and technology has changed how prostate cancer is managed, helping address its wide range of clinical presentations. Prostate cancer is one of the most common cancers in men worldwide and still poses challenges for detection and treatment (Belkahla et al., 2022; Sekhoacha et al., 2022). Standard treatments like radical prostatectomy, radiation therapy and hormone therapy are still essential, especially for cases that are localised or respond to hormones.

However, developments in molecular biology and targeted therapies have significantly expanded treatment options, particularly for advanced and metastatic

stages of the disease. Next-generation androgen receptor signaling pathway inhibitors, such as darolutamide, have been developed, offering improved safety profiles and efficacy (Chung & Abboud, 2022). PARP inhibitors (olaparib and rucaparib) have also been approved with favorable findings having shown progression free survival (PFS) improvement in patients with these DNA repair deficient mutations (Maughan & Antonarakis, 2021). Radioligand therapies targeting prostate-specific membrane antigen (PSMA), with Lu177-PSMA-617, have been shown to extend survival in metastatic castration-resistant prostate cancer (mCRPC) (Kim & Kim, 2018).

New immunotherapies include T-cell engagers that are being developed by institutions such as The Institute of Cancer Research aim to harness the immune system targeting prostate tumors, which could improve cure rates and may be used before the disease (Kwon & Joung, 2025). Small invasive focal therapies including high-intensity focused ultrasound, cryotherapy and radiotherapy are increasingly being used to target tumor tissue to minimize treatment-related side effects (Skribek et al., 2025).

Advances in AI and in-depth knowledge are improving the accuracy of diagnoses, allowing doctors to plan personalised treatments by analysing complex imaging and molecular data (Agrawal & Vagha, 2024; He et al., 2023). Adding nanotechnology to drug delivery systems also makes treatments more precise and effective, while reducing side effects throughout the body (Szwed & Marczak, 2024).

Even with these significant advances, treating metastatic prostate cancer, especially castration-resistant types, is still difficult because the disease often progresses and resists treatment. Clinical trials and research are investigating new drug combinations. Specific molecular pathways are being targeted and improving immunotherapy strategies in order to push back against these challenges (Swami et al., 2020; Saeed et al., 2025).

Care for prostate cancer is largely personalised, minimally intrusive techniques using the latest imaging, to keep care and public health initiatives in order to maintain quality of life, isn't affected. For this reason, imaging with multiparametric MRI (mpMRI) and PSMA PET is used. Lesions seen on imaging can be biopsied to determine if the lesion is cancerous (Varaprasad et al., 2023; Swami et al., 2020). This makes focal therapies more practical by targeting the cancerous part of the prostate gland rather than excising the whole gland. The main treatments currently available are high-intensity focused ultrasound (HIFU), cryotherapy and laser ablation. Perhaps the most important aspect of HIFU delivers highly focused ultrasound waves transrectally to generate heat, resulting in coagulative necrosis within the tumor but sparing surrounding tissue (van den Bijgaart et al., 2017). Cryotherapy is a treatment that helps control freezing to destroy cancer cells while sparing surrounding healthy tissue (Chin & Lynn, 2022). Another form of laser ablation employs imaging in real time to target and destroy tumors. This is a non-ionizing source of energy.

In comparison to traditional treatment methods such as radical prostatectomy or radiation therapy, focal therapies result in reduced damage to the areas that control urinary and sexual function, thereby lowering the risk of incontinence and erectile dysfunction. Use of these treatments also takes less time to faster recovery, with many done as outpatient surgeries (Borges et al., 2021). This is meaningful in intermediate-risk patients, localized prostate cancer who wish to have the cancer treated preserved function. Focal therapy works best when doctors use image fusion and biopsy-confirmed tumor mapping with mpMRI and PSMA PET to make sure all cancerous tissue is treated while healthy areas are left alone (Topoozian et al., 2023).

Future applications of emerging technologies, such as boiling histotripsy (a non-thermal, ultrasound-based ablation) and real-time imaging feedback during the procedure, may further improve the precision and visualization of treatment, possibly leading to better oncological control by lowering the risk of incomplete ablation of tumors (Rosnitskiy et al., 2025). For advanced, hormone-resistant prostate cancer, some new treatments have been recently approved. These include drugs that target the androgen receptor pathway and agents that target DNA repair mechanisms and radioligand therapies, which deliver radiation to specific cancer cells. It has been suggested that all these may have a positive effect on survival (Sumanasuriya & De Bono, 2018; Swami et al., 2020; Varaprasad et al., 2023). There are also trials underway for immunotherapeutic strategies, like immune checkpoint inhibitors and investigational vaccines. Prostate cancer is so different for each patient, so we need to keep researching to deal with how it changes from patient to patient and how it can become resistant to treatment (Kim & Koo, 2020; Handa et al., 2020).

AI helps in diagnosis and treatment of prostate cancer, medical imaging assessments, prognosis and selection of the best personalized therapies (Chaddad et al., 2023). At the same time, research on molecular biomarkers that show tumour progression and DNA repair ability may offer new ways to assess risk and guide treatment (Orafidiya et al., 2022; Koo et al., 2019). Robotic and minimally invasive surgery have gotten so much better in the last twenty years, meaning patients can get better faster and still do most of the things their bodies need to do while keeping cancer under control (Li et al., 2024).

Researchers are also beginning to investigate how the bacteria in the prostate may influence cancer development and treatment, a new area of research (Che et al., 2021). Management uses a multimodal, patient-centred approach to incorporating advances in

imaging, surgery, systemic therapies, immunotherapy and molecular diagnostics (Belkahla et al., 2022; Varaprasad et al., 2023; Swami et al., 2020). This strategy is all about ensuring patients live longer, experience fewer adverse side effects and can still enjoy life. More research and trials must happen to evaluate the interventions or address issues.

2. REVIEW METHODS

This study model aimed at capturing recent advances in prostate cancer treatment from high-quality peer-reviewed journals, almost exclusively published between January 2018 and August 2025. A systematic approach aligned with the PRISMA guidelines was adopted for searching multiple electronic databases, including PubMed, Web of Science and Google Scholar. The search strategy used keywords related to prostate cancer, such as "precision oncology," "focal therapy," "mpMRI," "PSMA PET," "immunotherapy," "robotic surgery," and "molecular diagnostics," reflecting the multidisciplinary nature of current therapeutic developments.

The most important things to read were original research articles, well-organised reviews and clinical trials. They also talked about new ways to treat prostate cancer, new ways to diagnose it and what the future might hold. The studies mainly looked at early and advanced disease stages and focused on personalised, non-invasive and new ways to treat the whole body.

The screening process includes two parts. First, we check the titles and summaries of publications. Then, we read the complete texts of the publications to make sure they are relevant. We give priority to publications that present human clinical data, translational research and technological innovations. Earlier publications that were very important were included when needed to provide context.

The review covered several key areas, including advanced imaging techniques for precise] localization of the tumor or promising focal therapies that minimize adverse effects, the development of new pharmacological agents such as PARP and androgen receptor inhibitors, progress in immunotherapy, artificial intelligence in diagnosis, treatment planning and prognostication one of the latest advances in robotic surgical techniques.

This research method provided a detailed, well-researched summary, showing how treatment for prostate cancer is moving towards a more joined-up, patient-focused approach. It also identified areas where further research is needed, such as developing methods to treat patients who don't respond to current treatments and personalizing treatments to each patient.

Exclusion Criteria

It is important to note that studies that did not address prostate cancer or its treatment, either traditional or recent, were excluded from the analysis. It is worth noting that non-English publications were overlooked unless they had been translated. It is also important to note that we excluded abstracts without the full text, case reports with fewer than five subjects and studies with unclear definitions or methods. Editorials, letters and conference abstracts that did not have original clinical data or a systematic review were not considered.

Screening

A total of 1,320 references were identified through database searches and other relevant documents. After automatically and manually removing the same files, 1,087 distinct studies remained. Two reviewers reviewed the titles and summaries of articles to determine if they pertained to new approaches to treating prostate cancer. Next, 375 full-text articles were reviewed to determine if they met the inclusion criteria. These regulations pertained to the quality of the articles, their scientific rigor and their relevance to the study's objectives. If there was any disagreement during the screening process, it was resolved through discussion, and everyone reached a mutual agreement.

As shown in Figure 1, the PRISMA 2020 flow diagram provides a transparent and systematic overview of the study selection process for this review of modern prostate cancer treatments. The process begins with the identification phase ended, 1,320 records had been uncovered near the four major databases: PubMed, Web of Science and Google Scholar. In line with recent standards for evidence synthesis methods in the field of oncology and urology (Belkahla et al., 2022; Varaprasad et al., 2023). After removing duplicates using both automated and manual methods, 1,087 unique records remained for screening.

In the screenings of 1,087 records were reviewed for relevance based on established inclusion and exclusion criteria tailored to prostate cancer, contemporary treatment modalities and technological innovations. Of these, 712 records were excluded as irrelevant to the review focus. In the eligibility phase, the full texts of 375 articles were thoroughly assessed. In total, 275 reports were excluded since they did not focus on the topic such as not focusing on advanced or contemporary prostate cancer management, being in a non-English language without an available translation, being inaccessible to the full article, or lacking methodological rigor consistent with the inclusion criteria (Varaprasad et al., 2023; Swami et al., 2020).

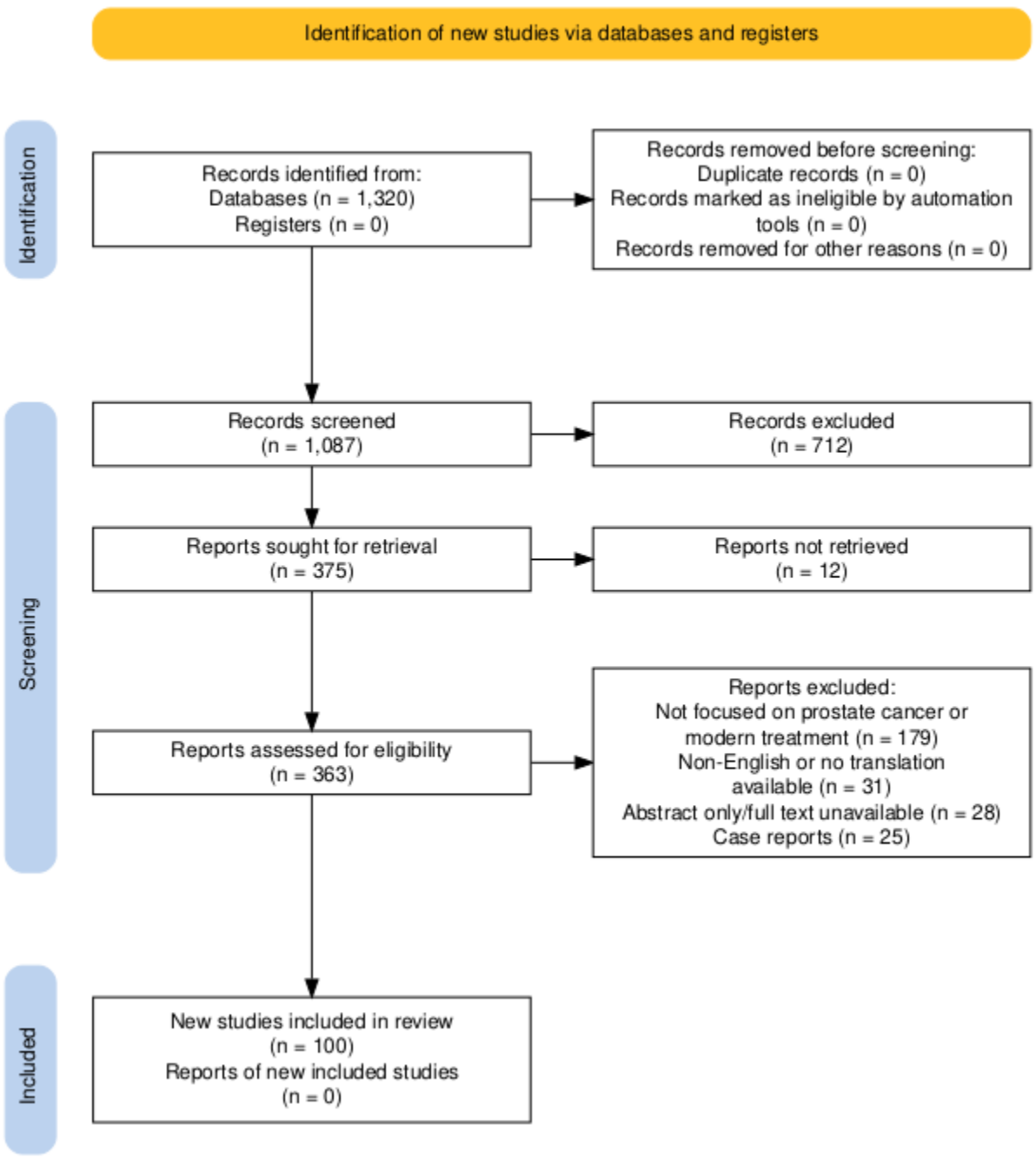

Figure 1. PRISMA flow diagram.

The final synthesis comprised 100 high-quality studies, representing the most relevant, substantial and up-to-date evidence on state-of-the-art and emerging prostate cancer therapies. In addition, reporting the PRISMA flow diagram describing the methodology and outcomes of each stage of the process, from identification to synthesis, adds methodological transparency and increases the trustworthiness of the systematic review (Belkahla et al., 2022; Varaprasad et al., 2023; Swami et al., 2020; Agrawal & Vagha, 2024).

3. RESULTS

A significant volume of scientific literature on modern prostate cancer management has emerged from January 2018 and August 2025, covering advances in diagnostics, therapy and technology integration. Multiple high-quality clinical studies, systematic reviews, and meta-analyses consistently show that the current and emerging interventions-especially those employing state-of-the-art imaging,

molecular diagnostics and precision therapies-have dramatically transformed multidisciplinary cancer care (Belkahla et al., 2022; Varaprasad et al., 2023; Swami et al., 2020).

Epidemiological and Diagnostic Insights

Recent studies have shown that advanced testing like multiparametric MRI (mpMRI) and prostate-specific membrane antigen PET (PSMA PET) have greatly improved the detection and localization of early prostate tumors, as well as their risk assessment. Multiparametric MRI (mpMRI) is performed using a combination of anatomical T2-weighted imaging and functional MRI including diffusion-weighted imaging (DWI) and dynamic contrast-improved MRI (DCE-MRI). mpMRI has a sensitivity of 74% to 86% and specificity of up to 88% for clinically meaningful prostate cancer.

The PI-RADS v2.1 system makes it easier to understand what is going on and ensures that the results are the same each time. More recently, a type of MRI called biparametric MRI (bpMRI) is just as good as a full MRI scan for detecting prostate cancer that is likely to be serious. It can be done more quickly and is cheaper and it is just as accurate as a full MRI scan. PSMA PET imaging is a very sensitive way to diagnose cancer using a molecular test. It can tell doctors if cancer has spread to other parts of the body. It works with mpMRI to help work out the risk of prostate cancer and plan treatment, allowing for individual treatment plans (Belkahla et al., 2022). As well as imaging, tests for biomarkers such as the Prostate Health Index (PHI), the 4K Score use total PSA, free PSA and other kallikrein-related peptidases to better predict the presence of aggressive tumours and reduce unnecessary biopsies, improving the selection of patients for more invasive tests and treatments. These improvements to diagnosis allow a multi-modal approach that improves early detection, guides management based on risk and forms the foundation of modern prostate cancer care pathways.

Therapeutic Advances and Outcomes

Studies looking at how common diseases are in different groups of people all over the world continue to show that prostate cancer is one of the most common cancers among men. The number of cases of prostate cancer is different in different places, depending on things like where people live, their ethnicity and other things that increase or decrease the risk of getting the disease, such as age and family history. Recent data on the entire population reveal differences in the severity of diseases and their impact on individuals, underscoring the need for improved methods to assess patients' risks (Belkahla et al., 2022; Sekhoacha et al., 2022).

From a diagnostic perspective, multiparametric MRI (mpMRI) has become a key part of the process of detecting prostate cancer. Its combination of anatomical and functional sequences allows for the distinction between clinically significant and indolent tumors to be made, which addresses the long-standing issue of overdiagnosis associated with PSA screening alone. Research shows that MRI can detect disease in up to 86% of cases and rule it out in almost 88% of cases (Belkahla et al., 2022; He et al., 2023).

Along with mpMRI, a type of PET scan called PSMA PET imaging is more effective at detecting hidden metastases (the spread of cancer) and biochemical recurrence (the cancer returning after treatment). PSMA PET can target molecules, which have improved staging and treatment for high-risk and advanced cases. The latest medical advice includes PSMA PET imaging to aid in planning radiotherapy and initiating systemic therapy (Varaprasad et al., 2023; Swami et al., 2020).

Different types of blood tests are being researched to identify cancer at an early stage and its risk. These include the Prostate Health Index (PHI) and the 4K Score. When used in conjunction with imaging, they can reduce the need for more invasive tests. These tests help doctors distinguish between cancers that require treatment and those that are slow-growing and can be monitored. The combination of advanced imaging techniques with diagnostics based on molecules and biomarkers marks a significant change in how we treat prostate cancer, to make sure that each patient gets the right care. These new ideas help identify dangerous diseases early on, while also ensuring that patients receive the proper amount of treatment. This leads to better results for patients and improves their quality of life (Belkahla et al., 2022; Varaprasad et al., 2023; Swami et al., 2020).

Role of Immunotherapy and Multimodal Strategies

Immunotherapy has become a new and vital way to treat prostate cancer, mainly when the cancer has spread and doesn't respond to hormone therapy (called metastatic castration-resistant prostate cancer or mCRPC). In these cases, other treatments often fail because the cancer cells can mutate and become resistant to treatment. Immune checkpoint inhibitors (ICIs) that target programmed death-1 (PD-1), programmed death-ligand 1 (PD-L1) and cytotoxic T-lymphocyte antigen-4 (CTLA-4) have been tested in prostate cancer, but they have not been as effective as they are in other cancers. This is partly because prostate tumours often have a "cold" immune microenvironment with low levels of mutations and T-cell infiltration (Kim & Koo, 2020). However, some patients with certain

biomarkers (such as mismatch repair deficiency (dMMR), microsatellite instability-high (MSI-H), or high tumour mutational burden (TMB)) have shown good responses to ICIs, showing the importance of choosing patients based on their biomarkers (Handa et al., 2020). Active immunotherapies, including Sipuleucel-T, a cancer vaccine that activates the immune system against prostate acid phosphatase (PAP), have shown benefits in terms of survival in mCRPC and are an early success of immunotherapy in prostate cancer (Kim & Koo, 2020).

To get around the body's natural defence mechanisms, doctors are testing a mix of treatments that combine ICIs with hormonal therapies, chemotherapy, targeted drugs, or radiation. These strategies aim to change the tumor microenvironment, improve antigen presentation and activate immune cells that can kill cancer cells - combining androgen receptor signalling inhibitors with ICIs. It could lead to immunogenic cell death and increased immune infiltration. Some new ways of treating prostate cancer that are being studied. This includes using two different types of treatment to enhance the immune system's response to prostate cancer cells. In addition to blocking the immune system, strategies targeting the cells that suppress the immune system in the tumour environment, such as regulatory T cells, myeloid-derived suppressor cells and tumour-associated macrophages, could help reverse immune evasion and strengthen the body's natural defences against the tumour. Personalised vaccines and medicines that target the immune system, based on the characteristics of each tumour, are the latest developments in this field (Handa et al., 2020).

Technological Innovation

Emerging digital tools-such as artificial intelligence for diagnostics, risk prediction and treatment planning-are improving the accuracy and efficiency of clinical decision-making. Nanotechnology and new phototherapies are beginning to expand the armamentarium for local and recurrent disease (Agrawal & Vagha, 2024; Szwed & Marczak, 2024; Chaddad et al., 2023).

Surgical and Molecular Frontiers

Robotic-assisted surgery has completely changed how prostate cancer is treated. It makes it much more accurate and less likely to damage the important structures around it that are needed for urination and sex. The way robot-assisted laparoscopic prostatectomy has changed over the past 20 years has made it better. It causes less bleeding, resulting in patients spending less time in the hospital and recovering faster. These results are similar to those seen with other types of keyhole surgery (Li et al., 2024). Using augmented reality, real-time X-rays and haptic feedback means that surgery is more accurate and causes fewer complications. This is making surgery more popular and helping patients to have better outcomes (Varaprasad et al., 2023). Scientists are making significant progress in understanding how vital long non-coding RNAs (lncRNAs) and microRNAs (miRNAs) are in prostate cancer development. These non-coding RNA molecules regulate the activity of genes involved in the initiation, growth, spread and resistance to treatment of tumours. It is now possible to see that specific non-coding RNA molecules (lncRNAs) can act as early warning signs for certain cancers. These molecules can help doctors select the most effective treatment for each patient (Orafidiya et al., 2022). Similarly, microRNAs like miR-21 and miR-221 contribute to cancer by targeting tumour suppressor genes and helping the body to evade the immune system.

The tumour microenvironment (TME) is now recognised as a crucial factor in determining how tumours behave and respond to treatments. Changes to molecules in the TME, such as immune cell infiltration, alterations to the stroma and interactions with the extracellular matrix, can influence how much a tumour grows and how likely it is to spread (Koo et al., 2019). Targeting parts of the TME, such as through immune checkpoint blockade or modulation of cancer-associated fibroblast activity, shows promise as a treatment and is currently being investigated in clinical trials. Integrative molecular profiling combines data from different areas of research to make a more detailed classification of prostate tumours. This allows the identification of mutations and resistance mechanisms that can be targeted. This helps to develop new targeted treatments and combination therapy strategies. For example, tumours with defects in DNA repair can be treated with PARP inhibitors, while changes in the androgen receptor signalling pathway can help to improve antiandrogen therapy (Belkahla et al., 2022; Sumanasuriya & De Bono, 2018).

Table 1. Key Areas of Progress in Prostate Cancer Treatment (January 2018 and August 2025).

Area	Key Development	Primary References
Diagnos	mpMRI, PSMA PET, biomarkers	Belkahla et al., 2022
Therapy- focal/local	HIFU, cryotherapy, SBRT	Varaprasad et al., 2023; Swami, 2020

Systemic therapy	ARIs, PARPs, radioligands	Sumanasuriya & De Bono, 2018
Immunotherapy	Checkpoint inhibitors, Sipuleucel-T	Kim & Koo, 2020; Handa et al., 2020
AI & Technology	Imaging, diagnosis, planning	Agrawal & Vagha, 2024; Chaddad, 2023
Molecular/Genetic Trends	lncRNAs, miRNAs, TME	Orafidiya et al., 2022; Koo, 2019

Even though there have been significant improvements in the treatment of prostate cancer, there are still many problems in making care better for patients with advanced, metastatic, or treatment-resistant disease. A key issue is that prostate cancer is very different from one person to the next. Tumours can be very different in how they behave and this affects how they respond to treatment. This makes it hard to predict how the disease will progress and how well treatments will work. This highlights the need for personalised treatment plans that are supported by strong signs of disease (Belkahla et al., 2022). Treatment also becomes ineffective for other reasons, especially in cases of prostate cancer that has spread and doesn't respond to hormone therapy (metastatic castration-resistant prostate cancer or mCRPC). The body's resistance to this treatment remains a significant challenge for doctors, often due to changes in the androgen receptor (AR) pathway, activation of other growth pathways, neuroendocrine differentiation, or defects in DNA repair. These different ways that cancer can resist treatment mean that new ways to treat patients with cancer are needed.

These new ways to treat patients with cancer combine current treatments with new treatments that target specific parts of the cancer. These unexplored treatments include PARP inhibitors and radioligand therapies. These new treatments are tailored to the specific molecular profile of each patient (Swami et al., 2020; Varaprasad et al., 2023). Different individuals have varying access to new treatments and diagnostic methods. This means that precision medicine is not utilized as extensively in areas that lack sufficient resources. Urgently, it is needed to conduct trials in various countries to verify that biomarkers and treatments are effective for different groups of people and across different healthcare systems. Using artificial intelligence to combine information from genomics, imaging and clinical results could enhance how patients are grouped and improve the prediction of their responses to treatment (Belkahla et al., 2022). Many new ways of looking after patients with cancer are being developed in which all aspects of the patient's health including the biology of the tumor are studied and other treatments combined according to patient preferences and clinical circumstances, leading to more personalized oncology (Varaprasad et al., 2023).

In short, to beat the problems we have now and make things better for everyone with prostate cancer, we need to keep working on finding new ways to do research, find new signs of disease, invent new technology and make sure that healthcare is given to everyone in the same way. We also need to collaborate on trials to verify that we can utilize innovative approaches to treat individuals based on their unique needs (Belkahla et al., 2022; Swami et al., 2020; Varaprasad et al., 2023).

4. DISCUSSION

The latest results in diagnosing and treating prostate cancer address the challenges that hinder providing patients with optimal care. The different ways prostate cancer can appear show that it is not all the same, so men should have screening and treatment that is done specially for them (Belkahla et al., 2022; Sekhoacha et al., 2022). The remarkable progress in imaging techniques, particularly multiparametric MRI (mpMRI) and prostate-specific membrane antigen PET (PSMA PET), is a crucial aspect of how prostate cancer is managed today. These modern methods can spot, find and measure tumours more accurately than traditional PSA tests and conventional biopsies. For example, using mpMRI with a standardised PI-RADS scoring system is a tool that is helpful to find cancers. This means that medicines should make more informed decisions about whether to perform a biopsy and which treatment to administer (He et al., 2023). The disease can be monitored through markers in the blood and tissue and proper treatment can be ensured with careful measurements on the individuals (Agrawal & Vagha, 2024). The newer methods of imaging the body and tests for the disease markers have been very recently recommended for personalizing treatment for patients (Varaprasad et al., 2023; Swami et al., 2020). In the following years, robots will be used in surgery, greatly improving prostate operations with fewer complications and a faster recovery. However, it is still crucial to study the cancer's genes (Li et al., 2024; Orafidiya et al., 2022). Increasingly, focal therapies are being used to treat tumors without compromising patients' quality of life. However, it is still essential to examine long-term data and determine the most effective approach to selecting patients (Varaprasad et al., 2023).

Immunotherapy, while still new, offers hope, particularly for patients with metastatic disease who have specific biomarkers. The use of immune checkpoint inhibitors and cellular vaccines, often in combination with hormonal therapy and new drugs, indicates the varied techniques being employed to overcome resistance and achieve lasting results (Kim & Koo, 2020; Handa et al., 2020). However, there are still some significant issues. The fact that prostate cancer cells can change and become resistant to treatment makes it hard to treat advanced prostate cancer. This shows that we urgently need new ways to spot signs of prostate cancer and the latest therapies. To ensure that these advances consistently yield better results, it is essential to continue research with various experts, conducting trials, developing biomarkers, strengthening our healthcare systems and creating care models that prioritize patient care. This detailed review highlights the evolving approach to managing prostate cancer (Belkahla et al., 2022; Varaprasad et al., 2023; Swami et al., 2020).

5. CONCLUSION

The conclusion of this review shows that modern prostate cancer treatment has changed a lot because of new ways to scan the body, understand cancer at the molecular level, perform surgery, and use whole-body and immune-based treatments. New tools, such as advanced MRI and PSMA PET scans, help doctors detect cancer earlier and choose the most effective treatment, while causing fewer side effects. Robot-assisted surgery helps patients recover better when the cancer is still in one area. Learning more about how cancer works at the smallest level is leading to new, more focused treatments.

Immunotherapy and combinations are hopeful new options when cancer spreads and does not respond to hormone therapy, though study is needed to see if the options are better in aggressive cancer. Even amid progress, because tumors differ, cancer resists treatment, and health is unequal, scientists and doctors must study and collaborate more.

Overall though, one must tailor care for the needs of each individual patient, and one must provide new technology and information to help men with prostate cancer live longer and improve their quality of life. Future research both into the long term and into the use of tests and treatment selection to guide management is needed to improve men's care further.

Acknowledgments

The authors have no acknowledgments to disclose.

Author's contribution

Justyna Ewa Gręda - Conceptualization; writing - rough preparation; supervision

Agnieszka Kowalska, Milena Kędzierska, Michał Biernacki & Michał Wójcicki - Writing - rough preparation

Informed consent

Not applicable.

Ethical approval

Not applicable. This article does not contain any studies with human participants or animals performed by any of the authors.

Funding

This research did not receive any external funding like specific grant from funding agencies in the public, commercial, or nonprofit sectors.

Conflict of interest

The authors declare that they have no conflicts of interests, competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data and materials availability

All data associated with this study will be available based on reasonable request to the Corresponding Author.

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