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Review

The Performance and Role of PSMA PET Scans in Localised Prostate Cancer

Jianliang Liu [1,2,3,4], Jack Dunne [2], Karim A. Touijer [5,6], Marlon Perera [2,3,4,7] and Nathan Lawrentschuk [1,2,3,4,*]

1 EJ Whitten Prostate Cancer Research Centre, Epworth Healthcare, Melbourne, VIC 3005, Australia
2 Department of Urology, The Royal Melbourne Hospital, University of Melbourne, Melbourne, VIC 3052, Australia
3 Department of Surgery, University of Melbourne, Melbourne, VIC 3052, Australia
4 Department of Surgery, Peter MacCallum Cancer Centre, Melbourne, VIC 3000, Australia
5 Urology Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY 10065, USA
6 Department of Surgery, Weill Cornell Medical School, Cornell University, New York, NY 10065, USA
7 Department of Urology, Austin Health, University of Melbourne, Heidelberg, VIC 3084, Australia
* Correspondence: nlaw@unimelb.edu.au

Abstract: Background/Objectives: Prostate cancer (PCa) is one of the most prevalent cancers in men. While PSA testing aids in early detection, it often identifies clinically insignificant PCa (ciPCa), which may not necessitate treatment. Prostate-specific membrane antigen (PSMA) PET scans have emerged as a promising tool to evaluate of localised PCa. This review aims to assess the current evidence of using PSMA PET scans for localised PCa. Methods: Peer-reviewed publications on PSMA PET scans in localised PCa, from inception to May 2024, were retrieved from PubMed. The outcomes evaluated included diagnostic performance in identifying intraprostatic lesions, detecting csPCa (ISUP GG $\geq$ 2), and role peri-treatment. Results: The addition of PSMA PET/CT to MRI improved the sensitivity (from 83% to 97%) and NPV (72% to 91%) of detecting csPCa. PSMA PET helped improve risk stratification in active surveillance by identifying MRI-occult lesions in up to 29% of patients, of which up to 10% may harbour underlying unfavourable pathology. In local staging, PSMA PET/MRI outperforms MRI in identifying extra-prostatic extension (77% vs. 73%) and seminal vesicle invasion (90% vs. 87%). PSMA PET scans are also superior to MRI in nodal staging and bone scans in identifying bony metastasis. PSMA PET scans appear useful in guiding treatment of localised PCa and aiding follow-up. Conclusions: PSMA PET scans are valuable for evaluating localised PCa by improving the detection of csPCa and enhancing local staging. However, most available studies are retrospective, and long-term oncological outcomes remain underreported due to the relative novelty of PSMA PET scans.

Keywords: diagnostic imaging; magnetic resonance imaging; prostatic neoplasms; prostate-specific membrane antigen; positron emission tomography computed tomography; positron emission tomography magnetic resonance imaging; radiopharmaceuticals

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1. Introduction

The rising incidence of prostate cancer (PCa) can be attributed to factors such as an aging population and the widespread uptake of prostate-specific antigen (PSA) testing [1]. One criticism that PSA screening has faced is the risk of increased detection of clinically insignificant PCa (ciPCa) [2]. The European Association of Urology (EAU) Guidelines define ciPCa as PCa that does not cause harm, while clinically significant PCa (csPCa) is

defined as PCa that may result in morbidity or mortality [3]. This distinction is crucial to avoid unnecessary side effects associated with the overtreatment of ciPCa.

The diagnosis of PCa often involves prostate biopsies, preferably with imaging guidance. The current imaging modality of choice is magnetic resonance imaging (MRI). The PRECISION trial [4] compared MRI-guided biopsy against ultrasound-guided biopsy and demonstrated that the addition of MRI increased the detection rate of csPCa from 26% to 38%, while reducing the detection of ciPCa from 22% to 9%. However, the use of MRI is not without limitations. MRI may still result in unnecessary biopsies and potentially miss some csPCa [5]. There is further room to improve the detection of csPCa while reducing the detection of ciPCa. Therefore, newer imaging modalities such as PSMA positron emission tomography (PET) scans are being explored.

Prostate-specific membrane antigen (PSMA) is a transmembrane protein that is upregulated in PCa cells, making it an ideal target for molecular imaging due to its limited expression in benign prostatic tissue [6]. The introduction of PSMA PET scans has undoubtedly changed our diagnosis and management of PCa (Figure 1). Following the ProPSMA trial, PSMA PET scans have replaced conventional imaging modalities (abdomen and pelvis computed tomography (CT) and whole-body bone scan (WBBS)) for staging [7]. The EAU guidelines recommend PSMA PET scans only for selected PCa patients with concerns of recurrence or staging of the International Society of Urologic Pathologists grade group (ISUP GG) ≥ 3 [3]. While PSMA PET scans have limited utility in staging ISUP GG 2 PCa, they may play a role in assessing localised intraprostatic disease. There is emerging evidence for the use of PSMA PET scans to improve the detection of csPCa [8]. For example, in the PRIMARY trial [9], the addition of PSMA PET scans to MRI improved the sensitivity and reduced the false negative for detecting csPCa. Therefore, PSMA PET scans could potentially help further reduce the number of unnecessary biopsies. This review aims to provide an overview of the current clinical applications and performance of PSMA PET scans in localised PCa.

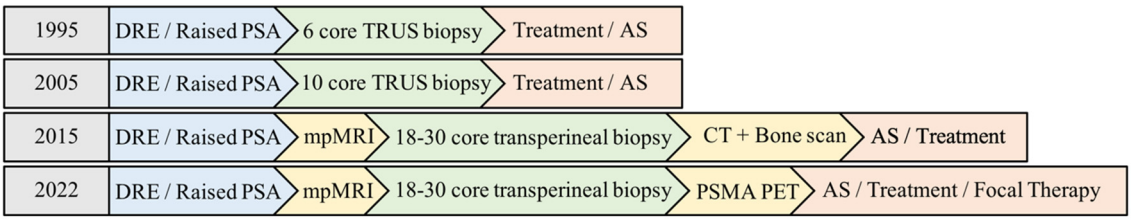

Figure 1. Change in the diagnostic pathway of prostate cancer over time. Abbreviations: Digital rectal exam (DRE), prostate-specific antigen (PSA), transrectal ultrasound (TRUS), active surveillance (AS), multiparametric magnetic resonance imaging (MRI), computed tomography (CT), prostate-specific membrane antigen positron emission tomography (PSMA PET).

2. Materials and Methods

A literature review was performed on PubMed using variations of keywords, which included "PSMA PET" and "prostate neoplasm". The population included all patients with localised PCa, which was defined as cancer confined within the prostate or prostatic bed/fossa. Studies which evaluated extra-prostatic extension (EPE) were also included. EPE was defined as the presence of PCa in tissue beyond the confines of the prostate gland, such as the neurovascular bundle or peri-prostatic adipose tissue [10]. Post-prostatectomy, the histological evidence of PCa extending beyond the prostate is described as pT3a and above in the tumour, lymph node, and metastasis (TNM) staging system [11]. The intervention in question was the utilisation of PSMA PET scans, such as PSMA PET/CT and PSMA PET/MRI. PET scans using non-PSMA-based tracers were excluded. The comparator might include prostate MRI or conventional imaging modality. Outcomes of interest included

methods of reporting PSMA PET scans for localised PCa, evaluation of intraprostatic cancer, detection of csPCa, local tumour staging, utility of PSMA PET scans peri-treatment, and the prognostic value of PSMA PET scans in localised PCa. csPCa was defined as ISUP GG 2 and above. All English-language, peer-reviewed publications from inception to May 2024 were considered. Case reports, case series, letters to editors, commentaries, conference abstracts, and unpublished studies were excluded.

3. Results

3.1. Methods of Reporting Localised Prostate Cancer on PSMA PET Scans

Standardised reporting of PSMA PET scans is crucial for PCa diagnosis. Standardisation ensures the quality and reproducibility of reports for clinical decision-making and research. PSMA PET scans distinguish between malignant and benign lesions using semiquantitative measurements and qualitative analyses. Semiquantitative measurements include standardised uptake values (SUV) and tumour-to-background ratios (TBR) [12]. SUV is a measurement of the relative concentrations of PSMA uptake, with maximum SUV (SUVmax) representing the highest uptake in a region of interest. Qualitative analyses include visual interpretation of images and lesion morphology.

The PRIMARY Score is a 5-category scale developed based on the ^{68}Ga PSMA tracer to evaluate intraprostatic lesions. The aim is to standardise reporting and identify csPCa by combining anatomical patterns and SUVmax [13]. The criteria of the PRIMARY score are detailed in Table 1. A high PRIMARY score of 3 to 5 demonstrates 88% sensitivity, 64% specificity, 76% positive predicting value (PPV), and 81% negative predicting value (NPV) in detecting csPCa. A validation study showed that the PRIMARY score had higher interrater reproducibility compared to the MRI-based Prostate Imaging–Reporting and Data System (PIRADS) score [14]. However, both reporting systems had similar diagnostic performance.

Table 1. PRIMARY Score classification.

PRIMARY Score	Description	Clinical Implication	Proportion of Men with csPCa Based on Original Study
Score 1	No significant PSMA uptake pattern or low-grade activity only.	Likely benign; very low likelihood of csPCa.	8.5%
Score 2	Diffuse uptake in transition or central zone.	Low likelihood of csPCa	27%
Score 3	Focal transition zone activity above background activity (visually at least twice).	Intermediate likelihood of csPCa;	38%
Score 4	Focal peripheral zone activity of any intensity.	High likelihood of csPCa	76%
Score 5	SUVmax > 12 in any zone.	Very high likelihood of csPCa	100%

Abbreviations: Clinically significant prostate cancer (csPCa), prostate-specific membrane antigen (PSMA), maximum standardised uptake values (SUVmax).

3.2. PSMA PET Scans for Primary Diagnosis of Localised Prostate Cancer

Previous meta-analysis demonstrated that PSMA PET/CT can detect localised PCa with a sensitivity between 0.71 and 0.84 and specificity of up to 0.92 [15]. Given the moderate sensitivity, PSMA PET/CT may miss some intraprostatic lesions. There appears to be no significant difference in terms of the sensitivity and specificity of detecting localised PCa when comparing PSMA PET/CT to multiparametric MRI (mpMRI) (Table 2) [8].

However, PSMA PET/MRI appear to have a higher diagnostic accuracy of detecting localised PCa when compared to PSMA PET/CT (97% vs. 86%) [16].

Table 2. Estimated diagnostic performance of various imaging modalities at detecting localised prostate cancer.

	Median Sensitivity	Median Specificity
PSMA PET scan only	0.83	0.76
MRI only	0.80	0.76
PSMA-PET + MRI	0.82	0.77

Estimated performance values extracted from meta-analysis by Wang et al. [8]. Abbreviations: Prostate-specific membrane antigen positron emission tomography targeted biopsy (PSMA PET), magnetic resonance imaging (MRI).

In low- to intermediate-risk PCa, PSMA PET scans identified MRI occult lesions in 12.3–29% of patients, of which up to 10% may harbour underlying unfavourable pathology that may not be suitable for active surveillance [17]. MRI-occult lesions (Figure 2) are defined as areas of concern that are not visible or detectable on MRI but are identified on alternative imaging modalities such as PSMA PET scans. PSMA PET scans can potentially improve patient selection during active surveillance by identifying aggressive disease, which may be better managed with active treatment. This improves risk stratification and prevents patient misclassification. However, these findings are limited by the fact that most existing studies are retrospective in nature with small sample sizes. Therefore, further prospective trials are needed.

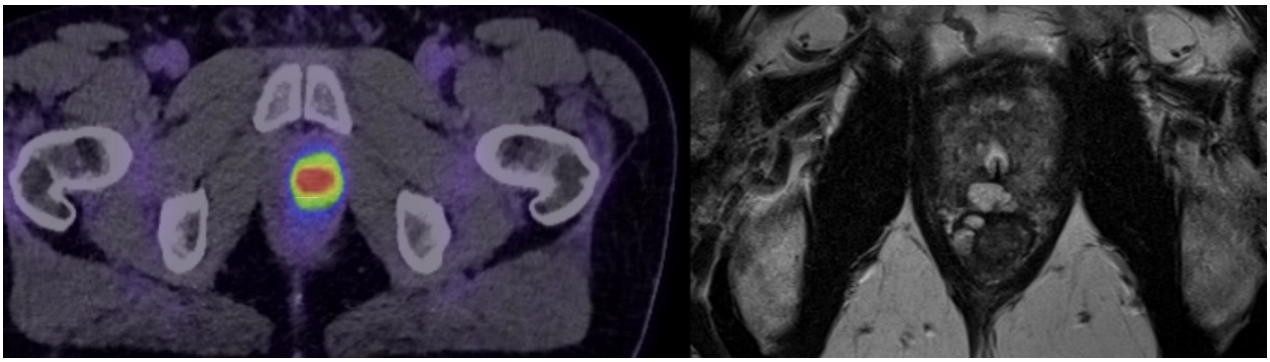

Figure 2. Example of an MRI-occult lesion (transverse imaging), which was not visible on mpMRI and classified as PI-RADS 2 (image on the **right**). However, the lesion was detected as a PSMA-avid lesion on 18F PSMA PET/CT (image on the **left**). MRI-occult lesions are those that do not show up clearly on MRI scans but are detected using alternative imaging techniques, such as PSMA PET. Abbreviations: Prostate Imaging–Reporting and Data System (PIRADS), prostate-specific membrane antigen positron emission tomography (PSMA PET), multiparametric magnetic resonance imaging (mpMRI).

It is also worth noting that some studies use prostatectomy histopathology as a reference point instead of prostate biopsies. Since prostate biopsies represent only a small proportion of PCa being sampled, it is not uncommon to observe histopathological upgrading during the examination of prostatectomy specimens [18]. Additionally, PSMA PET scans may miss up to 5–10% of PCa, which are PSMA-negative [19].

3.3. Identifying Clinically Significant Prostate Cancer

The identification of csPCa may be more clinically relevant, as it is crucial for distinguishing between patients who are suitable for active surveillance and those who require active treatment. Higher-grade PCa has been shown to have higher PSMA expression, which correlates to higher SUV on PSMA PET scans [20]. Although there is no consensus

on the optimal SUVmax to differentiate csPCa from ciPCa, previous studies have proposed cutoffs between 5.4 and 8 [21].

The PRIMARY trial was a landmark multi-centre prospective study that explored the use of PSMA PET/CT in MRI-naïve patients [9]. The inclusion criteria were clinical suspicion of PCa, indicated by abnormal PSA levels or digital rectal examination (DRE) findings. The PRIMARY trial demonstrated that the addition of PSMA PET/CT to MRI compared to MRI alone improves the NPV (91% vs. 72%) and sensitivity (97% vs. 83%) of detecting csPCa (ISUP GG $\geq$ 2). Independent of the MRI findings, an SUVmax of 12 was also found to have 100% specificity and 100% PPV in detecting csPCa. In the presence of a PIRADS 4 or 5 lesion on MRI, an SUVmax of 8.7 showed 100% specificity and 100% PPV for csPCa. PSMA PET/CT appears to be a useful adjunct in the MRI-triaged population. These findings raise the question whether prostate biopsies could be safely avoided in patients without any imaging evidence of csPCa. The additive value of PSMA PET scans to MRI for detection of csPCa was validated in a subsequent meta-analysis with performance described in Table 3 [22,23]. It is worth noting that out of the 19 studies included in the meta-analysis, only seven were prospective, and only three had a sample size larger than 100.

Table 3. Estimated diagnostic performance of various imaging modalities at detecting clinically significant prostate cancer (defined as International Society of Urologic Pathologists grade group greater or equal to two).

	Pooled Sensitivity	Pooled Specificity	PPV	NPV
PSMA PET scan only	0.89	0.56	0.69	0.78
MRI only	0.89	0.50	NR	NR
PSMA-PET + MRI	0.91–0.96	0.55–0.64	0.75	0.85

Estimated performance values extracted from meta-analysis by Brondani Torri et al. [22] and Kawada et al. [23]. Abbreviation: Prostate-specific membrane antigen positron emission tomography targeted biopsy (PSMA PET), magnetic resonance imaging (MRI), positive predictive value (PPV), negative predictive value (NPV), not reported (NR).

3.4. Local Staging

Accurate pre-operative detection of EPE on imaging is critical for treatment planning and informed consent. The presence of EPE usually contraindicates ipsilateral nerve-sparing during prostatectomy and necessitates a wider excision margin. The presence of EPE also indicates a worse oncological prognosis such as the risk of biochemical recurrence (BCR) [24]. The existence of seminal vesicle invasion (SVI) has also been linked to increased rates of BCR and reduced overall survival (OS) [25].

In a meta-analysis by Wang et al. [8], there appeared to be no statistically significant difference in sensitivity and specificity between PSMA PET/CT and mpMRI in detecting EPE and SVI (Table 4). In a subsequent meta-analysis by Gossili et al. [16], PSMA PET/MRI demonstrated higher diagnostic accuracy compared to PSMA PET/CT in the detection of EPE (77% vs. 73%) and SVI (90% vs. 87%). In a separate meta-anlaysis by Chow et al. [26], PSMA PET/MRI showed higher sensitivity than mpMRI in detecting EPE (78.7% vs. 52.9%) and SVI (66.7% vs. 51.0%) during initial staging of intermediate to high-risk PCa. It is worth noting that in the meta-analysis by Gossili et al. [16], 18 of the 23 included studies utilised gallium-based PSMA tracers. Additionally, of the 23 studies, only one was multicentre and only one had a sample size of $\geq$ 100 participants.

Table 4. Estimated diagnostic performance of various imaging modalities at local tumour staging.

	Extra-Prostatic Extension		Seminal Vesicle Invasion	
	Sensitivity	**Specificity**	**Sensitivity**	**Specificity**
PSMA PET scan only	0.61	0.74	0.62	0.90
MRI only	0.67	0.77	0.60	0.92

Estimated performance values extracted from meta-analysis by Wang et al. [8]. Abbreviation: Prostate-specific membrane antigen positron emission tomography targeted biopsy (PSMA PET), magnetic resonance imaging (MRI).

3.5. PSMA PET Scans Peri-Prostatectomy

Active treatment is typically reserved for localised PCa; therefore, accurate staging excluding metastatic PCa is essential during pre-operative selection. Chow et al. [26] performed a meta-analysis of 31 studies comparing PSMA PET to conventional imaging for the primary staging of intermediate to high-risk PCa (Table 5). Compared to mpMRI, PSMA PET demonstrated higher sensitivity (38.9% vs. 73.7%) and higher specificity (82.6% vs. 97.5%) in nodal staging. Compared to WBBS for detection of bony metastasis, PMSA PET showed higher sensitivity (73% vs. 98%) and higher specificity (79.1% vs. 96.2%).

Table 5. Estimated diagnostic performance of various imaging modalities at nodal and bony metastasis staging.

	Nodal Metastasis		Bony Metastasis	
	Sensitivity	**Specificity**	**Sensitivity**	**Specificity**
PSMA PET scan	0.74	0.98	0.98	0.96
MRI	0.39	0.83	NR	NR
WBBS	NR	NR	0.73	0.79

Estimated performance values extracted from meta-analysis by Chow et al. [26]. Abbreviation: Prostate-specific membrane antigen positron emission tomography targeted biopsy (PSMA PET), magnetic resonance imaging (MRI), not reported (NR), whole-body bone scan (WBBS).

A meta-analysis found that the increased diagnostic accuracy of PSMA PET/CT over conventional imaging during primary staging resulted in a change in clinical management in up to 28% of patients [15]. The improved detection of lymph node involvement and metastatic disease leads to a "stage migration" among patients who would have traditionally undergone prostatectomy in the era of conventional imaging. While long-term follow-up data are lacking, early results have shown that PSMA PET scans improve post-prostatectomy oncology outcomes by decreasing the risk of BCR by up to 42% [27].

Prior to prostatectomy, patients undergo prostate biopsies for diagnosis, which may delay time to surgery. Prostate biopsies may occasionally result in complications such as urinary retention, haematuria, rectal bleeding, or sepsis [28]. Additionally, patients who undergo multiple prostate biopsies may have worse functional outcomes post-prostatectomy, possibly due to scar tissues limiting nerve sparring intra-operatively [29]. Some recent studies have suggested a biopsy-free method for identifying candidates for prostatectomy, utilising pre-operative risk stratification through the combination of elevated PSA, abnormal DRE, and clinically concerning imaging (PSMA PET/CT and mpMRI) [30]. Given the relatively low morbidity associated with prostate biopsies and the lack of large prospective randomised controlled trials, PSMA PET scans should not replace pre-prostatectomy biopsies at this stage.

During post-prostatectomy follow-up, PSMA PET/CT can detect residual PCa in patients experiencing persistently elevated PSA levels [31]. In BCR, PSMA PET/CT can

help identify local recurrence within the prostatic fossa, especially when combined with MRI [32]. In a prospective study by Ghezzo et al. [33], PSMA PET/MRI had higher sensitivity in detecting recurrence during BCR. It is worth noting that detection rates are dependent on the patient's PSA level. According to the EAU guidelines, PSMA PET/CT is recommended as a staging tool when PSA levels rise above or persistently remain above 0.2 ng/mL, particularly if the results are anticipated to influence treatment decisions [3].

3.6. PSMA PET Scans in Radiotherapy

Gross tumour volume (GTV) is measured on imaging to ascertain the extent and size of PCa. In both radiotherapy and focal therapy, GTV influences treatment delivery and guides treatment intensity. PSMA PET scans outperform mpMRI in estimating GTV, demonstrating higher sensitivity (75.7% vs. 64.7%), specificity (87.1% vs. 86.4%), and area under the receiver operating characteristic curve (AUROC) (0.889 vs. 0.852) [34].

Higher-grade PCa are known to be more resistant to radiotherapy and linked to higher rates of local recurrence [35]. An appropriate increase in radiation dose has been previously shown to improve oncological outcomes [36]. PSMA PET scan's ability to predict higher-grade PCa appears promising in guiding radiotherapy dose escalation. A study by Eade et al. [37] showcased the effectiveness of PSMA PET/MRI-guided focal boost within stereotactic body radiation therapy (SBRT).

In post-radiotherapy follow-up, MRI serves to identify local recurrences, assist in target biopsy, and guide local salvage therapy [38]. However, it may underestimate the extent of local recurrence [39]. PSMA PET/CT appears to be comparable to MRI in detecting local recurrences post-radiotherapy but offers the added benefit of lymph node and distal metastasis detection [40,41]. Concordant findings on both PSMA PET/CT and MRI are strong indicators of local PCa recurrence. Currently, the EAU guidelines recommend PSMA PET/CT as a staging tool in patients with PSA recurrence after radiotherapy only if they are suitable for curative salvage therapy [3].

After prostatectomy or focal therapy, salvage radiotherapy (SRT) to the prostatic fossa is a viable option for selected patients experiencing PSA-only recurrence (i.e., BCR without distant metastasis) [3]. PSMA PET/CT enables accurate staging to rule out distal metastasis before initiating SRT. PSMA PET scans may also help identify the site of local recurrence and tailor radiation dosimetry [42]. Additionally, PSMA PET scans may be predictive of responsiveness to SRT [43]. Previous studies have shown that PSMA PET/CT influences treatment decisions in patients with BCR; however, there is a lack of data regarding its impact on long-term outcomes [42].

3.7. PSMA PET Scans in Focal Therapy

Focal therapy aims to target small foci of low- and selected intermediate-grade PCa while preserving surrounding healthy tissue. MRI is often performed prior to identifying the size and location of PCa. The addition of PSMA PET scans may help improve patient selection for focal therapy by excluding csPCa and identifying MRI-occult lesions [17].

Post-focal therapy follow-up involves repeat MRIs and prostate biopsies. However, MRI may be confounded by post-focal therapy artifacts. Theoretically, PSMA PET scans should be able to detect recurrent PCa without being hindered by treatment artifacts and could be a valuable tool for post-focal therapy follow-up [44]. However, there is a lack of studies evaluating the use of PSMA PET scans in focal therapy [45].

3.8. PSMA PET Scans in Theranostics

Theranostics is a field of medicine that combines diagnostic techniques with therapeutic interventions. Given PSMA tracers' affinity to PCa, there is growing interest in modifying the tracers into therapeutic isotopes for treatment. After the identification of

metastatic deposit with PSMA PET scans, therapeutic radiopharmaceuticals labelled with β (lutetium-177 or yttrium-90) or α (actinium-225)-emitting isotopes can be given. In metastatic castration-resistant PCa, Lutetium-177 [177Lu]Lu-PSMA-617 has been shown to result in more than 50% decrease in PSA and improvement in OS [46]. Given the high rates of BCR after prostatectomy in high-risk PCa, the LuTectomy trial explored the use of [177Lu]Lu-PSMA-617 in localised PCa [47]. It demonstrated that in men with high-risk features (e.g., PSA > 20 ng/mL, or ISUP GG 3–5) with high PSMA expression on PSMA PET/CT, two cycles of [177Lu]Lu-PSMA-617 prior to prostatectomy were well tolerated with minimal side effects, did not compromise surgical safety, while delivering targeted doses of radiation to tumour-affected tissues. However, this study only 20 patients. Further studies in this area will be interesting to determine whether theranostics can reduce the long-term risk of BCR in localised PCa.

3.9. PSMA PET Scans for Prognostication

Increased uptake of PSMA tracer in PCa has been linked to traditional prognostic indicators, such as higher Gleason scores, higher ISUP GG disease, and lower BCR free survival after prostatectomy [48]. As described above, PSMA PET scans are effective for local staging, particularly in the detection of adverse surgical pathology such as EPE and SVI, which also serve as unfavourable prognostic indicators [49]. PSMA PET/MRI have been shown to be comparable to Memorial Sloan Kettering Cancer Centre (MSKCC) and Partin nomograms for prediction of ECE and SVI [50]. The ability to estimate GTV is also important, as it has been previously shown to be an independent predictor of mortality from PCa and OS [51].

4. Discussion

This review found that PSMA PET scans are useful for identifying csPCa in localised PCa (Figure 3). In resource-limited settings, accessibility to PSMA PET scans may be challenging. In these situations, PSMA PET scans should be prioritised for pre-treatment staging to exclude distant metastasis. If PSMA PET scans are unavailable, prostate MRI remains essential for guiding biopsies, and conventional imaging for staging.

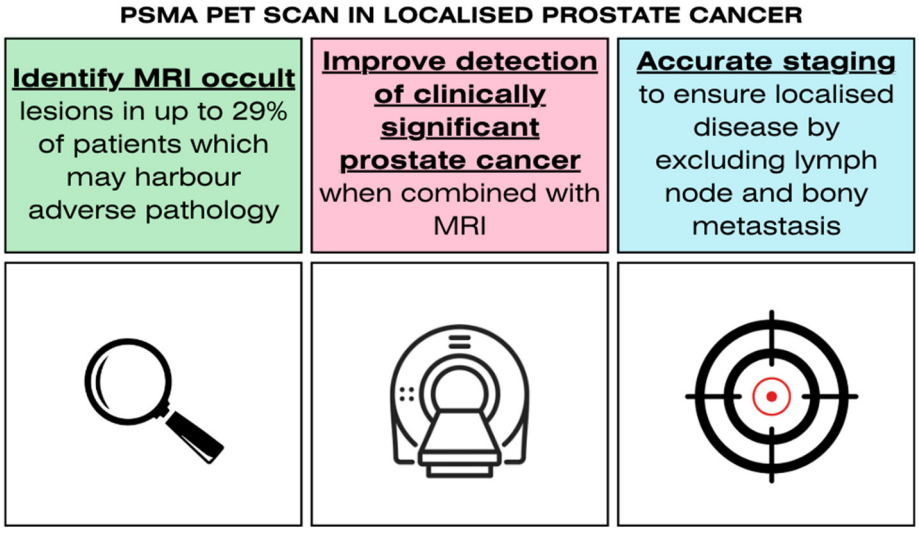

Figure 3. Graphical abstract summarising key utility of PSMA PET scan in localised prostate cancer.

The incorporation of new imaging modalities in diagnostic pathways leading to "stage migration" has implications for the way PCa is risk-stratified. There is a need for more

prospective studies to provide data regarding long-term oncological outcomes of patients whose management decisions are influenced by PSMA PET scans.

Due to the low risk of developing metastatic disease, there is no role for PSMA PET scans as a staging modality in low-risk and intermediate-risk PCa [3]. However, there are ongoing studies evaluating the role of PSMA PET scans in active surveillance. The CONFIRM trial is an ongoing study assessing the utility of PSMA PET scans prior to confirmatory biopsy [52]. Early results of the CONFIRM trial have demonstrated the potential of PSMA PET scans to improve risk stratification for active surveillance patients by increasing the detection of csPCa [53]. Another area of interest being explored is how PSMA PET scans could potentially help patients avoid unnecessary biopsies. The PRIMARY II trial is an ongoing multi-centre study that involves patients with clinical suspicion of csPCa with PIRADS 2 or 3 on mpMRI [54]. Participants are then randomised into either an experimental arm where they undergo pelvic PSMA PET/CT or a control arm where they undergo template prostate biopsy. Targeted prostate biopsies are performed in the experimental arm if the pelvic PSMA PET/CT is avid; otherwise, participants undergo PSA monitoring only. The goal is to determine whether the addition of PSMA PET/CT will help some men exclude csPCa and avoid prostate biopsy.

In conclusion, current guidelines limit PSMA PET scans for pre-treatment staging or detection of recurrent PCa. However, emerging evidence suggests that PSMA PET scans may also be beneficial as a tool for the primary diagnosis and local staging of PCa, particularly when combined with mpMRI.

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