Check for updates

The Prostate

WILEY

The Prostate

ORIGINAL ARTICLE OPEN ACCESS

Impact of Pelvic Lymph Node Dissection on Early Oncological Outcomes in Intermediate-Risk Prostate Cancer Patients With Node-Negative PSMA PET

Baris Esen[1] | Hulya Seymen[2] | Ayşe Armutlu[3] | Ersin Koseoglu[1] | Ibrahim Can Aykanat[1] | Hatice Zoroğlu[4] | Abdullah Erdem Canda[1,5] | Yakup Kordan[1] | Mevlana Derya Balbay[1] | Dilek Ertoy Baydar[3] | Mehmet Onur Demirkol[2] | Derya Tilki[1,6,7] | Tarık Esen[1]

[1]Department of Urology, Koc University Hospital, Istanbul, Turkiye | [2]Department of Nuclear Medicine, Koc University Hospital, Istanbul, Turkiye | [3]Department of Pathology, Koc University Hospital, Istanbul, Turkiye | [4]Department of Urology, Tokat Gaziosmanpasa University Hospital, Tokat, Turkiye | [5]RMK AIMES, Rahmi M. Koc Academy of Interventional Medicine, Education, and Simulation, Istanbul, Turkiye | [6]Department of Urology, University Hospital Hamburg-Eppendorf, Hamburg, Germany | [7]Martini-Klinik Prostate Cancer Center, University Hospital Hamburg-Eppendorf, Hamburg, Germany

Correspondence: Baris Esen (barsesen90@gmail.com)

Received: 8 August 2024 | **Revised:** 30 January 2025 | **Accepted:** 20 February 2025

Funding: The authors received no specific funding for this work.

Keywords: intermediate | lymph node dissection | PET | prostate cancer | PSMA | staging

ABSTRACT

Background: PSMA PET/CT has previously shown superior performance in nodal staging of prostate cancer (PCa) and may be used to reduce the number of unnecessary PLND procedures. This study aims to assess the performance of PSMA PET/CT in nodal staging of intermediate-risk prostate cancer and to evaluate the effect of PLND on oncological outcomes of intermediate-risk prostate cancer patients with a negative PSMA PET/CT.

Methods: A total of 308 patients with intermediate-risk PCa who underwent PSMA PET/CT for nodal staging between January 2014 and July 2024 were included in the study. Patients who underwent PLND had higher PSA and higher rates of PIRADS-5 and biopsy grade-group 3 disease. A 1:1 propensity score matching was performed to eliminate patient characteristics differences between groups and 140 patients were included in the final analysis. PSA persistence rates (≥ 0.1 ng/dL) and biochemical recurrence (BCR; ≥ 0.2 ng/dL) rates after RP were recorded. Kaplan-Meier curves were constructed to evaluate oncological outcomes. Log-rank test was utilized to compare oncological outcomes in patients with and without PLND.

Results: The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of PSMA PET/CT on nodal staging were 53.3%, 95%, 47.1%, and 96.1%, respectively. The NPV of PSMA PET/CT in patients with biopsy GG3 disease (96.3%) was similar to those with biopsy GG2 disease (95.6%). The median follow-up after propensity score matching was 20.7 months. The 24-month BCR-free survival rates were 83.7% and 86.9% in the PLND-RP group and RP-only groups, respectively ($p = 0.078$).

Conclusions: NPV of PSMA PET/CT in determining LNI was remarkable in patients with intermediate-risk PCa and PLND was found to have no impact on oncological outcomes. Therefore PLND may be omitted to decrease surgery-related complications in patients with intermediate-risk PCa a negative PSMA PET/CT for nodal staging.

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2025 The Author(s). *The Prostate* published by Wiley Periodicals LLC.

1 | Introduction

Pelvic lymph node dissection (PLND) during radical prostatectomy (RP) is commonly performed to provide more accurate information about staging in patients with prostate cancer (PCa) considering the limited performance of conventional imaging on nodal staging [1]. However, PLND is a time-consuming procedure and is associated with a higher risk of complications such as neural injury (obturator nerve), ureteral injury, vascular injury, thromboembolic events, lymphocele, and lower limb lymphedema [2, 3]. Several nomograms have been developed to predict lymph node involvement (LNI) and PLND is recommended to be performed if the estimated risk of lymph node (LN) involvement exceeds predetermined thresholds [4, 5]. Still, the final pathology of PLND reveals that the majority of patients who underwent the procedure (even if it exceeds the nomogram threshold value) had no LNI [6]. Furthermore, the previous studies failed to show any oncological benefit of PLND in prostate cancer patients, raising the question of whether PLND can be safely omitted in a subgroup of patients [7]. The definiton for a necessary PLND remains unclear. It can be defined as pN1 following lymph node dissection or as lymph node dissection that results in improved oncological outcomes.

Previous mapping studies revealed almost one-third of nodal metastasis is missed with the usual template for extended PLND (ePLND) [8]. Besides, novel imaging with prostate-specific membrane antigen (PSMA) positron emission computerized tomography (PET/CT) consistently has shown superior accuracy in nodal staging compared to conventional imaging [7, 9]. Patients with intermediate-risk PCa have a significantly lower risk of LNI compared with those with high-risk disease [10]. Therefore, the added value of ePLND on proper staging and prognosis in the PSMA PET era in patients with intermediate-risk PCa needs to be investigated. Herein, we aimed to compare oncological outcomes of intermediate-risk PCa patients with node-negative PSMA PET/CT who underwent PLND versus who did not (RP-only).

2 | Patients and Methods

2.1 | Participants and Study Design

The medical records of 741 patients who underwent RP between January 2014 and July 2024 were retrospectively evaluated. Of those, 395 (53.3%) had RP for intermediate-risk PCa according to EAU risk groups for biochemical recurrence (BCR) [10]. The inclusion and exclusion criteria for different end-points of the study are summarized in Figure 1. In all patients, baseline characteristics such as age, clinical T stage, preoperative serum PSA, serum PSA density (PSAD; PSA divided by prostate volume according to mpMRI), PIRADS score on mpMRI and Gleason score of prostate biopsy were recorded. The decision to perform PLND during RP was at the

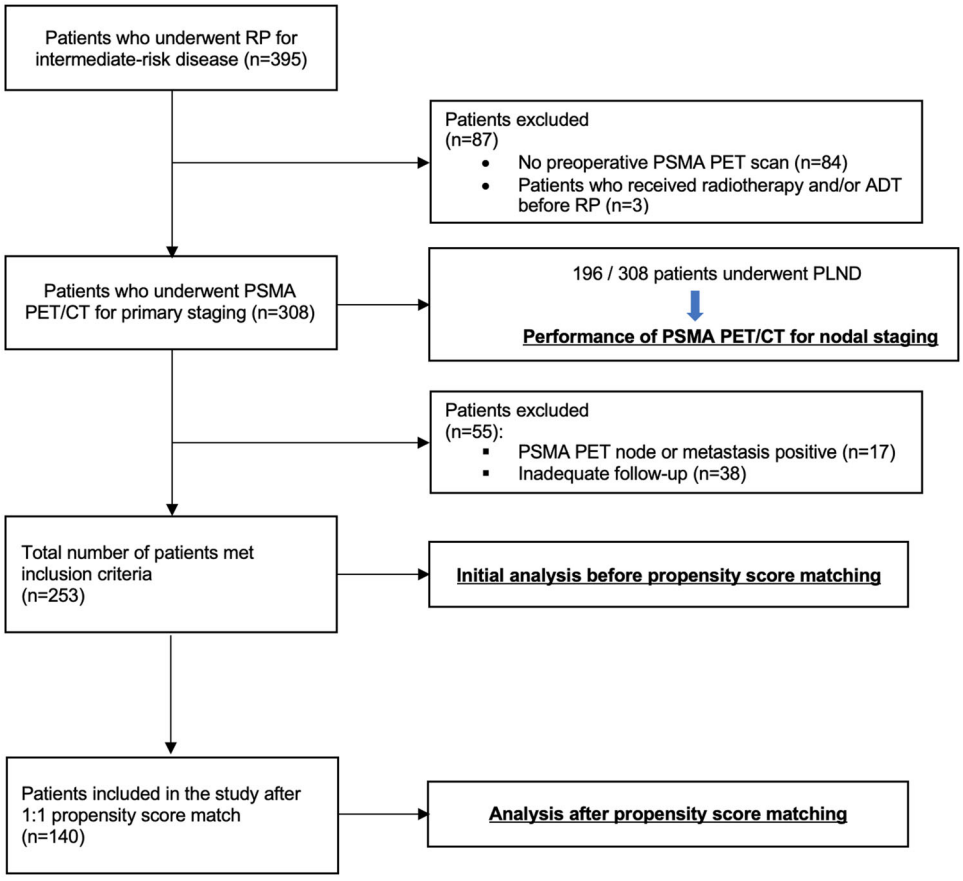


FIGURE 1 | Patient inclusion flow chart for different end-points of the study; (1) The performance of PSMA PET/CT for nodal staging; (2) oncological outcomes before propensity score matching and (3) the analysis after propensity score matching.

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

discretion of the surgeon. Higher grade group, higher number of positive cores or suspicion of ECE by preoperative imaging or during intraoperative dissection directed the decision in favor of performing an ePLND.

Patients with node-positive PSMA-PET have undergone RP and PLND as part of a multimodal treatment approach in case of histologically confirmed lymph node metastasis.

The template of ePLND included external iliac, internal iliac, and obturator lymph nodes. The medial border of the template was defined by the ureters, the cranial border was defined as the point where ureters crossed the common iliac arteries, the lateral boundary was marked by the genitofemoral nerve, and the caudal boundary by the Cooper's ligament. All surgeries were performed by four high-volume surgeons specialized in urologic oncology who have performed at least 500 prior radical prostatectomies. The PSA nadir was defined as the lowest PSA value achieved without receiving ADT or adjuvant radiotherapy within 6 months after RP. The number of patients who received adjuvant radiotherapy was recorded. The follow-up included routine serum PSA tests and further imaging whenever deemed necessary. BCR-free survival was defined as the time interval between RP and the time of BCR or death. BCR was defined as the two serum PSA values of ≥ 0.2 after surgery.

2.2 | ^{68}Ga-PSMA-11 PET/CT Scans

The PSMA PET/CT scans were performed using the tracer ^{68}Ga-PSMA-11 at either our center or other academic centers. All external PSMA PET scans underwent central review by a highly experienced nuclear medicine specialist and scans deemed technically unacceptable were excluded. A PSMA-positive lesion was defined as focal tracer accumulation exceeding the surrounding background, not attributable to physiological uptake or known pitfall as recommended by PROMISE (Prostate Cancer Molecular Imaging Standardized Evaluation) criteria [11].

2.3 | Statistical Analysis

SPSS version 24.0 for utilized for statistical analyses. Descriptive statistics were provided using either means and standard deviation (SD) or medians and interquartile range (IQR) for numerical parameters and percentages for categorical parameters. Means and medians were compared using either the student-*t*-test or the Mann-Whitney-U test. Chi-square or Fisher's exact test was utilized to compare proportions in different groups. 1:1 propensity score matching was performed using clinical and pathological parameters associated with aggressiveness of disease such as age, serum PSA level (< 10 vs 10–20 ng/mL), clinical T stage (cT1c vs cT2a-b), PIRADS score on MRI (PIRADS 1–3, vs PIRADS 4 vs PIRADS 5), and biopsy ISUP grade group (GG1 vs GG2 vs GG3). The Kaplan-Meier curves were constructed to demonstrate oncological outcomes. The log-rank test was performed to compare the oncological outcomes in patients who did and did not undergo PLND. All tests were 2-sided and a p-value of < 0.05 was considered statistically significant.

3 | Results

3.1 | The Performance of PSMA PET/CT in Nodal Staging of Intermediate-Risk Prostate Cancer

Overall, 196 out of 308 patients with intermediate-risk PCa and a primary PSMA PET/CT staging underwent an ePLND during RP. The patient characteristics of patients who underwent a PLND were summarized in Supplementary Table 1. PSMA PET was positive for nodal metastasis in 17 patients. The median number of LNs removed during ePLND was 17 (IQR: 11–25). The prostate biopsy and RP GG were concordant in 62% of the cases (122/196) (Supplementary Table-2). ePLND revealed LNI in 15 patients (7.7%). The overall sensitivity, specificity, PPV, and NPV of PSMA PET/CT in detecting nodal metastasis were 53.3%, 95%, 47.1%, and 96.1%, respectively (Table 1). The tumor diameter in lymph node metastasis was ≤ 3 mm in all patients in whom PSMA PET failed to detect the LNI ($n = 7$; solitary LNI in 6 cases, 2 LNI in the remaining case). The number of ePLND procedures needed to be performed to detect one patient with LNI was 25. The performance of PSMA PET/CT according to biopsy GGs is provided in Table 2. The PSMA PET/CT provided relatively superior outcomes in terms of sensitivity (63% vs 33%) and PPV (56% vs 29%) but similar specificity (95% for both) and NPV (96% for both) in patients with biopsy GG3 disease compared with those with biopsy GG2 disease.

3.2 | Oncological Outcomes

In the analysis before propensity score matching ($n = 253$), patients who underwent PLND had higher age, serum PSA, and PSAD, had a higher rate of PIRADS-5 lesions on mpMRI, and had higher rates of GG3 disease at prostate biopsy (Table 3). The PSA persistence rates (6.6% vs 3%, $p = 0.203$) were similar between PLND-RP and RP-only groups. The median follow-up time was 22.8 months (IQR: 13.9–37.9). The patients who did not undergo PLND showed higher BCR-free-survival rates than those who underwent PLND ($p = 0.023$). The 12 and 24-month BCR-free survival rates of patients in the PLND-RP and RP-only groups were 92.4% and 87.7%, and 95.7% and 90.6%, respectively

TABLE 1 | The performance of PSMA PET/CT in nodal staging of intermediate-risk prostate cancer.

	pN0	pN1	
PSMA miN0	172	7	NPV: 96.1%
PSMA miN1	9	8	PPV: 47.1%
Total	Specificity: 95.0%	Sensitivity: 53.3%	

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 2 | The performance of PSMA PET/CT in nodal staging of prostate cancer stratified according to the ISUP grade group of prostate cancer in prostate biopsy.

ISUP grade group	Sensitivity	Specificity	PPV	NPV
GG1 ($n = 7$)	100% (1/1)	100% (6/6)	100% (1/1)	100% (6/6)
GG2 ($n = 98$)	33.3% (2/6)	94.5% (87/92)	28.6% (2/7)	95.6% (87/91)
GG3 ($n = 91$)	62.5% (5/8)	95.2% (79/83)	55.6% (5/9)	96.3% (79/82)

TABLE 3 | Patient characteristics of PLND-RP and RP-only groups before and after propensity score matching.

	Before propensity score matching			After propensity score matching		
Parameters	**RP-only ($n = 101$)**	**PLND-RP ($n = 152$)**	***p*-value**	**RP-only ($n = 70$)**	**PLND-RP ($n = 70$)**	***p*-value**
Age, median (IQR)	62.7 (57.0–66.9)	65.4 (59.5–70.0)	0.005*	63.7 (57.1–68.3)	64.5 (58.6–68.5)	0.574
PSA, median (IQR)	5.7 (4.2–7.5)	7.3 (5.2–10.1)	0.001*	5.9 (4.7–7.9)	7.1 (5.2–9.9)	0.072
PSAD, median (IQR)	0.14 (0.11–0.18)	0.17 (0.11–0.27)	0.004*	0.14 (0.12–0.18)	0.18 (0.10–0.28)	0.074
PIRADS score						
• PIRADS ≤ 3	13 (13.4%)	23 (16.8%)	0.011*	12 (17.1%)	12 (17.1%)	0.982
• PIRADS 4	62 (63.9%)	61 (44.5%)		36 (51.4%)	37 (52.9%)	
• PIRADS 5	22 (22.7%)	53 (38.7%)		22 (31.4%)	21 (30.0%)	
Biopsy GS						
• GG1	2 (2%)	6 (3.9%)	< 0.001*	2 (2.9%)	3 (4.3%)	0.901
• GG2	90 (89.1%)	80 (52.6%)		59 (84.3%)	58 (82.9%)	
• GG3	9 (8.9%)	66 (43.4%)		9 (12.9%)	9 (12.9%)	
Clinical T stage						
• cT1c	75 (74.3%)	95 (62.5%)	0.051	52 (74.3%)	52 (74.3%)	1.000
• cT2a or cT2b	26 (25.7%)	57 (37.5%)		18 (25.75)	18 (25.75)	
GS at RP						
• GG1	2 (2.0%)	5 (3.3%)	< 0.001*	2 (2.9%)	3 (4.3%)	0.254
• GG2	86 (85.1%)	89 (58.6%)		59 (84.3%)	52 (74.3%)	
• GG3	13 (12.9%)	45 (29.6%)		9 (12.9%)	12 (17.1%)	
• GG4	0 (0%)	3 (2.0%)		0 (0%)	0 (0%)	
• GG5	0 (0%)	10 (6.6%)		0 (0%)	3 (4.3%)	
pT stage at RP						
• pT2a-b-c	59 (58.4%)	72 (47.4%)	0.226	33 (47.1%)	35 (50%)	0.756
• pT3a	36 (35.6%)	69 (45.4%)		32 (45.7%)	32 (45.7%)	
• pT3b	6 (5.9%)	11 (7.2%)		5 (7.1%)	3 (4.3%)	
pN status						
• pN0	0 (0%)	147 (96.7%)	NA	0 (0%)	68 (97.1%)	NA
• pN1	0 (0%)	5 (3.3%)		0 (0%)	2 (2.9%)	
• pNx	101 (100%)	0 (0%)		70 (100%)	0 (0%)	
Positive surgical margin						
• No	73 (72.3%)	91 (59.9%)	0.045*	49 (70%)	43 (61.4%)	0.373
• Yes	28 (27.7%)	61 (40.1%)		21 (30%)	27 (38.6%)	

Abbreviations: GG, grade group; GS, Gleason score; IQR, interquartile range; NA, not applicable; PIRADS, prostate imaging-reporting and data system; PLND, pelvic lymph node dissection; PSA, prostate-specific antigen density; RP, radical prostatectomy.

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

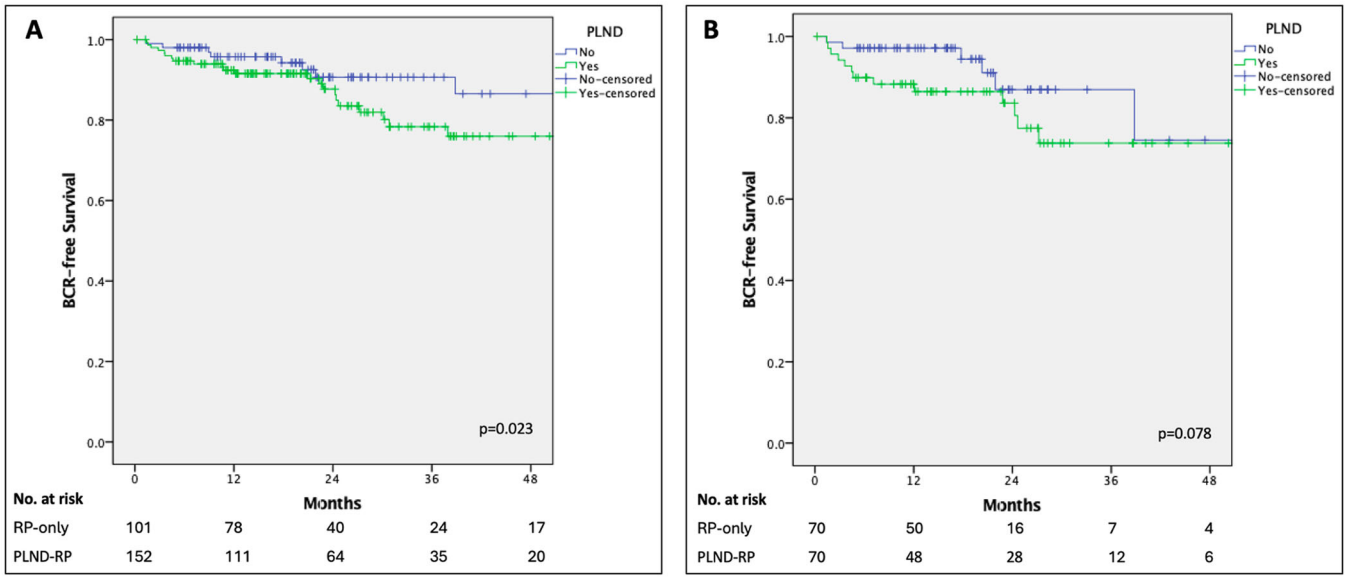


FIGURE 2 | Kaplan-Meier curves comparing the biochemical recurrence-free survival of patients who underwent PLND and those who did not undergo PLND before (A) and after (B) propensity score matching.

(Figure 2A). During follow-up, a total of 4 patients (1.6%) died, all due to non-cancer-related causes. Overall, OS rates of PLND-RP and RP-only groups were similar between groups (24 months OS rates; 98.9% in RP-only group, 98.8% in PLND-RP group, $p = 0.422$).

To test whether the differences in oncological outcomes were due to selection bias, we next undertook a propensity score-matched analysis and all baseline characteristics were similar between groups after propensity score matching (Table 3). The median follow-up time after propensity score matching was 20.7 months (IQR: 12.3 – 29.4). The 12 and 24-month BCR-free survival rates were 88.3% and 83.7% in the PLND-RP group and 97.1% and 86.9% in RP-only group (Figure 2B, $p = 0.078$). During follow-up, only one patient in the PLND-RP group died 62.1 months after RP due to non-cancer-related causes, rendering OS rates of PLND-RP and RP-only groups similar ($p = 0.173$).

4 | Discussion

The outcomes of this study are remarkable for several reasons. First, studies investigating the performance of PSMA PET for nodal staging of intermediate-risk PCa specifically are limited in the literature. All prospective studies using ePLND as the reference standard included patients with high-risk disease or a mixed cohort with intermediate and high-risk disease [7]. A previous meta-analysis including 27 studies and 2832 patients concluded that the sensitivity, specificity, PPV, and NPV of PSMA PET for nodal staging were 58% (95% confidence interval [CI]: 50–66%), 95% (95% CI 93–97%), 79% (95% CI 72–85%), and 87% (95% CI 84–89%) [6]. Herein, it is important to note that 26 out of 27 studies included patients with either high-risk or mixed (intermediate and high-risk) risk group disease. Recently, sensitivities of as low as 25% were reported despite decent NPV and specificities, which is an important issue that should be investigated in further studies [12]. To date, only a few retrospective studies with a limited number of patients ($n = 39$ and 88) explored the performance of PSMA PET on nodal staging in patients with purely intermediate-risk disease with sensitivities of 20% and 50%., NPV being 89% and 99% [13, 14]. These inconsistent results and the lack of available data indicate the obvious need for further data on patients with intermediate-risk diseases. In this study, the performance of centrally reviewed PSMA PET for nodal staging was tested in 196 patients with intermediate-risk disease who underwent ePLND. The median number of LNs removed during ePLND was 17, which is in line with the previous series [6]. Overall, LNI was detected in 15 patients (7.7%). Being comparable with the previous series that included patients with intermediate-risk disease only [15, 16]. PSMA PET/CT detected 8 out of 15 patients with LNI. Performing ePLND in 179 patients with miN0 disease revealed LNI in only 7 patients (3.9%) translating to an NPV of 96.1% for PSMA PET/CT. Besides, the NPV of subgroups of GG2 or GG3 disease at prostate biopsy remained equally high (95.6% and 96.3%, respectively). The number of ePLND procedures needed to be performed to detect one patient with LNI was 25 making a time-consuming procedure associated with increased risk of complications as well as the consequent economic burden more questionable. Most studies investigating the efficacy and toxicity of whole pelvic radiotherapy (WPRT) versus prostate-only radiotherapy (PORT) were performed before the introduction of PSMA PET into clinical practice [17]. The WPRT is associated with an increased risk of grade ≥ 2 acute and late gastrointestinal and genitourinary toxicity [17]. Therefore, the added value of WPRT over PORT also needs to be challenged in the era of superior imaging modalities.

Our current knowledge regarding the effect of ePLND on oncological outcomes also needs to be challenged in the era of superior imaging modalities. A meta-analysis including 66 studies and 275,269 patients evaluated the benefits and harms of PLND in patients with PCa and found no direct benefit of PLND on oncological outcomes. In 16 out of 18 studies

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

evaluating BCR, no statistically significant difference was observed in BCR rates between those who did and did not undergo PLND. In the remaining two studies, patients who underwent PLND had worse BCR-free survival [18, 19]. Two randomized controlled trials comparing the oncological outcomes in patients who underwent limited vs ePLND failed to show any oncological benefit in favor of ePLND [20, 21]. A prior multicenter study involving 9,742 patients with intermediate or high-risk PCa found no significant difference in oncological outcomes between those who did and did not undergo PLND during RP [22]. However, all of the abovementioned studies did not focus on intermediate-risk disease specifically and have not used PSMA PET for nodal staging. Our results represent the initial data regarding the effect of ePLND on oncological outcomes in patients with intermediate-risk disease who were node-negative according to PSMA PET/CT.

In our study, the initial analysis before propensity score matching revealed lower BCR-free survival in patients who underwent PLND similar to two abovementioned retrospective studies by Boehm et al and Liss et al [18, 19]. Although these results seem confusing, this is the reflection of the baseline characteristics selected for PLND and no PLND groups. Patients who underwent ePLND had higher age, serum PSA, PSAD, a higher rate of PIRADS-5 lesions on mpMRI, and higher rates of GG3 disease at prostate biopsy in the analysis before propensity score matching. Propensity score matching eliminated this selection bias and achieved well-balanced groups for both PLND-RP and RP-only groups. Therefore, after propensity score matching revealed no statistically significant difference between PLND-RP and RP-only groups regarding the BCR-free survival rates. BCR-free survival rates at 24 months were 83.7% and 86.9% in PLND-RP and RP-only groups indicating ePLND does not have any impact on early oncological outcomes in patients with intermediate-risk PCa.

This study has several limitations. Initially, this is a retrospective study with its inherent shortcomings. Secondly, the modest median follow-up times of 22.8 and 20.7 months for the analyses before and after propensity score matching must be acknowledged as a limitation as they only provide data for short-term oncological outcomes. This duration is insufficient for further analysis of distant metastasis-free survival rates or cancer-specific mortality rates. The sample size and the number of events are limited. Finally, the prostate biopsies performed at other centers were not centrally reviewed at our center explaining significant rates of downgrading and upgrading from prostate biopsy to RP. However, the use of prostate biopsies from various centers may be better representing a real-life experience for this group of patients. The central review of PSMA PET scans performed in other referral centers and well-balanced groups for those who did and did not undergo PLND in the analysis can be marked as the strengths of our study.

In conclusion, PSMA PET/CT achieves remarkable NPV for nodal staging of patients with intermediate-risk prostate cancer. The additional benefit of ePLND on staging and prognostic data in PSMA PET/CT primary staged intermediate-risk patients seems to be very limited. ePLND was found to have no impact on early oncological outcomes. ePLND might be omitted to decrease surgery-related complications in patients with intermediate-risk PCa and a negative PSMA PET/CT for nodal staging if further data from prospective studies support these findings.

Acknowledgments

B. E. is supported by European Urological Scholarship Programme through a 1-year research scholarship.

Ethics Statement

All reported investigations were conducted in accordance with the principles of the Declaration of Helsinki. The study was approved by local ethics committee.

Conflicts of Interest

Abdullah Erdem Canda reports speaker honoraria for CONMED Corporation, congress expenses were covered by CORDAMED Biomedical Engineering.

Data Availability Statement

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

References

1. T. Esen, M. Kılıç, H. Seymen, Ö. Acar, and M. O. Demirkol, "Can Ga-68 PSMA PET/CT Replace Conventional Imaging Modalities for Primary Lymph Node and Bone Staging of Prostate Cancer?," *European Urology Focus* 6, no. 2 (2020): 218–220.

2. M. Musch, V. Klevecka, U. Roggenbuck, and D. Kroepfl, "Complications of Pelvic Lymphadenectomy in 1,380 Patients Undergoing Radical Retropubic Prostatectomy Between 1993 and 2006," *Journal of Urology* 179, no. 3 (2008): 923–929.

3. A. Clinckaert, K. Callens, A. Cooreman, et al., "The Prevalence of Lower Limb and Genital Lymphedema After Prostate Cancer Treatment: A Systematic Review," *Cancers* 14, no. 22 (2022): 5667.

4. A. Briganti, A. Larcher, F. Abdollah, et al., "Updated Nomogram Predicting Lymph Node Invasion in Patients With Prostate Cancer Undergoing Extended Pelvic Lymph Node Dissection: The Essential Importance of Percentage of Positive Cores," *European Urology* 61, no. 3 (2012): 480–487.

5. G. Gandaglia, G. Ploussard, M. Valerio, et al., "A Novel Nomogram to Identify Candidates for Extended Pelvic Lymph Node Dissection Among Patients With Clinically Localized Prostate Cancer Diagnosed With Magnetic Resonance Imaging-Targeted and Systematic Biopsies," *European Urology* 75, no. 3 (2019): 506–514.

6. A. Stabile, A. Pellegrino, E. Mazzone, et al., "Can Negative Prostate-Specific Membrane Antigen Positron Emission Tomography/Computed Tomography Avoid the Need for Pelvic Lymph Node Dissection in Newly Diagnosed Prostate Cancer Patients? A Systematic Review and Meta-Analysis With Backup Histology as Reference Standard," *European urology oncology* 5, no. 1 (2022): 1–17.

7. T. Esen, B. Esen, K. Yamaoh, U. Selek, and D. Tilki, "De-Escalation of Therapy for Prostate Cancer," *American Society of Clinical Oncology Educational Book* 44, no. 2 (2024): e430466.

8. A. Mattei, F. G. Fuechsel, N. Bhatta Dhar, et al., "The Template of the Primary Lymphatic Landing Sites of the Prostate Should be Revisited: Results of a Multimodality Mapping Study," *European Urology* 53, no. 1 (2008): 118–125.

9. M. S. Hofman, N. Lawrentschuk, R. J. Francis, et al., "Prostate-Specific Membrane Antigen PET-CT in Patients With High-Risk

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Prostate Cancer Before Curative-Intent Surgery or Radiotherapy (Propsma): A Prospective, Randomised, Multicentre Study,"*Lancet* 395, no. 10231 (2020): 1208–1216.

10. P. Cornford DT, R. C. N. van den Bergh, E. Briers, et al. EAU - EANM - ESTRO - ESUR - ISUP - SIOG Guidelines on Prostate Cancer. 2024, https://uroweb.org/guidelines/prostate-cancer.

11. M. Eiber, K. Herrmann, J. Calais, et al., "Prostate Cancer Molecular Imaging Standardized Evaluation (PROMISE): Proposed miTNM Classification for the Interpretation of PSMA-Ligand PET/CT," *Journal of Nuclear Medicine* 59, no. 3 (2018): 469–478.

12. G. Spena, T. B. Moretti, F. S. Dávila, et al., "Ga68-PSMA PET for Lymph Node Staging in Intermediate and High-Risk Prostate Cancer Patients Undergoing Robotic Assisted Radical Prostatectomy," *Minerva Urology and Nephrology* 76, no. 4 (2024): 467–473.

13. D. Kopp, J. Kopp, E. Bernhardt, et al., "68Ga-Prostate-Specific Membrane Antigen Positron Emission Tomography-Computed Tomography-Based Primary Staging and Histological Correlation After Extended Pelvic Lymph Node Dissection in Intermediate-Risk Prostate Cancer," *Urologia Internationalis* 106, no. 1 (2022): 56–62.

14. S. Dekalo, J. Kuten, J. Campbell, et al., "(68)Ga-Prostate-Specific Membrane Antigen Positron Emission Tomography/Computed Tomography for Patients With Favorable Intermediate-Risk Prostate Cancer," *Canadian Urological Association Journal* 16, no. 7 (2022): E381–E385.

15. B. Lodeta, H. Baric, D. Hatz, D. Jozipovic, and H. Augustin, "Benefit and Harm of Lymphadenectomy in Intermediate Risk Prostate Cancer: Comparison of Five Nomograms," *BMC Urology* 23, no. 1 (2023): 190.

16. M. Wenzel, F. Preisser, B. Hoeh, et al., "Influence of Biopsy Gleason Score on the Risk of Lymph Node Invasion in Patients With Intermediate-Risk Prostate Cancer Undergoing Radical Prostatectomy," *Frontiers in Surgery* 8 (2021): 759070.

17. S. Wang, W. Tang, H. Luo, F. Jin, and Y. Wang, "Efficacy and Toxicity of Whole Pelvic Radiotherapy Versus Prostate-Only Radiotherapy in Localized Prostate Cancer: A Systematic Review and Meta-Analysis," *Frontiers in Oncology* 11 (2021): 796907.

18. K. Boehm, B. Beyer, P. Tennstedt, et al., "No Impact of Blood Transfusion on Oncological Outcome after Radical Prostatectomy in Patients With Prostate Cancer," *World Journal of Urology* 33, no. 6 (2015): 801–806.

19. M. A. Liss, K. Palazzi, S. P. Stroup, R. Jabaji, O. A. Raheem, and C. J. Kane, "Outcomes and Complications of Pelvic Lymph Node Dissection During Robotic-Assisted Radical Prostatectomy," *World Journal of Urology* 31, no. 3 (2013): 481–488.

20. J. F. P. Lestingi, G. B. Guglielmetti, Q. D. Trinh, et al., "Extended Versus Limited Pelvic Lymph Node Dissection During Radical Prostatectomy for Intermediate- and High-Risk Prostate Cancer: Early Oncological Outcomes From a Randomized Phase 3 Trial," *European Urology* 79, no. 5 (2021): 595–604.

21. K. A. Touijer, D. D. Sjoberg, N. Benfante, et al., "Limited Versus Extended Pelvic Lymph Node Dissection for Prostate Cancer: A Randomized Clinical Trial," *European Urology Oncology* 4, no. 4 (2021): 532–539.

22. F. Preisser, R. C. N. van den Bergh, G. Gandaglia, et al., "Effect of Extended Pelvic Lymph Node Dissection on Oncologic Outcomes in Patients With D'amico Intermediate and High Risk Prostate Cancer Treated With Radical Prostatectomy: A Multi-Institutional Study," *Journal of Urology* 203, no. 2 (2020): 338–343.

Supporting Information

Additional supporting information can be found online in the Supporting Information section.

10970045, 2025, 8, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/pros.24884 by Koc University, Wiley Online Library on [21/08/2025]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License