Urologia Internationalis

Research Article

Urol Int 2024;108:175–182
DOI: 10.1159/000536317

Received: October 18, 2023
Accepted: January 3, 2024
Published online: February 5, 2024

How Might the Number of Lymph Nodes Removed during RARP Impact the Postoperative Outcomes?

Mahmoud Farzat[a, b] Florian M. Wagenlehner[b]

[a]Department of Urology and Robotic Urology, Diakonie Klinikum Siegen, Siegen, Germany; [b]Department of Urology, Pediatric Urology and Andrology, Justus-Liebig University of Giessen, Giessen, Germany

Keywords

Prostate cancer · Robot-assisted radical prostatectomy · Prostatectomy · Lymphocele

Abstract

Introduction: Symptomatic lymphocele remains a relevant complication after pelvic tumor surgery. This study aims to investigate how the number of lymph nodes removed may influence postoperative outcomes and if it increases the probability of detecting lymph node metastasis. ***Methods:*** The study included 500 patients who underwent RARP including lymphadenectomy performed by a single surgeon. Patients were divided into two groups: group 1 consisted of 308 patients with 20 or fewer lymph nodes removed (mean 15), while group 2 had 192 patients with over 20 nodes removed (mean 27). Perioperative data were analyzed, and postoperative outcomes were compared between groups. ***Results:*** Overall, lymph node metastasis was detected in 17.8% of men. In detail, out of 19.6 lymph nodes removed, an average of 3.14 lymph nodes per patient showed metastasis, with a slightly higher incidence of 19.7% in group 2 compared to 16.5% in group 1, though not statistically significant ($p = 0.175$). The number of lymph node metastases was significantly higher in group 2 patients (3.47) versus group 1 (2.37) ($p = 0.048$). All complications except symptomatic lymphoceles ($p = 0.004$) were not significantly different between groups. Univariate linear regression analysis revealed no correlation between the number of removed lymph nodes and symptomatic lymphocele. However, it did correlate with catheter days and readmissions. ***Conclusion:*** A correlation may exist between the number of lymph nodes removed during RARP and an increased incidence of complications, particularly symptomatic lymphocele. A more extensive PLND may result in prolonged catheter days and increased readmissions. With the increased extent of pelvic lymphadenectomy, the probability of detecting lymphogenic metastasis rises. The diagnostic value of PLND is well established. Further randomized trials are needed to weigh its necessity and extent.

Introduction

Symptomatic lymphocele remains a relevant complication after pelvic tumor surgery. It also impacts postoperative recovery and additional surgical intervention [1]. In the majority of intermediate- and high-risk prostate cancer patients, the removal of pelvic lymph nodes for diagnostic and therapeutic purposes is standard of care [2]. The extension of their removal is surgeon's and institute related, and it depends on the tumor stage

karger@karger.com
www.karger.com/uin

Correspondence to:
Mahmoud Farzat, mahmoud.farzat@diakonie-sw.de

and grade. The technique is also surgeon's dependent. Furthermore, pelvic lymphadenectomy (PLND) is the most exact method to detect the lymphogenic spread of prostate cancer [2]. The rate of positive lymph node metastases increases depending on the extent of dissection during RARP [3]. Interestingly, extended PLND-related complications were found to be higher in patients with lymph node invasion (8.9 vs. 12.9%) [4]. Several attempts were suggested to prevent the development of symptomatic lymphoceles [1, 5]. Stolzenburg et al. [1] performed a 4-point fixation of a peritoneal flap to the anterior and posterior side walls of the pelvis to prevent the formation of lymphocele and found it to be effective regarding overall lymphocele (p = 0.005) and symptomatic lymphoceles (p = 0.032). Lee and associates used another similar technique and found symptomatic lymphocele to be reduced from 6% to 0% in their cohort [5]. In order to prevent unnecessary overtreatment in terms of PLND in robot-assisted radical prostatectomy (RARP), various nomograms were developed and utilized to find out which patients will profit from PLND [4]. Although all common nomograms can predict lymphogenic invasion (LNi) acceptably in patients undergoing multiparametric prostate MRI-guided biopsy, only MSKCC and Briganti 2012 nomograms were superior in the prediction of LNi in patients undergoing systematic biopsy [4]. This study aimed to explore the relationship between the number of lymph nodes removed as well as the extent of PLND and the incidence of symptomatic lymphocele and its related complications in a single-center single-surgeon cohort of 500 patients without any exclusion criteria.

Materials and Methods

All procedures (n = 500) were completed transperitoneally with the Da Vinci X® Surgical Systems (Intuitive Surgical, Sunnyvale, CA, USA). Extended pelvic lymphadenectomy [6] according to our institution's standard template was performed on all patients. It usually follows the ablative part of the prostatectomy and is done before starting with the vesicourethral anastomosis (VUA). It included the external iliac vessels, partially internal iliac vessels, fossa obturatoria, and lymph nodes in the inner inguinal region lateral to the inferior epigastric vessels. Before beginning with PLND, the ureters on both sides are identified to prevent iatrogenic injury. Lymphatic vessels are ligated using clips or bipolar coagulation. Lymph nodes are then marked and brought into an endobag. No intra-abdominal drainage was introduced. The VUA was done in a one-layer fashion with a continuous circumferential double-armed barbed suture. All patients received a transurethral catheter and a suprapubic catheter (SPC). While the transurethral catheter was removed on the first postoperative day (POD1), the suprapubic catheter was removed when the micturition's trial was successful and uneventful. All patients received an ultrasound examination the day after surgery and before leaving the hospital. In case of macrohematuria or when the first ultrasound examination was suspicious like the presence of dilatation of the upper urinary tract, lymphocele, or urinary leakage, the examination was repeated daily until discharge. We repeated ultrasound examination and laboratory controls after discharge only in patients with apprehensive findings. When the suspicious findings were resolved, the follow-up was terminated. When an intervention was required, the follow-up continued until treatment was concluded. Nonetheless, patients with symptomatic lymphoceles usually returned 1–2 months after discharge. We reported our results within 90 days after RARP through a reflexive follow-up, in which referring urologists and treating physicians reported postoperative outcomes of our shared patients and referred those with probable complications back for further diagnosis and treatment.

The analysis included 500 patients who underwent RARP between April 2019 and August 2022 by an expert surgeon. In our practice, all patients receive PLND to reduce the uncertainty that might be encountered in the preoperative diagnostic workup done by diverse referring urologists. As per the EAU guidelines, lymphadenectomy should be performed only when the probability of lymph node metastases is more than 5% [2]. When performing it, it should be extended. We informed all our patients about the need for an extended lymphadenectomy before the surgery and discussed its benefits and associated risks. However, the number of lymph nodes detected by pathologists varied from patient to patient, even though the surgical field of resection was the identical template in all patients.

In the literature, the common number of lymph nodes removed during RARP is between 10 and 20 [7]. We divided patients, regarding the number of lymph nodes in the final histological report, into two groups. Group 1: 20 LN or less (n = 308, 61.6%). Group 2: more than 20 LN (n = 192, 38.4%). Considering 20 LN to be some sort of threshold for possibly extended PLND [8], demographic, intraoperative, and postoperative data were analyzed and compared. Variables included were age, international prostate symptom score (IPSS), international index of sexual function (IIEF), initial PSA, pre- and postoperative Gleason score, prostate volume in transrectal ultrasound (TRUS), American Association of Anesthesiology Morbidity Score (ASA), pre- and postoperative hemoglobin (Hgb), previous medical and surgical treatment of the prostate, and D'Amico risk classification. Postoperative complications were graded by Clavien-Dindo classification [9]. Symptomatic lymphocele requiring an intervention was considered the primary endpoint of the study. Further major complications were considered the secondary endpoint. Univariate logistic regression models were used to investigate the association between removed LN and diverse perioperative outcomes.

Statistical analysis was performed using SPSS® v27. Categorical variables were summarized as frequencies (percentage) and continuous variables as mean ± standard deviation and median values. The Kolmogorov-Smirnov one-sample test was used to verify normal distribution. Match pair analysis using independent T test for parametric numeric variables and Mann-Whitney U-test for nonparametric variables was performed. Pearson χ^2 was also used to compare relative frequencies. Univariable logistic regression and linear regression models were used in the analysis.

Table 1. Analysis of demographic, baseline clinical, and preoperative characteristics

	Total cohort (500)	20 or under, *n* = 308, 61.6%	Above 20 LN, *n* = 192, 38.4%	*p* value
Age, years				
Mean±SD	66.8±7.1	67±6.4	66±8	0.240
Median	68	69	67	
BMI, kg/m^2				
Mean±SD	28.4±4.3	28.2±4.2	28.8±4.5	0.288
Median	28	28	28	
ASA-score				
1	99 (19.8)	64 (20.7)	32 (16.6)	0.844
2	317 (63.4)	182 (59)	132 (68.7)	
3	84 (16.8)	58 (18.8)	26 (13.5)	
Preoperative HGB, g/dL				
Mean±SD	14.7±1.18	14.6±1.3	14.7±1.3	0.161
Median	14.8	14.8	14.9	
IPSS				
Mean± SD	11.4±8.3	11±8	12±8	0.163
Median	8.3	10	11	
IIEF				
Mean±SD	15.2±8.7	15±8.7	15±8.7	0.956
Median	17	17	16	
Initial PSA, ng/mL				
Mean±SD	14.8±24.5	14.2±25	15.8±22	0.681
Median	8	7.7	8.8	
Prostate-volume, mL				
Mean±SD	49±28	48±28	51±29	0.875
Median	43	43	45	
D'Amico risk classification				
Low risk	117 (23.4)	80 (25.9)	37 (19.2)	0.013
Intermediate risk	229 (45.8)	145 (47)	84 (43.7)	
High risk	154 (30.8)	83 (26.9)	71 (36.9)	
Preoperative Gleason score				
5	1 (0.2)	1 (0.3)	0	0.962
6	140 (28)	91 (29.5)	49 (25.5)	
3+4	176 (35.2)	107 (34.7)	69 (35.9)	
4+3	59 (11.8)	40 (12.9)	19 (9.8)	
8	82 (16.4)	46 (14.9)	46 (23.9)	
9	36 (7.2)	20 86.4)	20 (10.4)	
10	5 (1.0)	2 (0.6)	3 (1.5)	
Unclassified	1 (0.2)	1 (0.3)	0	
NHT	55 (11)	31 (10)	24 (12.5)	0.390
Previous TUR-P	34 (6.8)	22 (7.1)	12 (6.2)	0.700
Nerve sparing				
Bilateral	374 (69.4)	221 (71.7)	126 (65.6)	0.032
Unilateral	19 (3.8)	14 (4.5)	5 (2.6)	
No	134 (26.8)	73 (23.7)	61 (31.7)	

Categorical data are presented as numbers (%). SD, standard deviation; BMI, body mass index; ASA, American association of Anesthesiology Morbidity Score; Hgb, hemoglobin; IPSS; international prostate symptom score; IIEF, international index of erectile function; PSA, prostate specific antigen; NHT, neo-adjuvant hormonal therapy; TUR-P, transurethral resection of the prostate.

Results

Baseline Parameters

Patients were 1 year older in group 2. Nonetheless, groups were similar regarding ASA, IPSS, and IIEF scores. More high-risk patients, according to D'Amico risk classification, were found in group 2 than in group 1 (36.9% vs. 26.9%). Other cancer parameters like initial PSA and Gleason score were similarly distributed among groups. The nerve-sparing technique was performed more often in group 1 (p = 0.032). Details are in Table 1.

Intraoperative Data

The median number of lymph nodes removed was 15 in group 1 versus 26 in group 2. Despite a trend for higher incidence of positive lymph nodes among group 2 (19.7% in group 2 vs. 16.5% in group 1), statistical analysis didn't confirm significance (p = 0.175). The median console time was 2 min longer in group 2 without statistical difference (p = 0.823). Tumor stage and Gleason score distribution were also similar among the groups. The median hospital stay was equal in both groups (5 days), while catheter days were 1 day longer in patients with more than 20 LN removed (4 vs. 5 days in groups 1 and 2, respectively, p = 0.027). 78% of men in group 1 left the hospital catheter-free, whereas only 66.6% of them left the hospital without a catheter in group 2 (p = 0.006). All other intraoperative parameters were comparable among groups. Further details are in Table 2.

Complications and Readmissions

In total (n = 21/500), 4.2% men experienced complications requiring interventions after RARP. In detail, n = 11/308, 3.6% in group 1 versus n = 10/192, 5.2% in group 2 without significant statistical difference (p = 0.786). Regarding lymphoceles, statistical analysis confirmed that patients with more than 20 lymph nodes removed are at elevated risk to develop symptomatic lymphoceles (p = 0.004). In detail, overall 10 men (n = 4/308), 1.3% in group 1 and (n = 6/192) 3.1% in group 2 developed symptomatic lymphocele, which was treated via percutaneous drainage in local anesthesia. Minor complications were equally distributed among groups without statistical difference (p = 0.914). The most common minor complications were acute urinary retention (n = 28/500, 5.6%) followed by vesicourethral anastomosis insufficiency and urinary tract infections with equal incidence (n = 11/500, 2.2%). In our series, 3 patients suffered from upper urinary tract obstruction (UUTO), which necessitated the insertion of a DJ catheter. n = 28/500 patients had to be readmitted due to one or more complications within 90 days after RARP, with an equal distribution among both study groups (p = 0.764). Details are given in Table 3.

A univariate regression analysis to determine the relation between the number of lymph nodes removed and relevant postoperative outcomes resulted in a correlation between the number of lymph nodes removed and suprapubic catheter days (p = 0.041) as well as readmissions (p = 0.037). Conversely, no minor or major complications, hospital stay, symptomatic lymphoceles, or console time were correlated with the number of lymph nodes removed. Further details are in Table 4.

Another univariate regression analysis was performed to determine if lymphogenic invasion may impact other intra- and postoperative outcomes. None of the investigated parameters like complications, hospital, or catheter days correlated with lymphogenic invasion.

Discussion

The main result of our study is that patients with more than 20 lymph nodes removed during robot-assisted radical prostatectomy due to prostate cancer compared to those with less than 20 removed, have a higher probability of developing symptomatic lymphocele. Even though the incidence of symptomatic lymphocele in our cohort is low (n = 10/500, 2%) which is in the range of others [1, 3], a statistical difference with a higher incidence in group 2 was observed (p = 0.004). Despite the small sample size, the rate of symptomatic lymphoceles was significantly higher in group 2 (n = 6/192, 3.1%) compared to group 1 (n = 4/308, 1.2%). This specific complication, despite being managed in all cases in local anesthesia with percutaneous drainage, is considered a major adverse event and could have led to vital consequences like pulmonary embolism.

Our study confirms a commonly held belief that removing more lymph nodes during RARP increases the likelihood of developing lymphocele. This finding adds to the existing body of literature supporting this theory. It helps in educating patients about the necessity and potential risks of performing PLND, especially in cases when it is not strictly necessary. While others found higher BMI and prolonged surgical time in multicenter settings as an independent risk factor for both lymphocele and symptomatic lymphoceles [10], we could not find this association in our single surgeon experience as median BMI 28 kg/m^2 and console time were only 2 min longer in group 2 patients (median 140 vs. 142 min, p = 0.823).

Table 2. Intra- and postoperative data and pathological findings

	Total (500)	20 or under, n = 308, 61.6%	Above 20 LN, n = 192, 38.4%	p value
Console time				
Mean±SD	151±45	149±47	153±42	0.823
Median	140	140	142	
Prostate weight, g				
Mean±SD	61±25.6	60±23	64±28	0.531
Median	55	55	58	
Pathological stage				
0	1 (0.2)	0	1 (0.5)	0.633
pT1	1 (0.2)	1 (0.3)	0	
pT2	295 (59)	189 (61.3)	106 (55.2)	
pT3	183 (36.6)	109 (35.3)	74 (38.5)	
pT4	20 (4.0)	9 (2.9)	11 (5.7)	
Postoperative Gleason score				
6	28 (5.6)	20 (6.4)	8 (4.1)	0.288
3+4	282 (56.4)	181 (58.7)	101 (52.6)	
4+3	89 (17.8)	55 (17.8)	55 (28.6)	
8	26 (5.2)	12 (3.8)	12 (6.2)	
9	29 (5.8)	15 (4.8)	15 (7.8)	
10	1 (0.2)	1 (0.3)	1 (0.5)	
Unclassified*	45 (9.0)	24 (7.7)	21 (10.9)	
Positive surgical margins	36 (7.2)	24 (7.7)	12 (6.2)	0.517
Lymph nodes, n				
Mean±SD	19.6±7.4	15±3.6	27±5.6	<0.001
Median	18	15	26	
Lymph nodes metastasis	89 (17.8)	51 (16.5)	38 (19.7)	0.175
Positive lymph node per patient, n	3.14	2.37	3.47	0.048
Detailed number of positive LN				
0–2	49	29	20	0.219
2–5	31	18	13	
>5	9	3	5	
Hgb-difference, g/dL				
Mean±SD	2.5±4.8	2.7±1.3	2.7±1.3	0.523
Median	2.6	2.6	2.6	
Transfusion	7 (1.2)	4 (1.2)	3 (1.5)	0.807
Hospitalization, days				
Mean±SD	5.6±1.5	5.6±1.2	5.6±2	0.264
Median	5	5	5	
Catheter days				
Mean±SD	6.9±4.7	6.6±4.4	7.4±5.1	0.027
Median	5	4	5	
Catheter removed before discharge	368 (73.6)	240 (77.9)	128 (66.6)	0.006

Categorical data are presented as numbers (%). SD, standard deviation; Hgb, hemoglobin. *Patients who received hormonal therapy preoperatively.

Table 3. 30-day complications and readmissions

Complications in detail		Total (n = 500)	20 or under, n = 308, 61.6%	Above 20, n = 192 38.4%	p value
Minor		74 (14.8)	46 (14.9)	28 (14.5)	0.914
CDI 51 (10.2)	VTE	4 (0.8)	3 (0.9)	1 (0.5)	
	Elevated blood analysis parameters	6 (1.2)	5 (1.6)	1 (0.5)	
	AUR	28 (5.6)	15 (4.8)	13 (6.7)	
	Diverse	13 (2.6)	10 (3.2)	3 (1.5)	
CD II 23 (4.6)	Secondary VUAL*	11 (2.2)	7 (2.2)	4 (2)	
	UTI	11 (2.2)	6 (1.9)	5 (2.6)	
	Hematoma requiring transfusion	1 (0.2)	1 (0.3)	0	
Major		21 (4.2)	11 (3.6)	10 (5.2)	0.786
CD III a 12 (2.4)	Myocardial infarction	1 (0.2)	1 (0.3)	0	
	Hiatus hernia	1 (0.2)	1 (0.3)	0	
	Symptomatic lymphocele	10 (2.0)	4 (1.2)	6 (3.1)	0.004
CD III b 8 (1.6)	Revision	5 (1.0)	4 (1.2)	1 (0.5)	
	UUTO	3 (0.6)	1 (0.3)	2 (1)	
CD VI 1 (0.2)	Rhabdomyolysis	1 (0.2)	0	1 (0.5)	
	Readmissions	28 (5.6)	18 (5.8)	10 (5.2)	0.764

Categorical data are presented as numbers (%). AUR, acute urinary retention; UTI, urinary tract infection; VTE, venous thromboembolism; VUAL, vesicourethral anastomosis leakage; UUTO, upper urinary tract obstruction. *Some patients came to emergency with mixed AUR+VUAL+UTIs; we listed the most serious complaint.

Table 4. Univariate linear regression analysis to determine the relation between the numbers of lymph nodes removed as well as lymph node metastasis and various postoperative outcomes

	Readmission	Minor	Major complications	Catheter days	Hospital stay	Lymphoceles	Console time
LN removed	0.037	0.124	0.583	0.041	0.212	0.540	0.984
LN metastasis	0.948	0.89	0.839	0.126	0.062	0.846	0.436

LN, lymph nodes.

In their meta-analysis, Cacciamani and colleagues [11] stated that the morbidity of PLND in patients undergoing prostatectomy in various surgical modalities significantly correlates with the extent of PLND. Except for symptomatic lymphoceles, our findings show in contrast to Cacciamani et al. [11] that all minor and major complications were equally distributed between groups. Our findings were also confirmed in univariate linear regression analysis. Here also, we found that the extent of PLND expressed by the number of LN removed did not correlate with complications. Furthermore, the analysis didn't demonstrate an association between lymphogenic invasion and the investigated intra- and postoperative parameters.

Additionally, the mean number of lymph nodes removed in our cohort is 18, which is in the higher range of the spectrum of others including all prostatectomy modalities [3, 8, 12]. Briganti et al. [13] reasoned that if a PLND is indicated, then it should be extended, and in low-risk PCa, a staging ePLND might be spared. In our practice, we perform pelvic lymph adenectomy in all patients to prevent the risk of under-staging or undergrading due to the high rate of tumor misclassification from referring centers [14]. We abstained from further discrimination between standard and extended since it did not result in any clinical implications in our cohort, in which all patients received an extended PLND. Liss and associates reported no statistical difference between standard versus extended 18 versus 20 lymph nodes in their cohort ($p = 0.070$) [12].

Only a few of our patients underwent a PSMA-PET-CT scan before their surgery, given the restrictive approval of insurance companies in this indication. As a result, in such cases, pelvic lymph node dissection (PLND) was more precise in removing all potentially malignant lymph nodes. However, we could not report the accuracy of the PSA-PET-CT scan in predicting lymph node metastases before surgery, as it was not within the scope of our study. Therefore, we could not provide information on the number of lymph nodes removed and how many of them were positive in this particular case. Ideally, if all patients had the opportunity to undergo a highly specific diagnostic test before surgery, PLND could be less extensive for a larger percentage of them.

In our study, $n = 89/500$, 17.8% of patients had lymph node invasion with a mean of 3.14 positive lymph nodes per patient with a significant difference between groups (2.37 vs. 3.47) for groups 1 and 2, respectively. The rate of LNi in our cohort is significantly higher than that reported by others [3, 4, 15]. Our findings confirm those of Ploussard et al. [3] who argued that the more lymph nodes dissected, the higher the probability of finding positive lymph nodes. The higher rate of LNi in our study might be explained by the higher proportion of locally advanced cancers (almost 40%) which is significantly higher than those of other cohort studies [4]. Furthermore, Oderda and associates mentioned that ePLND-related complications are higher in patients with pN1 disease patients (8.9 versus 12.9%). Conversely, we could not confirm such a finding in our cohort, as univariate analysis resulted in no correlation between positive lymph node metastases and postoperative complications or readmissions. We did not compare parameters between patients without and those with lymphogenic metastasis, since it was out of the scope of our current study.

Fossati and associates argued in their comprehensive systematic review that the more extensive the PLND, the greater the adverse outcomes in terms of operating time, blood loss, length of stay, and postoperative complications [16]. Others found the dissection of lymph nodes to prolong the procedure [3]; conversely, console time in our cohort was similar between groups (mean 140 vs. 142 min, $p = 0.823$). Also, the change concerning pre- and postoperative hemoglobin values (median 2.6 g/dL) was not different between groups ($p = 0.523$). However, catheter days were 1 day longer in group 2 (median 5 vs. 4 days in group 1, $p = 0.027$). Additionally, 77.9% of men in group 1 left the department catheter-free compared to 66.6% only in group 2. This specific parameter is not usually investigated in the literature as patients usually have shorter hospital stays than men in our study and they moreover have longer catheter days. Additionally, in univariate linear regression analysis, we found the number of LN removed to correlate with readmissions and catheter days. This somehow implicates a relative level of comorbidity caused by PLND.

A strong relation can be suggested between thromboembolic events and the extent of lymphadenectomy [11]. In our study, 4 patients developed deep vein thromboses. Yet none of them had concurrent lymphocele. Nonetheless thromboembolic events are linked to longer OR-time [14], the least mentioned it prolonged by extended lymph adenectomy.

The common number of lymph nodes removed during RARP is between 10 and 20 [7, 8]. Moreover, the number of removed lymph nodes is individual and differs from 1 patient to another. Also, it is influenced by the pathologist and the way the lymph tissues are managed and sorted.

The major limitation of our study lies in its retrospective nature. Furthermore, we did not include any long-term or oncological outcomes like biochemical recurrence or functional outcomes like continence or erectile function. In our country, follow-up is conducted by referring urologists. Patients visit tertiary referral centers like ours only for surgical intervention or in case of emergency. We reported our results through a passive follow-up, in which we requested referring physicians share the functional, oncological, and other postoperative outcomes of our mutual patients. We did not mention asymptomatic lymphoceles because they can be misdiagnosed or falsely interpreted with any other free abdominal fluids postoperatively. Almost 96% of our patients experienced an uneventful postoperative course after RARP. The majority of them were of minor nature and necessitated a small intervention in local anesthesia. Besides lymphocele, it is difficult to distinguish between lymph node dissection-related and not-related postoperative complications. Perioperatively 36.9% of men were D'Amico high risk in group 2 compared to 26.9% in group 1. Postoperative Gleason score, pathological stage, and surgical margins did not differ between groups. This implicates a surgical-related selection bias in that in those specific cases, a more extended lymphadenectomy was carried out resulting in a median number of lymph nodes removed of 26 versus 15 in groups 2 and 1 respectively.

Conclusion

A correlation may exist between the number of lymph nodes removed during RARP and an increased incidence of complications, particularly symptomatic lymphocele. A more extensive PLND may result in prolonged catheter days and increased readmissions. Furthermore, the increased extent of pelvic lymphadenectomy increases the probability of detecting lymphogenic metastasis. Nonetheless, positive lymph node metastasis doesn't result in more complications. Further randomized trials are needed to weigh its necessity and extent.

Statement of Ethics

The study was conducted in accordance with the ethical standards of the Declaration of Helsinki and was approved by the Ethics Committee of the Medical Association Westfalen-Lippe and Wilhelm's University of Münster (protocol number 2022-585-f-S). The need for informed consent was waived by the Medical Association Westfalen-Lippe and Wilhelm's University of Münster.

Conflict of Interest Statement

Both authors declare that they have no conflicts of interest to disclose.

Funding Sources

The authors received no funding for this study.

Author Contributions

Mahmoud Farzat (M.F.) and Florian M. Wagenlehner (F.W.) contributed to conceptualization. M.F. contributed to data curation, formal analysis, visualization, methodology, and writing of the original draft. M.F. and F.W. contributed to project administration and wrote – review and editing. Both authors read and approved the final manuscript and gave informed consent for the publication of this study.

Data Availability Statement

All data generated or analyzed during this study are included in this article. Further inquiries can be directed to the corresponding author.

References

1 Stolzenburg JU, Arthanareeswaran VKA, Dietel A, Franz T, Liatsikos E, Kyriazis I, et al. Four-point peritoneal flap fixation in preventing lymphocele formation following radical prostatectomy. Eur Urol Oncol. 2018;1(5):443–8.
2 Mottet N, van den Bergh RCN, Briers E, Van den Broeck T, Cumberbatch MG, De Santis M, et al. EAU-EANM-ESTRO-ESUR-SIOG guidelines on prostate cancer-2020 update. Part 1: screening, diagnosis, and local treatment with curative intent. Eur Urol. 2021;79(2):243–62.
3 Ploussard G, Briganti A, de la Taille A, Haese A, Heidenreich A, Menon M, et al. Pelvic lymph node dissection during robot-assisted radical prostatectomy: efficacy, limitations, and complications-a systematic review of the literature. Eur Urol. 2014;65(1):7–16.
4 Oderda M, Diamand R, Albisinni S, Calleris G, Carbone A, Falcone M, et al. Indications for and complications of pelvic lymph node dissection in prostate cancer: accuracy of available nomograms for the prediction of lymph node invasion. BJU Int. 2021;127(3):318–25.
5 Lee M, Lee Z, Eun DD. Utilization of a peritoneal interposition flap to prevent symptomatic lymphoceles after robotic radical prostatectomy and bilateral pelvic lymph node dissection. J Endourol. 2020;34(8):821–7.
6 Claps F, de Pablos-Rodríguez P, Gómez-Ferrer Á, Mascarós JM, Marenco J, Collado Serra A, et al. Free-indocyanine green-guided pelvic lymph node dissection during radical prostatectomy. Urol Oncol. 2022;40(11):489.e19–e26.
7 Novara G, Ficarra V, Rosen RC, Artibani W, Costello A, Eastham JA, et al. Systematic review and meta-analysis of perioperative outcomes and complications after robot-assisted radical prostatectomy. Eur Urol. 2012;62(3):431–52.
8 Kim KH, Lim SK, Kim HY, Shin TY, Lee JY, Choi YD, et al. Extended vs standard lymph node dissection in robot-assisted radical prostatectomy for intermediate- or high-risk prostate cancer: a propensity-score-matching analysis. BJU Int. 2013;112(2):216–23.
9 Clavien PA, Barkun J, de Oliveira ML, Vauthey JN, Dindo D, Schulick RD, et al. The Clavien-Dindo classification of surgical complications: five-year experience. Ann Surg. 2009;250(2):187–96.
10 Gloger S, Wagner C, Leyh-Bannurah SR, Siemer S, Arndt M, Stolzenburg JU, et al. High BMI and surgical time are significant predictors of lymphocele after robot-assisted radical prostatectomy. Cancers. 2023;15(9):2611.
11 Cacciamani GE, Maas M, Nassiri N, Ortega D, Gill K, Dell'Oglio P, et al. Impact of pelvic lymph node dissection and its extent on perioperative morbidity in patients undergoing radical prostatectomy for prostate cancer: a comprehensive systematic review and meta-analysis. Eur Urol Oncol. 2021;4(2):134–49.
12 Liss MA, Palazzi K, Stroup SP, Jabaji R, Raheem OA, Kane CJ. Outcomes and complications of pelvic lymph node dissection during robotic-assisted radical prostatectomy. World J Urol. 2013;31(3):481–8.
13 Briganti A, Blute ML, Eastham JH, Graefen M, Heidenreich A, Karnes JR, et al. Pelvic lymph node dissection in prostate cancer. Eur Urol. 2009;55(6):1251–65.
14 Farzat M, Elsherif M, Wagenlehner FM. How may longer console times influence outcomes after robot-assisted radical prostatectomy (RARP)? J Clin Med. 2023;12(12):4022.
15 Yuh B, Wu H, Ruel N, Wilson T. Analysis of regional lymph nodes in periprostatic fat following robot-assisted radical prostatectomy. BJU Int. 2012;109(4):603–7.
16 Fossati N, Willemse PM, Van den Broeck T, van den Bergh RCN, Yuan CY, Briers E, et al. The benefits and harms of different extents of lymph node dissection during radical prostatectomy for prostate cancer: a systematic review. Eur Urol. 2017;72(1):84–109.