







# The effect of peritoneal re-approximation on lymphocele formation in transperitoneal robot-assisted radical prostatectomy and extended pelvic lymphadenectomy

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## ABSTRACT

**Objective:** The objective of the study was to evaluate the effect of peritoneal re-approximation at the end of the procedure in transperitoneal robot-assisted radical prostatectomy (tRARP) and extended pelvic lymphadenectomy (ePLND) on operative, oncologic, and symptomatic lymphocele rates.

**Material and methods:** A total of 79 patients were included in the study who underwent tRARP and bilateral ePLND performed by two different experienced surgeons. One of the surgeons performed the peritoneal re-approximation (Group 1, n=41) and the other did not re-approximate the peritoneum (Group 2, n=38) at the end of the procedure in tRARP and ePLND. Operative parameters and symptomatic lymphocele rates were compared between the groups.

**Results:** There were no significant differences between the preoperative parameters age, body mass index, and preoperative prostate-specific antigen values ( $p>0.05$ ). The perioperative parameters were as follows: the operation time and estimated blood loss (EBL) was less, and the number of removed lymph nodes was higher in Group 2. However, only the difference in the EBL was statistically significant ( $p=0.03$ ). Hospitalization time, symptomatic lymphocele, intervention requiring lymphocele, and complication rates were found to be less in Group 2, but only hospitalization time was statistically significant ( $p=0.04$ ). Pathological parameters were similar for both groups. There was a significant correlation between lymph node positivity and the presence of symptomatic lymphocele in the correlation analysis ( $p=0.05$ ).

**Conclusion:** It has been shown in this study that the re-approximation of the peritoneum does not provide any additional benefit in terms of complications. Considering that this process also increases the operation time and lymphocele formation, we think there is no need for re-approximation after robot-assisted radical prostatectomy and pelvic lymphadenectomy.

**Keywords:** Lymphocele; pelvic lymphadenectomy; prostate; robotics; robot-assisted radical prostatectomy.

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## Introduction

Prostate cancer (PCa) is the second most common cancer in males and accounts for about 15% of all cancer diagnoses.<sup>[1]</sup> Although the prevalence of prostate cancer in autopsy studies is 5% in males under the age of 30 years, this rate increases with aging, and the rate of PCa prevalence is 59% (48%–71%) at the age of >79 years.<sup>[2]</sup> Radical prostatectomy (RP) is applied primarily in low and intermediate-risk localized PCa or is applied as a part of potential multimodal therapy in selected high-risk localized prostate cancers.<sup>[3]</sup>

As urologists have gained more experience with the utilization of robotic surgery, over 80% of the RP cases are done using robotic surgery in the USA.<sup>[4]</sup> Pelvic lymphadenectomy (PLND) is an important staging procedure for the detection of nodal metastases in prostate cancer. PLND is recommended in patients who are at intermediate and high-risk of suffering from prostate cancer.

The general concept is that the extended PLND (ePLND) should be done in the presence of PLND indications, although there are

different conceptions in the form of limited or extended PLND on the basis of the complication and positive lymph node rates of PLNDs.<sup>[5]</sup>

The complication rates of PLND have been reported to be between 2% and 51% in different series. These complications include lymphocele, hematoma, deep vein thrombosis (DVT), pulmonary edema, and urethral and obturator nerve injuries.<sup>[6-8]</sup>

Lymphocele formation is the most common complication of robot-assisted RP (RARP) and PLND in PCa.<sup>[9]</sup> Most of these lymphoceles are asymptomatic and resorbed spontaneously without additional intervention. However, 2%–15% of patients remain symptomatic and may require additional intervention such as percutaneous drainage or surgery.<sup>[7]</sup>

Some predictive factors that may have an effect on the rate of lymphocele formation are the patient's age, body mass index (BMI), surgical approach as extraperitoneal or transperitoneal, resected lymph node level or lymph node yields, node positivity, concurrent inguinal hernia repair, perioperative anticoagulation, surgeon experience, and pelvic drain placement after RARP.<sup>[7-11]</sup>

It has been shown that the rate of lymphocele in cases of extraperitoneal prostatectomy is higher than transperitoneal.<sup>[12]</sup> A lower rate of lymphocele in transperitoneal prostatectomy may be caused due to the resorption property of the peritoneum.<sup>[13,14]</sup>

In this study, we aimed to evaluate the effect of peritoneal re-approximation at the end of the procedure in transperitoneal RARP (tRARP) and ePLND on operative, oncologic, and symptomatic lymphocele rates.

## Material and methods

After institutional ethical committee approval (date and number: 12.09.2019- 20/2) was obtained for this retrospective study, we identified 92 patients for review who underwent

tRARP and bilateral ePLND performed by two different surgeons using four-arm *da Vinci Xi Robot* (Intuitive Surgical, CA, USA) between January 2016 and September 2018. RARP and ePLND were performed in appropriate patient groups by two different experienced surgeons (MA and MS) in our center. Both surgeons had experienced over 100 radical prostatectomies. One of the surgeons performed the peritoneal re-approximation (Group 1, n=41), and the other did not perform the re-approximation of the peritoneum (Group 2, n=38) at the end of the procedure in tRARP and ePLND. Pre-, peri-, and postoperative and pathological parameters were compared between the groups.

Patients with a history of radiation therapy and pelvic surgery such as inguinal hernia, those who had not undergone bilateral ePLND, and those who had a record of less than 6 months follow-up were excluded from the study. Patients were routinely dressed in lower extremity compression stockings. Low molecular weight heparin was administered, in case of necessity, for DVT prophylaxis.

Lymphocele was diagnosed with cystography, ultrasound, and computed tomography (CT) scan, if necessary, in patients with lower abdominal pain, fever, swelling of the lower extremities, infection, excessive drainage, or suspicion of leakage. The CT scan image of lymphocele formation is shown in Figure 1.

Written informed consent of each patient was obtained before the surgery, and our study was conducted according to the principles of the Helsinki Declaration.

## Surgery technique

All RARP and ePLND procedures were performed through a transperitoneal approach using the four-arm *da Vinci Xi robotic system* (Intuitive Surgical, CA, USA) in the 45° steep Trendelenburg position. A total of six ports were placed, including four ports (8-mm) for the robotic arms and two ports for the assistance (8-mm and 10-mm). The placement of the ports is shown in Figure 2.

A transverse anterior peritoneal incision was made between the left and the right medial umbilical ligament. Then, the seminal vesicles and the prostate in a posterior part were dissected. This was followed by the return to the anterior of the prostate and separation of the dorsal vein complex. The neurovascular bundle (NVB) was completely released if planned preservation was carried out, and using electrocautery at this point was avoided. Then, the prostate was dissected from the bladder neck. Urethrovesical anastomosis was performed continuously using two 15-cm 3-0 V-lock sutures (Covidien, Mansfield, MA, USA), and an 18-French Foley catheter (Rusch®, Teleflex, USA) with 10 mL balloon was inserted.

### Main Points:

- Lymphocele is the most common complication of radical prostatectomy and pelvic lymphadenectomy in prostate cancer.
- Peritoneum creates a natural surface for lymphatic re-absorption, and lymphatic fluid can be resorbed through the peritoneum.
- Although peritoneal re-approximation provides normal anatomy, in this study, it did not provide any additional benefit in terms of complications. In addition, it increased the operation time and lymphocele formation in transperitoneal robot-assisted radical prostatectomy and extended pelvic lymphadenectomy.

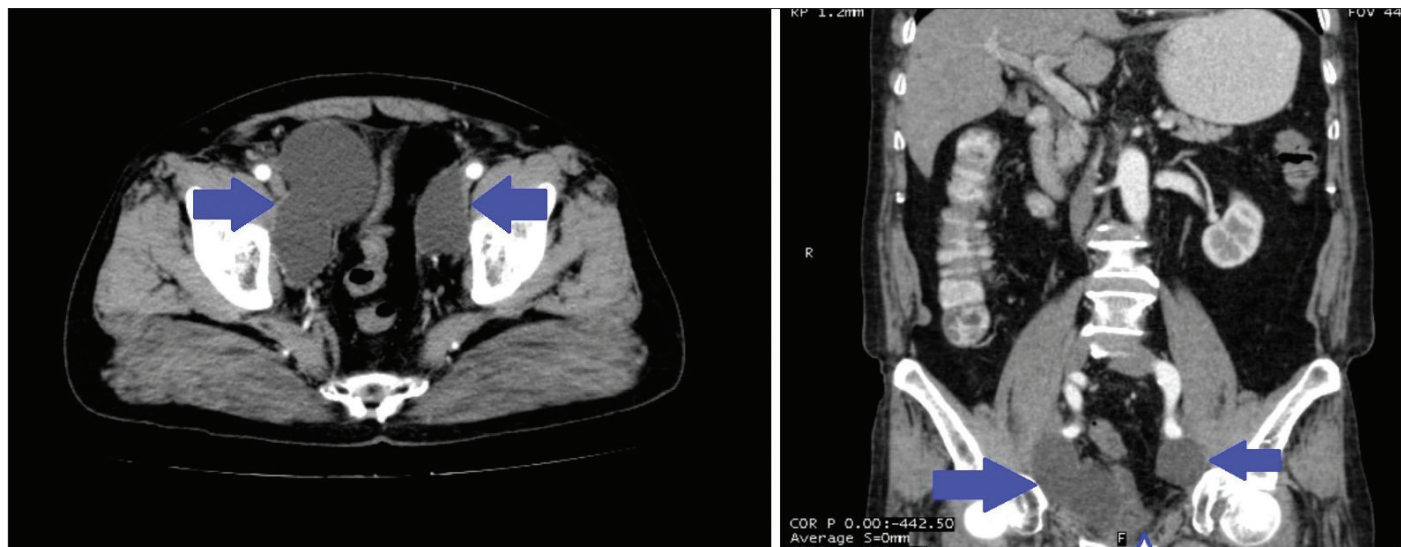


Figure 1. Demonstration of lymphocele formation in CT scan imaging vertically and coronally. In the right obturator region of the pelvic area, a cystic appearance with a lobulated contour approximately in size of 92×60mm, which is compatible with lymphocele, does not show contrast enhancement after intravenous contrast  
CT: computed tomography

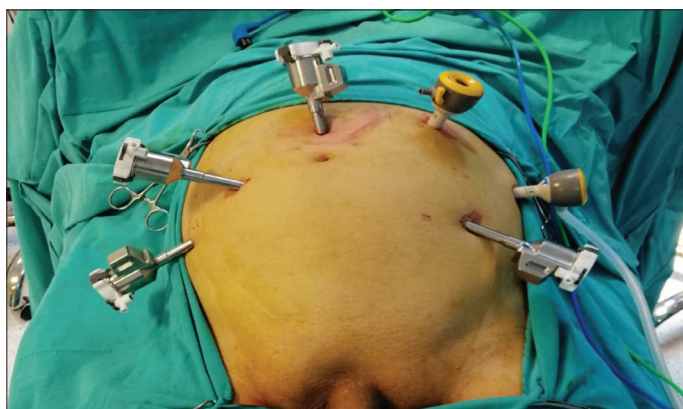


Figure 2. Demonstration of the placement of the ports. A total of six ports, four for robotic arms and two for assistance

Bilateral extended pelvic lymphadenectomy was performed in patients with a risk classification of more than 5% according to the Briganti nomogram.<sup>[15]</sup> Removal of the external iliac, obturator, internal iliac, and common iliac lymph nodes up to the level of the ureter and distally to the node of Cloquet were our boundaries for all ePLND in RARP as described before.<sup>[16]</sup> Electrocautery or Hem-o-Lok clips (Ethicon US, LLC.) were used for the last part of the lymph nodes. Nodal packets were grouped into the anatomic region and noted for the attention of the pathologist.

Both surgeons followed the same procedure with the exception of the peritoneal re-approximation. One of the surgeons performed the peritoneal re-approximation (MA) continuously

using 3.0 Vicryl (Ethicon US, LLC.), and the other did not perform the peritoneal re-approximation (MS) at the end of the procedure. The mean intra-abdominal pressure during the operation was between 12–15 mmHg in case of both the surgeons. A silicone lodge drain was inserted routinely from the assistant's port at the end of the procedure and was removed 1 day later when the drainage was less than 50 mL during the day. The peritoneal re-approximation and placement of lodge drain before the end of the operation are shown in Figure 3.

### Statistical analysis

Dataset analyses were carried out using the IBM Statistical Package for Social Sciences version 23.0 (IBM SPSS Corp.; Armonk, NY, USA) program. Continuous variables were presented as mean and standard deviations. Independent *t*-test and Mann–Whitney U test were used for analyzing two groups. The chi-square test was used for the analysis of the relationship between categorical variables. Pearson and Spearman correlation tests were performed between the variables. P-value less than 0.05 was accepted as statistically significant.

### Results

A total of 79 patients who underwent RARP and bilateral ePLND was included in the study. The patients were divided into two groups-Group 1, peritoneal re-approximation and Group 2, without peritoneal re-approximation—according to the surgeons. There were 41 patients in Group 1 and 38 patients in Group 2. The mean follow-up time was 18.6 months with a minimum of 6 and a maximum of 30 months.



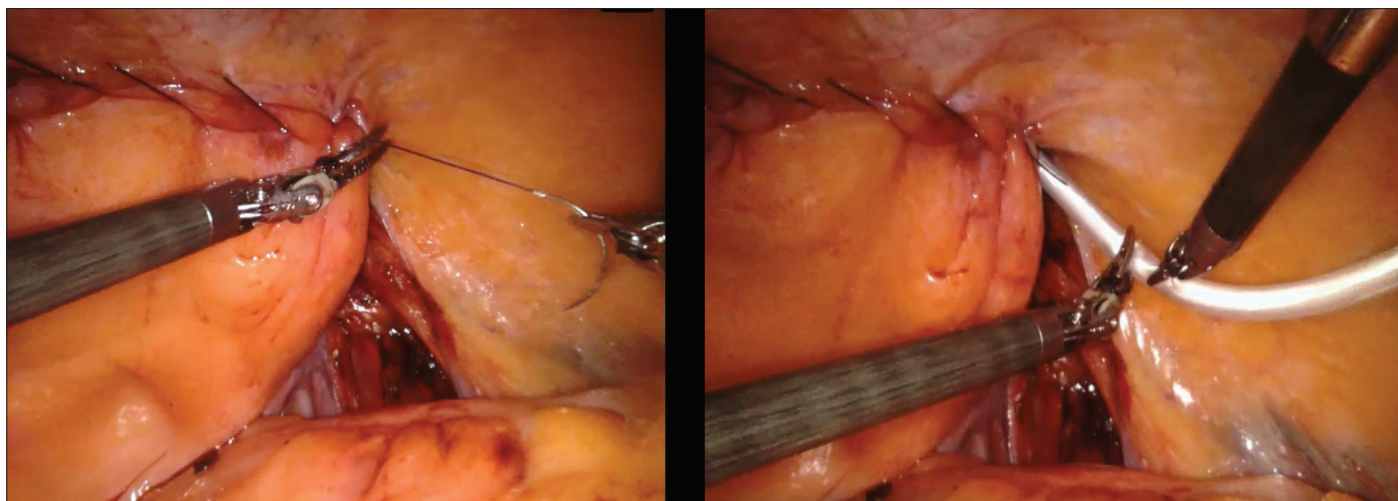


Figure 3. Demonstration of peritoneal re-approximation and placement of log drain before termination of the surgery

**Table 1. Patient demographics and perioperative outcomes**

Variables	Group 1 (Mean±SD)	Group 2 (Mean±SD)	p*
Number of patients	41	38	
Age (years)	64.85±5.42	66.47±7.53	0.28
PSA (ng/dL)	13.92±7.44	17.34±18.44	0.27
BMI (kg/m <sup>2</sup> )	26.36±3.55	27.42±5.01	0.29
Mean operation time (minutes)	240.49±50.45	220.92±52.86	0.09
<b>D'Amico risk group, n (%)</b>			
1–2	17 (41.5)	16 (42.1)	0.61
3	24 (58.5)	22 (57.9)	
EBL (cc)	194.88±68.01	159.87±79.17	0.03
Number of lymph nodes resected, n	15.20±7.88	18.97±10.66	0.07
NVB sparing, n (%)	16 (39)	17 (44.7)	0.61

\*p<0.05 was considered statistically significant. PSA: prostate-specific antigen; BMI: body mass index; NVB: neurovascular bundle; EBL: estimated blood loss; SD: standard deviation

There was no significant difference between preoperative parameters age, BMI, and preoperative prostate-specific antigen (PSA) values ( $p=0.28$ ,  $p=0.29$ , and  $p=0.27$ , respectively). The perioperative parameters in Group 2 were as follows: the operation time was shorter, the amount of estimated blood loss (EBL) was less, and the lymph node yield was higher. However, only the difference in the amount of EBL was statistically significant ( $p=0.09$ ,  $p=0.03$ , and  $p=0.07$ , respectively). Preoperative and perioperative parameters are shown in Table 1.

Hospitalization time, symptomatic lymphocele, and intervention requiring lymphocele and complication rates were found to be less in Group 2, but only hospitalization time was statistically significant ( $p=0.04$ ,  $p=0.27$ ,  $p=0.19$ , and  $p=0.17$ , respectively).

The median detection time of the symptomatic lymphocele was 28 (23–36) days. Biopsy Gleason score, clinical stage, final pathology Gleason score, pathology T stage, and N + values as pathological parameters were not statistically significant ( $p=0.13$ ,  $p=0.98$ ,  $p=0.07$ ,  $p=0.29$ , and  $p=0.19$ , respectively). Postoperative and pathological parameters are shown in Table 2.

There was a significant correlation at the border between lymph node positivity and the presence of symptomatic lymphocele in the correlation analysis ( $p=0.05$ ). No significant correlation was found between age, BMI, the number of removed lymph nodes, time of operation, amount of bleeding, PSA level, T stage, and presence of symptomatic lymphocele ( $p>0.05$  for all parameters).

**Table 2. Postoperative and pathological outcomes**

Parameters	Group 1	Group 2	p*
Length of stay (day)	3.98±1.15	3.55±0.65	0.04
Symptomatic lymphocele, n (%)	5 (12.19)	2 (5.26)	0.43**
Drainage of the lymphocele, n (%)	4 (9.75)	1 (2.63)	0.62**
<b>Complication Clavien, n (%)</b>			
1–2	2 (4.87)	1 (2.56)	0.17**
3a	0	2 (5.26)	
3b	7 (17.07)	2 (5.26)	
4–5	0	0	
<b>Biopsy Gleason score sum, n (%)</b>			
6	13 (31.7)	5 (13.15)	0.07**
7	22 (53.65)	23 (60.52)	
8	4 (9.75)	10 (26.31)	
9	1 (2.43)	0	
10	1 (2.43)	0	
<b>Final Gleason score n (%)</b>			
6	8 (19.51)	1 (2.63)	0.07**
7	22 (53.65)	28 (73.68)	
8	3 (7.31)	4 (10.52)	
9	8 (19.51)	5 (13.15)	
10	0	0	
<b>Pathological stage, n (%)</b>			
T2c	21 (51.21)	13 (34.21)	0.29
T3a	9 (21.95)	10 (26.31)	
T3b	11 (26.82)	15 (39.47)	
<b>Number of patients with positive lymph nodes, n (%)</b>			
N+	2 (4.87)	5 (13.15)	0.25**
N–	39 (95.12)	33 (86.84)	

\*p<0.05 was considered statistically significant. \*\*Fisher's Exact Test was used for these variables.

## Discussion

Lymphocele is the most common complication in patients undergoing RP and PLND.<sup>[9]</sup> Symptomatic patients may cause various morbidities such as DVT and thromboembolic events, and these patients usually require additional interventions.

Studies show that asymptomatic lymphocele rates are around 50%. However, 2%–15% of patients remain symptomatic and may require additional interventions.<sup>[7,8]</sup> Patients with symptomatic lymphocele typically present with lower abdominal pain, fevers, lower urinary tract symptoms, lower extremity swelling, infection, and thromboembolic events by compress-

ing pelvic venous blood vessels. Most symptomatic lymphoceles require interventions such as percutaneous drainage, sclerotherapy, or marsupialization.<sup>[17]</sup>

The rate of lymphocele varies according to different surgical methods such as open radical retropubic prostatectomy (RRP) and transperitoneal and extraperitoneal RARP. Solberg et al.<sup>[18]</sup> compared the incidence of lymphocele formation after laparoscopic and open PLND in patients with prostate cancer. The rates of lymphocele in case of open PLND were significantly higher than in laparoscopic cases (61% and 37%, respectively).

Orvieto et al.<sup>[17]</sup> reported the total lymphocele rate as 51% and the symptomatic lymphocele rate as 7.8% in cases of tRARP

and ePLND applied. Horovitz et al.<sup>[19]</sup> retrospectively compared lymphocele incidence rates in extraperitoneal RARP and tRARP cases. Although there were no statistically significant differences, the lymphocele incidence was twice as high in eRARP than in tRARP (2.83% vs 1.49%,  $p=0.09$ ). Kallidonis et al.<sup>[20]</sup> compared the transperitoneal RP cases with extraperitoneal RP in the review, and the rate of lymphocele in the extraperitoneal RP was shown to be higher than in the transperitoneal approach.

The low rate of lymphocele in the transperitoneal PLND is due to the fact that the transperitoneal process is performed by opening the peritoneum. In this way, the peritoneum creates a natural surface area within the body for lymphatic re-absorption, and the lymphatic leakage that may occur is resorbed through the peritoneum.

Stolzenburg et al.<sup>[10]</sup> demonstrated a markedly decreased symptomatic and asymptomatic lymphocele rate in a group of patients undergoing extraperitoneal RP and PLND by peritoneal fenestration versus in the group not undergoing peritoneal fenestration (6% vs 32%,  $p<0.001$ ).<sup>[10]</sup> Stolzenburg et al.<sup>[21]</sup> reported the use of four-point peritoneal flap fixation (4PPFF), which was performed by suturing the cut end of the ventral parietal peritoneum at four points (to the anterior and lateral pelvic side wall on both sides) to reduce lymphocele formation after RP and PLND. The symptomatic lymphocele rate was significantly lower in the 4PPFF group compared with control (4.6% vs 1.03%,  $p=0.0322$ ).<sup>[21]</sup>

In this study, it was observed that the lymphocele rate was higher in Group 1 (the peritoneal re-approximation group) than in Group 2 (12.19% vs 5.26%, respectively,  $p=0.27$ ). We think that the reason for this is that in the re-approximate group, the possible lymphatic leakage could not be drained into the abdomen; therefore, the lymphatic fluid could not be re-absorbed from the peritoneum, and this increased the likelihood of lymphocele formation.

Lebeis et al.<sup>[13]</sup> described the flaps formed by the peritoneal interposition flap (PIF) in robotic PLND that reduces the scarring effect of the bladder on the lymphadenectomy area. They showed that lymph leakage was absorbed through the peritoneal flap, and the lymphocele rate decreased in this group (11.6% vs 0%  $p=0.003$ ). Than Lee et al.<sup>[22]</sup> externally validated the utilization of PIF in preventing symptomatic lymphocele formation. They reported that the PIF had a lower incidence of symptomatic lymphocele than the control group (0.0% vs 6.0%,  $p=0.007$ ).

Fabrizio et al.<sup>[23]</sup> also showed that lymphatic fluid was flowing from the pelvic area to the abdomen by the method they ap-

plied, which was named as Preventing Lymphocele Ensuring Absorption Transperitoneally (P.L.E.A.T.). In this technique, they left two lateral openings of the peritoneum, allowing lymphatic fluid to drain away from the pelvis and into the abdomen. They showed the decrease of lymphocele formation by peritoneal absorption (4.1% and 0.6% for standard PLND and P.L.E.A.T technique, respectively,  $p=0.039$ ).<sup>[23]</sup>

In our study, percutaneous drainage was performed by the same interventional radiologist in four of the five symptomatic lymphoceles found in Group 1, but laparoscopic excision was performed on the recurrence of lymphocele in two cases. Percutaneous drainage was performed in one of the two lymphoceles detected in Group 2, and the other regressed spontaneously without any additional intervention.

Some predictive factors may have an effect on the rate of lymphocele formation, such as the patient's age, BMI, surgical approach as extraperitoneal or transperitoneal, number of lymph nodes resected, node positivity, extracapsular extension, seminal vesicle invasion, tumor volume, perioperative anticoagulation, surgeon experience, and pelvic drain placement after PLND in RRP.<sup>[7,8,10,24]</sup> According to our data, there was a significant correlation at the border between lymph node positivity and the presence of symptomatic lymphocele in the correlation analysis ( $p=0.05$ ). No significant correlation was found between age, BMI, the number of removed lymph nodes, operation time, EBL, PSA level, T stage, and the presence of symptomatic lymphocele ( $p>0.05$  for all parameters).

Correlation of lymph node positivity and lymphocele formation mechanism explained by the possibility of transecting larger lymphatic channels might be higher in cases of PCa with lymphatic invasion, which might increase postoperative lymph leakage and formation of lymphocele.<sup>[24]</sup> Especially, it might influence the incidence of lymphocele formation in intermediate and high-risk PCa.

In this study, we think that the re-approximation of the peritoneum does not provide additional benefit to the patient. Although the other complications are similar, we think that there is no need for peritoneal closure as it increases the rate of lymphocele.

We have some limitations of the study. First, our study was non-randomized and retrospective. Second, the comparison of cases of 2 different surgeons may differ in the lymphocele complication rates according to the experience of the surgeon. The other limiting factor is that we only reported the symptomatic lymphocele rate, and we do not know the exact ratio of asymptomatic lymphoceles in this study.

However, we think that it would not affect the discussion because the asymptomatic lymphocele does not have clinical significance in practice.

In conclusion, although conventionally, re-approximation of the peritoneum helps to provide normal anatomy after RARP and PLND, it has been shown in this study that it does not provide any additional benefit in terms of complication and postoperative outcomes. Considering that this process also increases the operation time and lymphocele formation, we think there is no need for re-approximation after RARP and PLND procedures. However, more randomized prospective studies are required.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of Health Sciences University, Antalya Training and Research Hospital (12.09.2019- 20/2).

**Informed Consent:** Written informed consent of each patient was obtained before the surgery, and our study was conducted according to the principles of Helsinki Declaration.

**Peer-review:** Externally peer-reviewed.

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**Conflict of Interest:** The authors have no conflicts of interest to declare.

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