REVIEW ARTICLE

Vol. 51 (2): e20240490, March - April, 2025
doi: 10.1590/S1677-5538.IBJU.2024.0490

Pelvic Lymph Node Dissection Before Versus After Radical Cystectomy: A Systematic Review and Meta-Analysis

Guilherme Melchior Maia Lopes [1], Luiz Guilherme Serrão Gimenez [2], Diogo Souto Santana [2], Rafael Baldissera Cardoso [3], Breno Cordeiro Porto [2], Rodrigo Afonso da Silva Sardenberg [4], Carlo Camargo Passerotti [2], José Pinhata Otoch [2], José Arnaldo Shiomi da Cruz [2, 4]

[1] Centro Universitário Faculdade de Medicina do ABC (FMABC), Santo André, SP, Brasil; [2] Laboratório de Técnica Cirúrgica e Cirurgia Experimental Faculdade de Medicina, Universidade de São Paulo – USP, São Paulo, SP, Brasil; [3] Hospital Moinhos de Vento, Porto Alegre, RS, Brasil; [4] Instituto Internacional de Ensino e Pesquisa - Hapvida NotreDame Intermédica, São Paulo, SP, Brasil

ABSTRACT

Purpose: Radical cystectomy (RC) is the standard of care for patients with bladder cancer, and pelvic lymph node dissection (PLND) is a pivotal step that can be carried out either before or after RC. Evidence on the optimal timing for PLND remains limited.

Materials and Methods: We searched PubMed, Embase, Cochrane Central, Scopus and Google Scholar for studies comparing PLND before versus after RC. Outcomes assessed were total operative time, PLND time, RC time, number of lymph nodes (LN) dissected, and estimated blood loss. Mean differences (MDs) and 95% confidence intervals (CIs) were computed using a random-effects model. Subgroup analysis was conducted for robot-assisted RC (RARC).

Results: A total of 801 patients from six studies were included, of whom 360 (44.94%) underwent PLND before RC. There were no significant differences in total operative time (MD -17.49; 95% CI -41.65,6.67; p = 0.16; I2 = 94%), PLND time (MD -14.91; 95% CI -44.91,15.09; p = 0.33; I2 = 96%), LN yielded (MD -1.13; 95% CI -4.81,2.55; p = 0.55; I2 = 83%), and estimated blood loss (MD 0.17; 95% CI -51.33,51.68; p = 0.99; I2 = 81%). However, RC time was significantly reduced (MD -28.89; 95% CI -42.84,-14.93; p < 0.0001; I2 = 75%) when PLND was performed prior to RC. In RARC studies, PLND before RC decreased total operative time, RC time, and estimated blood loss.

Conclusions: The timing of lymphadenectomy was not associated with a significant reduction in total operative time, PLND time, LN yield, and estimated blood loss.

ARTICLE INFO

Guilherme Melchior Maia Lopes
https://orcid.org/0000-0002-7115-4942

Keywords:
Lymph Node Excision; Cystectomy; Urinary Bladder Neoplasms; Systematic Review [Publication Type]; Cystectomy

Submitted for publication: August 25, 2024

Accepted after revision: November 17, 2024

Published as Ahead of Print: January 13, 2024

INTRODUCTION

Bladder cancer (BCa) ranks as the nineth most frequently diagnosed malignant tumor worldwide, with over 60,000 new cases and more than 12,000 deaths reported annually among men in the United States (1, 2). Up to 40% of patients present with muscle-invasive bladder cancer (MIBC), and a quarter of them will harbor lymph nodal metastasis (3). Thus, early diagnosis and rapidly implemented interventions are essential in this type of tumor to reduce the risk of metastasis and improve survival rates. Radical cystectomy (RC) is currently regarded as the standard of care for patients with MIBC without systemic involvement, and also, though less frequently, for some non-muscle-invasive bladder (NMIBC) when intravesical treatments, such as BCG (Bacillus Calmette-Guerin), have failed (4, 5). RC is associated with a significant survival gain compared to observation, multiple resections, chemotherapy, or radiotherapy (6-8).

Pelvic lymph node dissection (PLND) is a pivotal stage of RC and can be carried out either before or after cystectomy. While current literature extensively discusses PLND templates, lymph node (LN) yield, density, positive pathological rates, and oncological benefits (9-11), there is limited evidence on the optimal timing of the procedure relative to RC, which is rarely addressed in guidelines. This uncertainty has raised concerns about potential impacts on perioperative outcomes, including operative time, blood loss, and postoperative recovery, which are critical for patient safety and long-term prognosis.

Furthermore, variability in clinical practices concerning the timing of PLND highlights the need for more concrete, evidence-based guidelines. Standardizing this component of RC could lead to improved consistency in outcomes across medical health centers and provide clearer instructions for urologists managing BCa cases. Therefore, we aimed to undertake a systematic review and meta-analysis to compare PLND performed before versus after RC to determine the optimal approach.

MATERIALS AND METHODS

This systematic review and meta-analysis were performed and reported following the Cochrane Collaboration Handbook for Systematic Reviews of Interventions and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) Statement guidelines (12, 13). The prospective protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO; CRD42024550620)

Eligibility criteria

Inclusion in this meta-analysis was restricted to studies that met all the following eligibility criteria: (I) randomized controlled trials (RCTs) or nonrandomized studies; (II) involving patients undergoing RC; (III) comparing PLND before versus after RC; and (IV) reporting any of the outcomes of interest. We excluded studies with (I) no control group; (II) no outcome of interest; (III) overlapping population; or (IV) preliminary results from published studies.

Search strategy

We systematically searched PubMed (MEDLINE), Embase, Cochrane Central Register of Controlled Trials, Scopus, and Google Scholar from inception to June 2024. The search terms included 'radical cystectomy' and 'lymphadenectomy'. No filters or language limitations were applied in our search. A complete electronic search strategy is reported in the Supplementary Appendix. After removing duplicates, two authors (G.M.M.L. and L.G.S.G.) screened the titles and abstracts and independently assessed full-text articles for inclusion based on prespecified criteria. Discrepancies were resolved in a discussion panel with the senior author. We also searched for additional eligible studies through a review of the references from articles identified in the original search.

Data extraction

Two authors (G.M.M.L. and L.G.S.G.) independently extracted the data from each study using a

standardized data collection document to collect the following characteristics: inclusion and exclusion criteria, total number of participants in each group, baseline characteristics, RC technique, pathological staging, pathological LN metastasis, limitations of each study, endpoint data, and endpoint definitions. Our prespecified primary endpoints were total operative time, PLND time, and RC time. Our secondary outcomes included the number of dissected LN, and estimated blood loss. Baseline characteristics were reported as the mean and standard deviation for continuous variables and proportion for binary variables.

Quality assessment

We evaluated the risk of bias in randomized studies using version 2 of the Cochrane Risk of Bias assessment tool (RoB-2) (14), in which studies are scored as high, some concerns, low, or unclear risk of bias in 5 domains: selection, performance, detection, attrition, and reporting biases. Non-randomized studies were assessed with the Risk of Bias in Non-randomized Studies - of Interventions tool (ROBINS-I) (15). The two authors (G.M.M.L. and L.G.S.G.) independently conducted the assessments, and disagreements were resolved through consensus after discussing reasons for discrepancies.

Statistical analysis

Endpoints were primarily analyzed with a mean difference (MD) with 95% confidence interval (CI). Cochran Q test and I2 statistics were used to assess heterogeneity. We used the DerSimonian and Laird random-effect model to calculate pooled estimates, considering that the patients came from different populations. Review Manager 5.4 (Cochrane Centre, The Cochrane Collaboration, Denmark) was used for statistical analyses.

RESULTS

Study selection and characteristics

Our initial search yielded 10,770 results, as shown in Figure-1. After removing duplicate records and ineligible studies, 13 were retrieved and remained for full-text revision based on our previously detailed inclusion criteria. Six studies were ultimately included in the pooled analysis, comprising 801 patients from one RCT (16) and five cohort studies (17-21). Among these patients, 360 (44.94%) underwent PLND before RC, whereas 441 (55.06%) underwent PLND after RC. The main characteristics of the included studies are presented in Table-1. The mean age of all patients included was 60.17 years old, with no significant difference between both groups, and 658 (82.15%) were male. The clinical and surgical baseline characteristics of the included patients are detailed in Table-2.

Pooled analysis of all studies

In the group of patients that had PLND before RC, there was an overall trend towards decreased total operative time (MD -17.49; 95% CI -41.65,6.67; p = 0.16; I2 = 94%; Figure 2A) and significantly lower RC time (MD -28.89; 95% CI -42.84,-14.93; p < 0.0001; I2 = 75%; Figure-2B) when compared to those who underwent it after RC. Moreover, there was no statistical difference between both groups in PLND time (Figure-2C), number of LN dissected (Figure-3A), and estimated blood loss (Figure-3B).

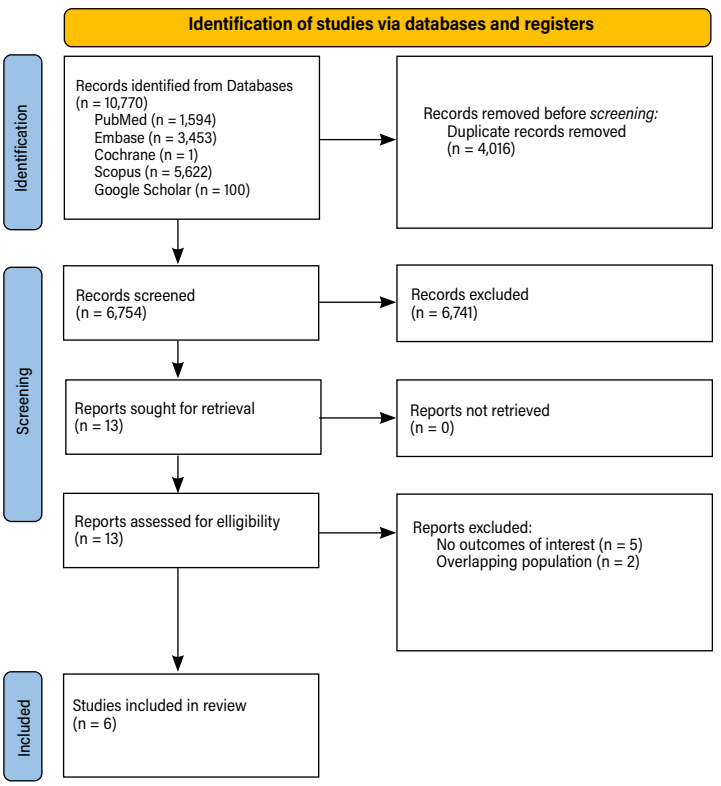
Subgroup analysis

In a subgroup analysis of studies that performed robot-assisted RC (RARC), there was a significant reduction in total operative time (MD -23.84; 95% CI -30.88,-16.81; p <0.00001; I2 = 0%; Figure-2A), RC time (MD -35.13; 95% CI -41.82,-28.44; p < 0.00001, I2 = 0%; Figure-2B), and estimated blood loss (MD -39.54; 95% CI -44.20,-34.88; p <0.00001; I2 = 0%; Figure-3B) in patients that had PLND before RC. Furthermore, there was no statistical difference between groups in the number of LN dissected (Figure-3A).

Quality assessment

Supplementary Appendix Figure-1 summarizes the individual risk of bias assessments of the included studies. The RCT was appraised using the Cochrane Collaboration's tool RoB-2, and it was con-

Figure 1 - PRISMA flow diagram od study screening and selection.



sidered to have an overall risk of bias classified as "some concerns", primarily due to the nature of the procedure, since it is inherently impossible to blind the surgeon. All five non-randomized studies were rated as "moderate risk" due to their potential to introduce confounding factors or bias in patient selection. Furthermore, the retrospective design of four of these studies might influence the determination of patient exclusion criteria based on specific findings such as outcomes and comorbidities.

DISCUSSION

In this systematic review and meta-analysis comprising six studies and 801 non-overlapping patients, we comprehensively compared performing PLND before or after RC. The main findings from our pooled analysis did not demonstrate statistically significant differences in total operative time, PLND time, number of LN dissected, and estimated blood loss. However, there was a significant reduction in RC time in patients that underwent PLND before RC.

Lymph node involvement in BCa is a crucial prognostic factor for oncological outcomes, and its incidence ranges from 5% in NMBIC and 18-27% in MBIC. Given the heightened risk of postoperative tumor recurrence associated with nodal metastases, PLND is a pivotal component of RC (22, 23). Multiple aspects have been studied to contribute to a safe and effective PLND, such as the extent of the dissection, the number of LN yielded, and the surgical technique.

The lymphatic drainage in bladder cancer surgery can follow two main templates: a limited PLND, which includes both sides of the obturator fossa, and an extended PLND, which covers a broader area, such as the aortic bifurcation, iliac vessels, and internal iliac nodes (24, 25). Studies have shown that extended PLND is associated with better relapse-free survival (RFS) due to improved local control, though extending beyond this (super-extended PLND) does not improve survival and may increase complications (3, 26-27).

Table 1 - Main characteristics of the included studies.

Study	Country; Period	Design	Exclusion criteria	RC technique
Moeen, et al. 2024 (16)	Egypt; 2014-2019	RCT, single-center	Palliative cystectomy, grossly enlarged LNs in MSCT or MRI, CKD, or refused to participate	Open
Kumaraswamy, et al. 2023 (17)	India; 2019-2022	Ambispective, single-center	Incomplete or missing data	Laparoscopic
Wang, et al. 2023 (18)	China; 2014-2022	Retrospective, single-center	Previous bladder or prostate surgery, previous RT, distant metastasis, coagulation dysfunction, important organ dysfunctions, or combined with other systemic malignant tumors	RARC
Salih Boga, et al. 2020 (19)	Turkey; 2017-2019	Retrospective, single-center	NA	RARC
Zhu, et al. 2013 (20)	China; 2003-2013	Retrospective, single-center	Non-extended or zoned PLND, distant metastasis, or neoadjuvant RT or CR	RARC
Ozen, et al. 2012 (21)	Turkey; 2005-2009	Prospective, multicenter	Previous pelvic RT, previous PLND, or neoadjuvant CT	Open

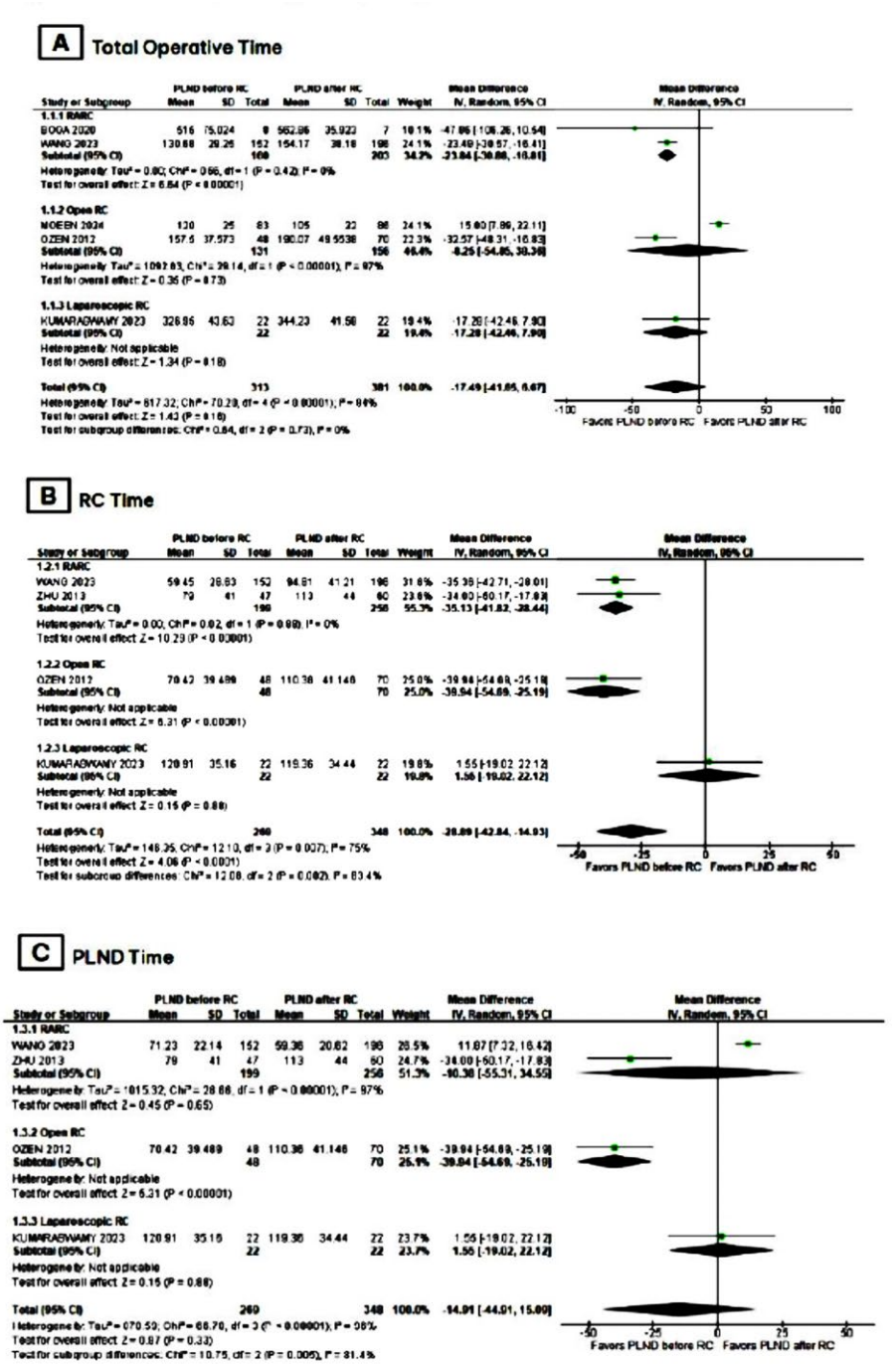
CKD = chronic kidney disease; CT = chemotherapy; LNs = lymph nodes; MRI = magnetic resonance imaging; MSCT = multi-sliced computed tomography; NA = not available; PLND = pelvic lymph node dissection; RARC = robot-assisted radical cystectomy; RC = radical cystectomy; RCT = randomized controlled trial; RT = radiotherapy

Table 2 - Clinical and surgical baseline characteristics of the included patients.

Study	Patients, n		Age, years (±SD)			Male, n (%)			Pathological stage, n (%)								Pathologic LN metastasis, n (%)		
	bRC	aRC	bRC	aRC	p	bRC	aRC	p	bRC				aRC				p	bRC	aRC	p
									≤T1	T2	T3	T4	≤T1	T2	T3	T4				
Moeen, et al. 2024 (16)	83	86	58.21 (±6.9)	55.03 (±7.6)	0.235	66 (79.5)	65 (75.5)	0.326	0 (0)	50 (60.3)	33 (39.7)	0 (0)	0 (0)	52 (60.5)	34 (39.5)	0 (0)	0.513	13 (15.7)	18 (20.9)	0.111
Kumaraswamy, et al. 2023 (17)	22	22	57.95 (±12)	57.95 (±9.97)	1.0	19 (86)	22 (100)	0.23	6 (27.3)	11 (50)	5 (22.7)	0 (0)	7 (31.8)	12 (54.54)	2 (9.09)	1 (4.54)	0.62	NA	NA	1.0
Wang, et al. 2023 (18)	152	196	61.08 (±7.66)	62.75 (±5.753)	0.588	114 (91.2)	157 (80.1)	0.158	24 (15.8)	56 (36.8)	53 (34.8)	19 (12.5)	30 (15.3)	62 (31.6)	67 (34.2)	37 (18.9)	0.228	34 (22.4)	53 (27.1)	0.376
Salih Boga, et al. 2020 (19)	8	7	61.00 (±7.67)	62.86 (±5.98)	0.608	7 (87.5)	7 (100)	NA	0 (0)	5 (62.5)	2 (25.0)	1 (12.5)	0 (0)	4 (57.1)	2 (28.6)	1 (14.3)	0.978	3 (37.5)	2 (28.6)	0.714
Zhu, et al. 2013 (20)	47	60	63.00 (±10)	61.00 (±10)	NA	44 (93.61)	50 (83.33)	NA	1 (2.1)	12 (25.5)	21 (44.7)	13 (27.7)	2 (2.3)	16 (26.7)	29 (48.3)	13 (21.7)	NA	16 (34.0)	19 (31.7)	NA
Ozen, et al. 2012 (21)	48	70	61.09 (±9.75)		NA	107 (90.7)		NA	10 (20.8)	12 (25.0)	21 (43.8)	5 (10.4)	15 (21.4)	20 (28.6)	21 (30.0)	14 (20.0)	0.181	19 (39.6)	24 (34.3)	0.385

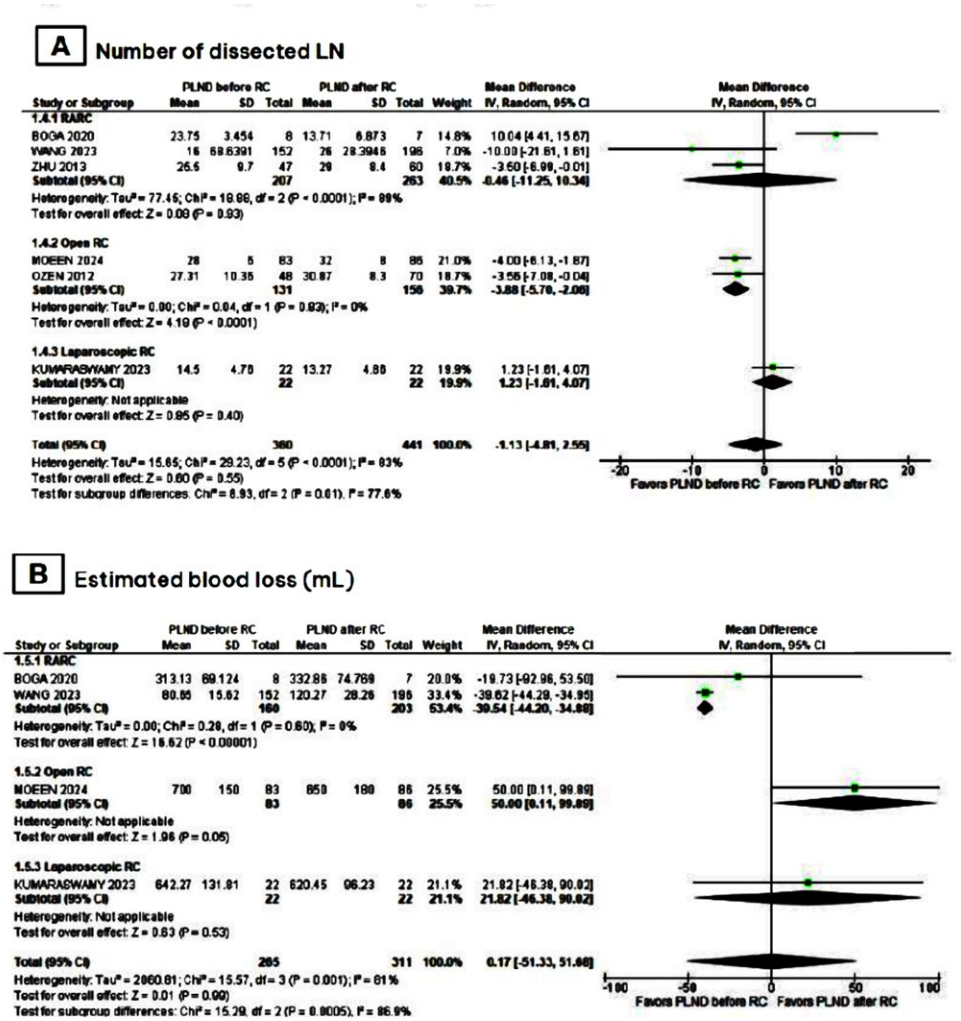
aRC = After radical cystectomy; bRC = Before radical cystectomy; LN = lymph node; NA = Not Available; RC = Radical cystectomy; SD = Standard deviation.

Figure 2 - Meta-analysis of primary endpoints.



(A) Recurrence rate; (B) Radical cystectomy time; (C) Pelvic lymph node dissection time.
CI = confidence interval; RARC = robot-assisted radical cystectomy; SD = standard deviation

Figure 3 - Meta-analysis of secondary endpoints.



(A) Number od dissected lymph nodes; (B) Estimated blood loos.

CI = confidence interval; RARC = robot-assisted radical cystectomy; SD = standard deviation

A higher number of lymph nodes (LNs) removed correlates with better survival rates, as it helps remove micrometastases and ensures more accurate staging (28-31). Research suggests that patients with at least 10 nodes removed tend to have better outcomes, and some recommend dissecting 15 to 20 nodes. However, rather than focusing solely on the number of nodes, the meticulous performance of the dissection within a well-defined template is more important for better oncological outcomes (32-34).

The optimal timing of PLND relative to RC has been controversial. Advocates for performing PLND before RC argue that this approach bares the vascular pedicles of the urinary bladder, which allows for

easier identification and control of these blood vessels, potentially reducing the risk of significant blood loss and making the subsequent steps of cystectomy faster and more efficient. However, the narrow pelvic space, especially in patients with large or locally advanced tumors, may make the procedure more challenging. On the other hand, proponents of performing PLND after RC emphasize the advantages of a wider operative field in the narrow pelvic cavity once the bladder is removed. The expanded surgical field facilitates the procedure, particularly in cases where previous pelvic surgery or tri-modality treatments have resulted in marked pelvic adhesions (16, 17, 21). Our study demonstrated a statistically significant reduction in RC time in patients who underwent early PLND, yet it did not find significant superiority in performing PLND before or after RC regarding the total operative time, PLND time, number of LNs yielded, and estimated blood loss. Moreover, this issue is not addressed in the guidelines of international medical associations, such as the American Urological Association (AUA) and the European Association of Urology (EAU) (4, 5, 35, 36). Consequently, the timing of PLND should be based on the surgeon's experience and preference, as well as the patient-related factors, to provide an effective procedure with minimal morbidity.

In recent years, advancements in surgical technology have impacted the approach to RC for BCa treatment. Despite typically requiring more operative time than open RC, RARC offers substantial benefits, such as smaller incisions, reduced blood loss, earlier bowel motility, fewer postoperative complications, and quicker recovery times. This increased surgical duration might be attributed to the complex setup of the robotic system, the docking of the robot, and the learning curve associated with mastering robotic surgical techniques (37-40). Our study showed that patients who had robotic PLND before RARC presented a statistically significant reduction in total operative time, RC time, and estimated blood loss. Therefore, performing PLND before cystectomy appears to be a favorable option for patients undergoing the robotic procedure.

This study has some limitations. Firstly, the scarcity of available literature on the optimal timing of PLND has led to a relatively small sample size, impacting the depth and robustness of our analysis and potentially restricting the generalizability of our results. Secondly, the generalizability of our findings may be affected by a geographical limitation, given that studies from Europe or the United States, regions known for their significant contributions to oncological research, were either not available or did not meet the inclusion criteria. Additionally, we observed significant heterogeneity in the outcomes studied. This increased heterogeneity could stem from multiple factors across the included studies, such as variability in surgical techniques used for RC and PLND, differences in surgeons' expertise, and inconsistencies in perioperative protocols. Moreover, patient-related variables, such as differences in tumor characteristics, baseline health status, and prior treatments, may further contribute to the observed heterogeneity, which underscores the need for more standardized protocols and reporting to reduce variability and improve comparability between studies. Lastly, there is a paucity of RCTs comparing PLND before and after RC, highlighting the importance of further research in this area.

CONCLUSION

In this meta-analysis including 801 patients who had PLND performed before or after RC, the timing of the lymphadenectomy was not associated with a significant reduction in total operative time, PLND time, number of LN dissected, and estimated blood loss. Additional RCTs are required to assess the comparative effectiveness of PLND before versus after RC and the oncological outcomes.

ABBREVIATIONS

BCa = Bladder cancer
MIBC = Muscle-invasive bladder cancer
RC = Radical cystectomy
NMIBC = Non-muscle-invasive bladder cancer
BCG = Bacillus Calmette-Guerin
PLND = Pelvic lymph node dissection
LN = Lymph node

RCT = Randomized controlled trial
MD = Mean difference
CI = Confidence interval
RARC = Robot-assisted radical cystectomy

CONFLICT OF INTEREST

None declared.

REFERENCES

1. Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA Cancer J Clin. 2024;74:229-63. doi: 10.3322/caac.21834.
2. Siegel RL, Miller KD, Jemal A. Cancer statistics, 2019. CA Cancer J Clin. 2019;69:7-34. doi: 10.3322/caac.21551.
3. Bi L, Huang H, Fan X, Li K, Xu K, Jiang C, et al. Extended vs non-extended pelvic lymph node dissection and their influence on recurrence-free survival in patients undergoing radical cystectomy for bladder cancer: a systematic review and meta-analysis of comparative studies. BJU Int. 2014;113(5b):E39-48. doi: 10.1111/bju.12371.
4. Witjes JA, Bruins HM, Cathomas R, Compérat EM, Cowan NC, Gakis G, et al. European Association of Urology Guidelines on Muscle-invasive and Metastatic Bladder Cancer: Summary of the 2020 Guidelines. Eur Urol. 2021;79:82-104. doi: 10.1016/j.eururo.2020.03.055.
5. Babjuk M, Burger M, Capoun O, Cohen D, Compérat EM, Dominguez Escrig JL, et al. European Association of Urology Guidelines on Non-muscle-invasive Bladder Cancer (Ta, T1, and Carcinoma in Situ). Eur Urol. 2022;81:75-94. doi: 10.1016/j.eururo.2021.08.010.
6. Martini A, Sfakianos JP, Renström-Koskela L, Mortezavi A, Falagario UG, Egevad L, et al. The natural history of untreated muscle-invasive bladder cancer. BJU Int. 2020;125:270-5. doi: 10.1111/bju.14872.
7. Gild P, Nguyen DD, Fletcher SA, Cole AP, Lipsitz SR, Kibel AS, et al. Contemporary Survival Rates for Muscle-Invasive Bladder Cancer Treated With Definitive or Non-Definitive Therapy. Clin Genitourin Cancer. 2019;17:e488-e493. doi: 10.1016/j.clgc.2019.01.009.
8. Sobhani S, Ghoreifi A, Douglawi A, Ahmadi H, Miranda G, Cai J, et al. Perioperative mortality for radical cystectomy in the modern Era: experience from a tertiary referral center. Int Braz J Urol. 2023;49:351-8. doi: 10.1590/S1677-5538.IBJU.2022.0405.
9. Zehnder P, Moltzahn F, Mitra AP, Cai J, Miranda G, Skinner EC, et al. Radical cystectomy with super-extended lymphadenectomy: impact of separate vs en bloc lymph node submission on analysis and outcomes. BJU Int. 2016;117:253-9. doi: 10.1111/bju.12956.
10. Rai BP, Bondad J, Vasdev N, Adshead J, Lane T, Ahmed K, et al. Robotic versus open radical cystectomy for bladder cancer in adults. Cochrane Database Syst Rev. 2019;4:CD011903. doi: 10.1002/14651858.CD011903.pub2.
11. Corradi RB, Galvao GJ, Oliveira GM, Carneiro VF, Miconi WG, Salles PG, et al. Radical cystectomy with pelvic lymphadenectomy: pathologic, operative and morbidity outcomes in a Brazilian cohort. Int Braz J Urol. 2016;42:431-7. doi: 10.1590/S1677-5538.IBJU.2015.0380.
12. Higgins J, Thomas J, editors. Cochrane handbook for systematic reviews of interventions. 2nd ed. Hoboken, NJ. Wiley-Blackwell. 2019; pp.
13. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. doi: 10.1136/bmj.n71.
14. Sterne JAC, Savović J, Page MJ, Elbers RG, Blencowe NS, Boutron I, et al. RoB 2: a revised tool for assessing risk of bias in randomised trials. BMJ. 2019;366:l4898. doi: 10.1136/bmj.l4898.
15. Sterne JA, Hernán MA, Reeves BC, Savović J, Berkman ND, Viswanathan M, et al. ROBINS-I: a tool for assessing risk of bias in non-randomised studies of interventions. BMJ. 2016;355:i4919. doi: 10.1136/bmj.i4919.
16. Moeen AM, Hameed DA, Mostafa MG, Shaban SH. Lymphadenectomy before and after radical cystectomy: does this affect the radicality? A prospective randomized comparative study. Int Urol Nephrol. 2024;56:965-72. doi: 10.1007/s11255-023-03826-4.
17. Kumaraswamy S, Das MK, Pandey A, Mandal S, Tripathy S, Nayak P. Pelvic lymph node dissection before or after laparoscopic radical cystectomy: An ambispective study comparing ease of surgery and operative outcomes. Indian J Urol. 2023;39:311-6. doi: 10.4103/iju.iju_253_23.

18. Wang S, Zhang D, Bai Y, Liu F, Qi X, Xie L. Clinical Outcomes of Pelvic Lymph Node Dissection Before Versus After Robot-Assisted Laparoscopic Radical Cystectomy. J Laparoendosc Adv Surg Tech A. 2023;33:776-81. doi: 10.1089/lap.2023.0118.
19. Salih Boga M, Ates M. Timing of lymphadenectomy during robot-assisted radical cystectomy: before or after cystectomy? Fifteen cases with totally intracorporeal urinary diversions. Wideochir Inne Tech Maloinwazyjne. 2020;15:596-601. doi: 10.5114/wiitm.2020.93793.
20. Zhu ZS, Ye M, Shi HQ, Zhou YB, Chen LY, Liu QQ, et al. [Effects of performing pelvic lymph node dissection before versus after radical cystectomy]. Zhonghua Yi Xue Za Zhi. 2013;93:2574-7. Chinese.
21. Ozen H, Ugurlu O, Baltaci S, Adsan O, Aslan G, Can C, et al. Extended pelvic lymph node dissection: before or after radical cystectomy? A multicenter study of the Turkish society of urooncology. Korean J Urol. 2012;53:451-6. doi: 10.4111/kju.2012.53.7.451.
22. Stein JP, Cai J, Groshen S, Skinner DG. Risk factors for patients with pelvic lymph node metastases following radical cystectomy with en bloc pelvic lymphadenectomy: concept of lymph node density. J Urol. 2003;170:35-41. doi: 10.1097/01.ju.0000072422.69286.0e.
23. Huang GJ, Stein JP. Open radical cystectomy with lymphadenectomy remains the treatment of choice for invasive bladder cancer. Curr Opin Urol. 2007;17:369-75. doi: 10.1097/MOU.0b013e3282dc95b5.
24. Weisbach L, Dahlem R, Simone G, Hansen J, Soave A, Engel O, et al. Lymph node dissection during radical cystectomy for bladder cancer treatment: considerations on relevance and extent. Int Urol Nephrol. 2013;45:1561-7. doi: 10.1007/s11255-013-0503-2.
25. Dorin RP, Daneshmand S, Eisenberg MS, Chandrasoma S, Cai J, Miranda G, et al. Lymph node dissection technique is more important than lymph node count in identifying nodal metastases in radical cystectomy patients: a comparative mapping study. Eur Urol. 2011;60:946-52. doi: 10.1016/j.eururo.2011.07.012.
26. Zehnder P, Studer UE, Skinner EC, Dorin RP, Cai J, Roth B, et al. Super extended versus extended pelvic lymph node dissection in patients undergoing radical cystectomy for bladder cancer: a comparative study. J Urol. 2011;186:1261-8. doi: 10.1016/j.juro.2011.06.004.
27. Małkiewicz B, Kiełb P, Gurwin A, Knecht K, Wilk K, Dobruch J, et al. The Usefulness of Lymphadenectomy in Bladder Cancer-Current Status. Medicina (Kaunas). 2021;57:415. doi: 10.3390/medicina57050415.
28. Lemiński A, Kaczmarek K, Michalski W, Małkiewicz B, Kotfis K, Słojewski M. The Influence of Lymph Node Count on Oncological Outcome of Radical Cystectomy in Chemotherapy Pre-Treated and Chemotherapy-Naïve Patients with Muscle Invasive Bladder Cancer. J Clin Med. 2021;10:4923. doi: 10.3390/jcm10214923.
29. Knap MM, Lundbeck F, Overgaard J. The role of pelvic lymph node dissection as a predictive and prognostic factor in bladder cancer. Eur J Cancer. 2003;39:604-13. doi: 10.1016/s0959-8049(02)00768-2.
30. Dangle PP, Gong MC, Bahnson RR, Pohar KS. How do commonly performed lymphadenectomy templates influence bladder cancer nodal stage? J Urol. 2010;183:499-503. doi: 10.1016/j.juro.2009.09.080.
31. Shariat SF, Ehdaie B, Rink M, Cha EK, Svatek RS, Chromecki TF, et al. Clinical nodal staging scores for bladder cancer: a proposal for preoperative risk assessment. Eur Urol. 2012;61:237-42. doi: 10.1016/j.eururo.2011.10.011.
32. Herr HW, Bochner BH, Dalbagni G, Donat SM, Reuter VE, Bajorin DF. Impact of the number of lymph nodes retrieved on outcome in patients with muscle invasive bladder cancer. J Urol. 2002;167:1295-8.
33. Leissner J, Hohenfellner R, Thüroff JW, Wolf HK. Lymphadenectomy in patients with transitional cell carcinoma of the urinary bladder; significance for staging and prognosis. BJU Int. 2000;85:817-23. doi: 10.1046/j.1464-410x.2000.00614.x.
34. May M, Herrmann E, Bolenz C, Brookman-May S, Tiemann A, Moritz R, et al. Association between the number of dissected lymph nodes during pelvic lymphadenectomy and cancer-specific survival in patients with lymph node-negative urothelial carcinoma of the bladder undergoing radical cystectomy. Ann Surg Oncol. 2011;18:2018-25. doi: 10.1245/s10434-010-1538-6.
35. Holzbeierlein J, Bixler BR, Buckley DI, Chang SS, Holmes RS, James AC, et al. Treatment of Non-Metastatic Muscle-Invasive Bladder Cancer: AUA/ASCO/SUO Guideline (2017; Amended 2020, 2024). J Urol. 2024;212:3-10. doi: 10.1097/JU.0000000000003981.

36. Chang SS, Boorjian SA, Chou R, Clark PE, Daneshmand S, Konety BR, et al. Diagnosis and Treatment of Non-Muscle Invasive Bladder Cancer: AUA/SUO Guideline. J Urol. 2016;196:1021-9. doi: 10.1016/j.juro.2016.06.049.
37. Pruthi RS, Smith A, Wallen EM. Evaluating the learning curve for robot-assisted laparoscopic radical cystectomy. J Endourol. 2008;22:2469-74. doi: 10.1089/end.2008.0320.
38. Moschini M, Zamboni S, Soria F, Mathieu R, Xylinas E, Tan WS, et al. Open Versus Robotic Cystectomy: A Propensity Score Matched Analysis Comparing Survival Outcomes. J Clin Med. 2019;8:1192. doi: 10.3390/jcm8081192.
39. Nix J, Smith A, Kurpad R, Nielsen ME, Wallen EM, Pruthi RS. Prospective randomized controlled trial of robotic versus open radical cystectomy for bladder cancer: perioperative and pathologic results. Eur Urol. 2010;57:196-201. doi: 10.1016/j.eururo.2009.10.024.
40. Gaya JM, Uleri A, Sanz I, Basile G, Verri P, Hernandez P, et al. Robot-assisted radical cystectomy and ileal conduit with HugoTM RAS system: feasibility, setting and perioperative outcomes. Int Braz J Urol. 2023;49:787-8. doi: 10.1590/S1677-5538.IBJU.2023.0349.

Correspondence address:
José Arnaldo Shiomi da Cruz, MD
Av. Dr. Arnaldo, 455 - Cerqueira César,
Pacaembu, São Paulo, SP, 01246-903, Brasil
Telephone: +55 11 9982-73310
E-mail: arnaldoshiomi@yahoo.com.br