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UROLOGY – REVIEW

Partial versus radical cystectomy in localized colorectal cancer: a systematic review and meta-analysis

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Abstract

Purpose Locally advanced colorectal tumors frequently invade adjacent organs, particularly the urinary bladder in the sigmoid colon and upper rectum, complicating multivisceral resections. This study compared postoperative outcomes of partial cystectomy (PC) and total cystectomy (TC) in patients with locally advanced colorectal cancer.

Methods A systematic review was conducted in PubMed, Scopus, Central Register of Clinical Trials, and Web of Science for studies published up to November 2024. Odds ratios (ORs) and mean differences (MDs) with 95% confidence intervals (CIs) were pooled using a random-effects model. Heterogeneity was assessed with I^2 statistics. Statistical analyses were performed in R Software 4.4.1.

Results Nine retrospective studies including 894 patients were analyzed. Among them, 433 (48.43%) underwent PC, and 461 (51.57%) underwent TC. Compared to TC, PC was associated with significantly lower rates of surgical site infection (OR 0.33; 95% CI 0.13–0.80; $p=0.015$), shorter operative time (MD − 169.7 min; 95% CI − 214.1 to − 125.3; $p<0.01$), reduced blood loss (MD − 1005.9 ml; 95% CI − 1362.1 to − 649.8; $p<0.01$), and shorter hospital stay (MD − 6.6 days; 95% CI − 9.4 to − 3.9; $p<0.01$). No significant differences were observed between groups in local or distant recurrence, urinary and intestinal leaks, pelvic abscess, ileus, urinary tract infection, or 90-day mortality.

Conclusion Partial cystectomy demonstrated superior postoperative outcomes, including fewer surgical site infections, reduced operative time, less blood loss, and shorter hospitalization. Oncological outcomes and other postoperative complications were comparable between PC and TC, supporting PC as a safe and effective option in selected patients.

Keywords Advanced colorectal cancer · Cystectomy · Urostomy · Neobladder

Introduction

Colorectal cancer ranks as the third most common cancer and the second leading cause of cancer-related mortality worldwide [1, 2]. Approximately 10% of cases present as locally advanced disease, with 5–20% involvement of adjacent organs [3–7]. The urinary tract is affected in 30% of cases, where the gold-standard surgical approach is pelvic exenteration with clear margins followed by adjuvant chemotherapy [8–10]. Untreated cases carry a poor prognosis, with a median survival of less than 1 year and a 5-year survival rate of only 5% [3, 9, 11].

Despite advancements in clinical, radiological, and cystoscopic evaluation tools, preoperative assessment of bladder involvement remains challenging. Urinary tract invasion is often defined intraoperatively, necessitating en-bloc

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resection to prevent tumor spillage [3, 6, 8, 9, 11, 12]. This approach typically involves multivisceral resection, including colorectal resection with partial or total cystectomy [3, 8, 9, 12]. Key factors influencing the choice between partial and radical cystectomy include achieving clear margins, minimizing local recurrence risk, preserving the quality of life, and optimizing patient performance status [3, 6, 9].

To address this clinical challenge, we conducted the first systematic review and meta-analysis comparing partial and total cystectomy in patients with locally advanced colorectal cancer undergoing en-bloc resection. By synthesizing the available evidence, we aim to guide surgical decision-making and optimize patient management in colorectal cancer cases amenable to curative surgical treatment while preserving function whenever possible. We aim to compare these two surgical approaches by evaluating postoperative complications, operative outcomes, and disease recurrence.

Materials and methods

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines [13]. The study protocol was registered in the International Prospective Register of Systematic Reviews (PROSPERO) with registration number CRD42024614891 [14].

Search strategy

A systematic search was performed on PubMed, Cochrane Central Register of Clinical Trials, Web of Science, and Scopus for studies published up to November 2024. The search strategy was as follows: (("Advanced colorectal cancer" OR "Colorectal neoplasms" OR "Locally advanced colorectal cancer" OR "Colorectal cancer" OR "Colon neoplasms" OR "Rectal neoplasms" OR "Colorectal carcinoma" OR "Colon carcinoma" OR "Rectal carcinoma" OR "Colorectal tumor" OR "Colon cancer" OR "Rectal cancer" OR "Colonic neoplasms" OR "Colorectal malignancy") AND ("Partial cystectomy" OR "Total cystectomy" OR "Complete cystectomy" OR "Radical cystectomy" OR "Bladder resection" OR "Bladder excision" OR "Segmental cystectomy" OR "Bladder removal" OR "Cystoprostatectomy" OR "Bladder invasion")).

Eligibility criteria

We included studies comparing partial and total cystectomy techniques in patients with colorectal cancer with bladder infiltration undergoing en-bloc resection. The exclusion criteria were: (1) urothelial bladder cancer, (2) patients who undergoing only palliative diverting urostomy, (3) studies lacking a control group; (4) publications that were not suitable for inclusion, such as single-arm studies, case reports, conference abstracts, meta-analyses, reviews, and animal experiments; or (5) overlapping populations. However, if different time periods or outcomes were addressed in the reports, both papers were considered for the analysis.

Data extraction and endpoints

Two authors (B.F.P and C.M.C.C.S) independently screened the articles for inclusion criteria and extracted data from the selected studies. Any disagreements were resolved by consensus or, if necessary, by consulting a third author (F.B.F). The outcomes assessed were postoperative complications, including (1) urinary leak, (2) intestinal leak, (3) pelvic abscess, (4) ileus, (5) surgical site infection (SSI), (6) urinary tract infection (UTI), (7) 90-day mortality, Furthermore we evaluated (1) blood loss, (2) operation time, (3) hospital stay, (4) local recurrence, and (5) distant recurrence.

Quality assessment

The evaluation of non-randomized studies was carried out using the Cochrane Collaboration tool for assessing the risk of bias in non-randomized studies (ROBINS-I) [15]. In this assessment, each study was categorized as critical, serious, moderate, or low risk in the seven domains: confounding, selection, classification, deviations from intended interventions, missing data, measurement of outcomes and selection of reported results. Two authors (B.F.P and L.S.S.P.G) independently assessed the risk of bias, and consensus resolved disagreements.

Statistical analysis

We pooled odds ratios (OR) for binary outcomes and mean differences (MD) for continuous endpoints, with 95% confidence intervals (CI). A random-effects model was used for all outcomes. Statistical significance was defined as $p < 0.05$. Heterogeneity was assessed using the Cochran Q test and I^2 statistics, with p values lower than 0.10 and $I^2 > 25\%$ being considered significant for heterogeneity. For outcomes with substantial heterogeneity, we used Baujat plots to assess each study's contribution to the overall effect and heterogeneity. Furthermore, we also performed leave-one-out sensitivity analyses by systematically removing each study from the pooled estimates to ensure the robustness of the results. R Software (R Foundation for Statistical Computing), version 4.4.1, was used for statistical analysis.

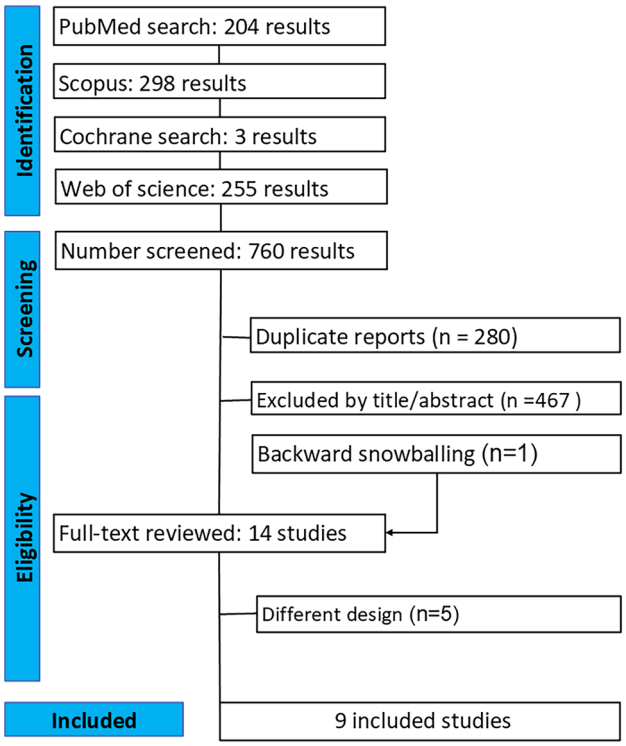

Fig. 1 PRISMA flow diagram of study screening and selection

Results

Study selection and characteristics

As shown in Fig. 1, the initial database search identified 760 results. After screening, 280 duplicates were removed, and 467 records were excluded based on titles and abstracts. One additional study was identified through backward snowballing, resulting in ten retrospective observational studies included in the final analysis [5, 16–23].

The studies involved 894 patients, of whom 433 (48.43%) underwent PC, and 461 (51.57%) underwent TC. Males comprised 75.6% of the cohort [5, 16–23]. The mean age was 59.87 ± 15.96 years for PC and 60.99 ± 12.63 years for TC. The mean BMI was 24.07 ± 2.46 kg/m^2 and 23.75 ± 3.00 [5, 16–23]. Tumor locations included the sigmoid (63.6%), rectum (30.7%), sigmoid + rectum (3.1%), right colon (2.1%), and transverse colon (0.5%) [5, 16–23].

Neoadjuvant treatment was predominantly chemotherapy (45.7%), followed by radiotherapy (41.50%) and chemoradiotherapy (12.7%) [5, 16–23]. For adjuvant therapy, 92.4% of patients received chemotherapy, 6.2% radiotherapy, and 1.3% chemoradiotherapy. All surgeries were performed via an open approach [5, 16–23]. Sigmoidectomies accounted for 50.75% of cases, with high anterior resections (HAR) and low anterior resections (LAR) representing 15.08% and 15.58%, respectively [5, 16–23]. Hartmann's procedures constituted 4.02% of cases, abdominoperineal resections (APR) 7.54%, total exenteration (TE) 6.03%, subtotal colectomy (STC) and intersphincteric resection 0.50% [5, 16–23]. In the PC group, urinary reconstruction was predominantly performed through primary repairs, comprising 78.57% of cases, with the remaining 21.43% involving ureteric reimplantation using a Boari flap and psoas hitch [5, 16–23]. Similarly, in the TC group, urinary reconstruction was primarily achieved with ileal conduits, accounting for 83.44% of cases [5, 16–23]. This was followed by colonic conduits at 10.26%, neobladder formations at 2.65%, ureterostomies at 3.31%, and primary repairs at 0.33 [5, 16–23]. The mean follow-up period was 47.03 ± 17.06 months. Study characteristics are detailed in Tables 1 and 2.

Pooled analyses of all studies

Postoperative complications

In the pooled analysis of patients with colorectal cancer undergoing partial or total cystectomy, no significant differences were observed between the groups for the following outcomes: UTI (OR 0.39; 95% CI 0.06–2.53; p = 0.325; I^2 = 80%; Fig. 2A) [5, 19, 21], with high heterogeneity; intestinal leak (OR 0.50; 95% CI 0.18–1.41; p = 0.191; I^2 = 0%; Fig. 2B) [5, 16, 19, 21, 22], ileus (OR 0.47; 95% CI 0.09–2.46; p = 0.374; I^2 = 0%; Fig. 2C) [19, 21, 22], 90-day mortality (OR 1.01; 95% CI 0.18–5.69; p = 0.990; I^2 = 0%; Fig. 3A) [17, 21, 22], and urinary leak (OR 1.02; 95% CI 0.52–2.00; p = 0.948; I^2 = 0%; Fig. 3B) [5, 16, 19, 21], all showing low heterogeneity. For pelvic abscess (OR 0.31; 95% CI 0.06–1.49; p = 0.144; I^2 = 65%; Fig. 3C), heterogeneity was high [5, 16, 21, 22]. In contrast, SSI was significantly lower in the PC group (OR 0.33; 95% CI 0.13–0.80; p = 0.015; I^2 = 24%; Fig. 4A), with low heterogeneity [5, 19, 21].

Operative outcomes and recurrence

Operative time was significantly shorter in the PC group (MD − 169.7 min; 95% CI − 214.1 to − 125.3; p < 0.01; I^2 = 35%; Fig. 4B), with moderate heterogeneity [5, 21–23]. Blood loss was also significantly lower in the PC group (MD − 1005.9 ml; 95% CI − 1362.1 to − 649.8; p < 0.01; I^2 = 52%; Fig. 4C), with moderate heterogeneity [5, 18, 21–23]. Hospital stay was significantly reduced in the PC group (MD − 6.6 days; 95% CI − 9.4 to − 3.9; p < 0.01; I^2 = 10%; Fig. 5A), showing low heterogeneity [5, 21–23]. For long-term outcomes, no significant difference was observed between the groups for local recurrence (OR 0.52; 95% CI 0.26–1.02; p = 0.058; I^2 = 0%; Fig. 5B), with low heterogeneity [17, 18, 20–22]. Similarly, no significant difference was found for distant recurrence (OR 0.78; 95% CI

Table 1 Baseline characteristics of the observational studies included

Author	Country	PC/TC	Design	Sex (male) n (%) PC/TC	BMI (kg/m^2) mean ± SD PC/TC	Age (years) mean ± SD PC/TC	ASA n (%) PC/TC	Tumor location n (%) PC/TC	Preoperative treatment n (%) PC/TC	Adjuvant therapy n (%) PC/TC
Balbay 1999	USA	35/46	R-Obs	9 (25)/36 (78)	NA	50.0 ± 30 /51.5 ± 23.5	NA	Sig/rectal 46 (57) Recurrent 35 (43)	Crt 25 (71)/24 (52), Ch 1(2.8)/5 (20) Rxt 2 (5.7)/5 (10.8)	NA
Carne 2004	New Zealand	45/4	R-Obs	30 (66)/1 (25)	NA	69.0 ± 31.0/72.5 ± 1.5	NA	RC: 2 (4.4)/0 (0) TC: 1 (2.2)/0 (0) Sig: 42 (93.3)/2 (50) Rectal: 0 (0)/2 (50)	NA	Ch 6 (13)/1 (25) Rxt 9 (20)/0 (0) Crt: 2 (4.4)/0 (0)
Chiang 2024	Taiwan	20/21	R-Obs	17 (85)/16 (76.1)	22.5 ± 0.9/20.8 ± 1.4	64.9 ± 4.7/64.5 ± 5.6	NA	Rectal: 0/12 (57.1) Sig: 16 (80)/3 (14.3) Sig/rectal: 4 (20)/6 (28.6)	1 (5)/9 (42.9)[a]	10 (50)/9 (42.9)[a]
Fujisawa 2002	Japan	19/12	R-Obs	14 (73.3)/12 (100)	NA	57.7 ± 14.2/61.1 ± 7.5	NA	Sig 15 (79)/4 (33) Rectal 4 (21)/8 (67)	NA	NA
Gao 2007	China	28/5	R-Obs	18 (64)/3 (60)	NA	60.2 ± 10.25/68.3 ± 2.75	NA	RC: 1 (3.5)/1 (20) TC: 1 (3.5)/0 (0) Sig 21 (75)/4 (80) Rectal: 5 (17.8)/0 (0)	NA	NA
Kondo 2019	Japan	72/18	R-Obs	60 (83.3)/ 15 (83.3)	NA	60.5 ± 9.75/ 53 ± 9	NA	Sig 46 (63.9)/5 (27.8) Rectal 26 (36.1)/13 (72.2)	Ch 5 (6.9) 0 (0) Crt 1 (1.4) 1 (5.5)	Ch 19 (26.4) 3 (16.7)

Table 1 (continued)

Author	Country	PC/TC	Design	Sex (male) n (%) PC/TC	BMI (kg/m^2) mean ± SD PC/TC	Age (years) mean ± SD PC/TC	ASA n (%) PC/TC	Tumor location n (%) PC/TC	Preoperative treatment n (%) PC/TC	Adjuvant therapy n (%) PC/TC
Palma 2023	Australia	60/269	R-Obs	31 (51.7)/221 (82.2)	NA	57 ± 16.2/57.5 ± 16.4	ASA1 5 (9.8)/23 (9.4)	Rectal 31 (51.7) 121 (45.0)	Rxt 29 (48.3)/169 (62.8)	NA
							ASA 2 26 (51.0)/100 (41.0)	Recurrent 29 (48.3) 148 (55.0)	Ch 33 (55.0)/174 (64.7)	
							ASA 3 20 (39.2)/121 (49.6)			
Suh 2024	Korea	105/46	R-Obs	78 (74.3)/38 (82.6)	23.9 ± 3.7/22 ± 3	63 ± 12/63 ± 11.5	ASA III, IV 7 (6.7) 7 (15.2)	Cecum 1 (1.0)/0 (0)	Crt 1 (1.0)/7 (15.2)	Ch 76 (72.4)/32 (69.6)
								Sig 68 (64.8)/20 (43.5)	Ch 2 (1.9)/1 (2.2)	
								Rectal 36 (34.3)/26 (56.5)		
Yoshida 2019	Japan	49/40	R-Obs	40 (82)/37 (93)	NA	55.5 ± 11.75/49.5 ± 15.25	NA	Cecum 3 (6)/1 (3)	Ch 1 (2) 4 (10)	NA
								Sig 40 (82)/12 (30)	Crt 1 (2) 3 (8)	
								U-rectal 5 (10)/10 (25)		
								L-rectal1 (2)/17 (42)		

R-obs retrospective observational study, *N/A* not available, *Ch* chemotherapy, *Rxt* radiotherapy, *Crt* chemoradiotherapy, *RC* right colon, *Sig* sigmoid, *U-rectal* upper rectal cancer, *L-rectal* lower rectal cancer

[a]No subsets were given

Table 2 Surgical characteristics of the studies included in the meta-analysis

Author	Surgical approach n (%) PC/TC	Surgical technique n (%) PC/TC	Stoma n (%) PC/TC	Urinary reconstruction n (%) PC/TC	Follow-up (months) PC/TC
Balbay 1999	Open all	NA	NA	NA	31.5 ± 30.7
Carne 2004	Open all	NA	NA	NA	62 ± 23.5
Fujisawa 2002	Open all	Sigmoidectomy 12 (63)/8 (67)	NA	Partial: Primary repair 19 Total: Neobladder 8 Ileal conduit 3 Ureterostomy 1	45.0 ± 19.8/28.8 ± 4.8
Gao 2007	Open all	NA	NA	NA	60 (no SD given)
Chiang 2024	NA	APR: 0 (0)/15 (71.4) HAR: 10 (50)/2 (9.5) LAR: 7 (35)/2 (9.5) Hartmann: 2 (10)/1 (4.8) STC: 1 (5)/0 (0)	Colostomy: 3 (50)/12 (63.2) Ileostomy: 3 (50)/7 (36.8)	Primary repair: 20 (100)/1 (4.8) Ureterostomy: 0/9 (42.9) Ileal conduit: 0/11 (52.4)	31.3 ± 9.4/15.7 ± 5.4/
Kondo 2019	Open all	Sigmoidectomy 31 (43.1)/1 (5.5) HAR17 (23.6)/1 (5.5) LAR 19 (26.4)/3 (16.8) Intersphincteric 0 (0)/1 (5.5) Hartmann 5 (6.9)/0 (0) TE 0 (0) 12 (66.7)	NA	NA	62 (no range given)**
Palma 2023	NA	NA	NA	Ileal Conduit 0/238 (88.5) Colonic Conduit 0/31 (11.5) Primary repair 38 (63)/0 Boari flap + psoas hitch 21 (35)/0	NA
Suh 2024	Open all	NA	NA	NA	63 (no range given)**
Yoshida 2019	Open all	Sigmoidectomy 29 (60)/20 (50)	NA	NA	71 ± 2.97

** *Median, R-obs* retrospective observational study, *N/A* not available, *HAR* high anterior resection, *LAR* lower anterior resection, *TE* total exenteration, *APR* abdominoperineal excision

0.45–1.36; p = 0.387; $I^2 = 0\%$; Fig. 5C), which also demonstrated low heterogeneity [18, 21–23].

Sensitivity analyses

In the Baujat plot analysis, the studies contributing most to heterogeneity were identified. For UTI, Kondo et al. were the primary contributors (Fig. S1), but their exclusion in the leave-one-out analysis did not alter the results, which remained consistent (Fig. S2). For pelvic abscesses, Kondo et al. were again identified as the main contributors (Fig. S3). However, removing this study had no impact, and the results remained stable (Fig. S4). Regarding operative time, Kondo et al. emerged as the primary drivers of heterogeneity (Fig. S5). The leave-one-out analysis successfully resolved the heterogeneity while preserving statistical significance in favor of partial cystectomy (Fig. S6). For blood loss, Kondo et al. were once more the main contributors to heterogeneity (Fig. S7). Their exclusion confirmed the consistency of the results (Fig. S8). The observed heterogeneity may be attributed to differences in patient selection criteria, definitions of interventions, perioperative management practices, and institutional variations. Despite these factors, the analysis reinforces the robustness of our conclusions and the reliability of the findings despite variability among studies. Nonetheless, future prospective studies with standardized methodologies are recommended to validate these results.

Quality assessment

The individual assessment of each study included in the meta-analysis is presented in Fig. 6. Nine studies were included in the assessment, with five classified as having a serious risk of bias [16, 17, 19, 20, 23], and four as having a moderate risk [5, 18, 21, 22, 24]. The primary contributing factor to the overall risk of bias was related to confounding (D1). Studies with a serious risk of bias did not employ preventive or analytical strategies to mitigate this issue, while those with a moderate risk utilized multivariate analysis to adjust for potential confounding variables. Key biases, particularly in the domains of confounding, were inherent to the retrospective nature of the studies. These biases could influence the comparability of groups and the interpretation of outcomes, particularly perioperative results. Other domains assessed by the ROBINS-I tool demonstrated a low risk of bias and did not significantly impact the findings. However, sensitivity analyses confirmed the robustness of our findings despite these limitations. Future prospective

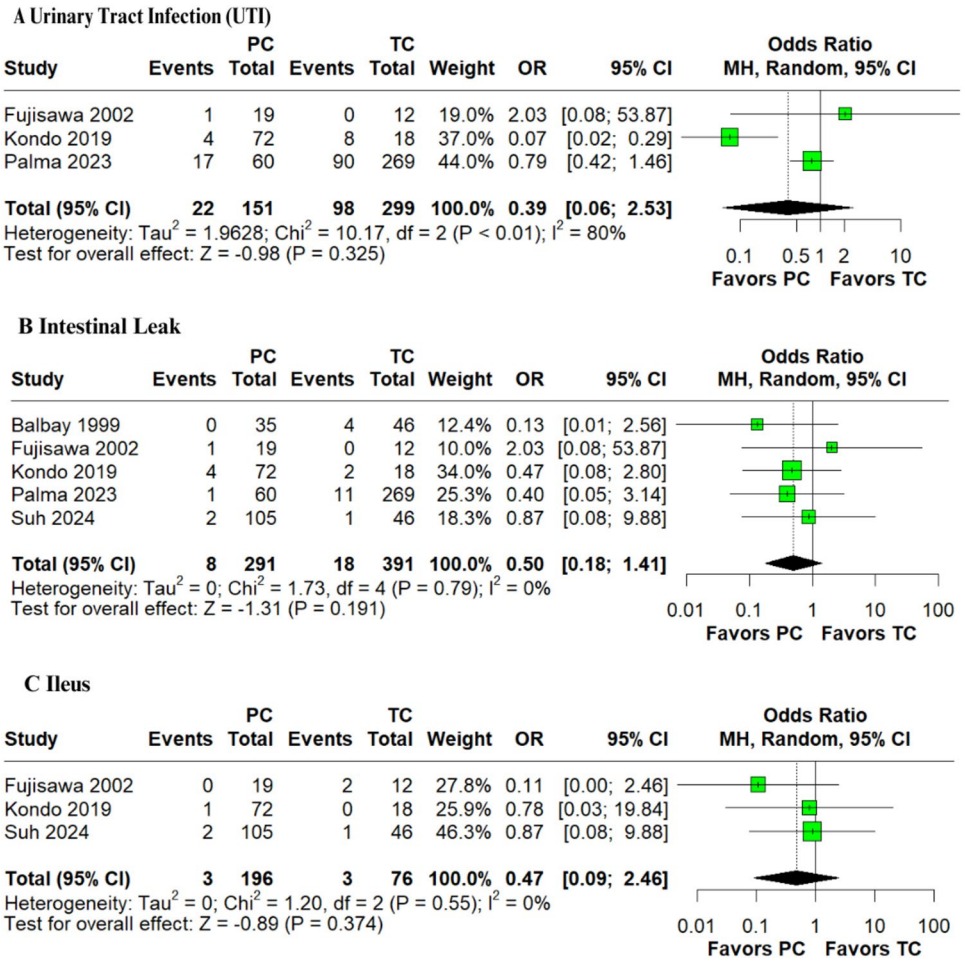

Fig. 2 Forest plots of comparison between partial vs total cystectomy in advanced colorectal cancer: **A** UTI, **B** intestinal leak, **C** ileus

studies with standardized methodologies are recommended to validate these results.

Discussion

In this systematic review and meta-analysis, which included nine retrospective observational studies with a total of 894 patients undergoing partial or total cystectomy for advanced colorectal cancer, partial cystectomy was associated with reduced surgical site infection rates, shorter operative time, decreased blood loss, and shorter hospital stay. No significant differences were observed for local recurrence, distant recurrence, urinary leak, intestinal leak, pelvic abscess, ileus, urinary tract infection, or 90-day mortality.

Tumors of the sigmoid colon and upper rectum often adhere to or invade the bladder in approximately 30% of T4b cases [7, 25, 26]. However, some studies indicate that only 55% of these tumors invade adjacent organs, while the remaining 45% involve inflammatory adhesions without malignancy [3, 7, 8, 26–30]. Attempts to separate adherent structures should be avoided, as doing so when adhesion is due to malignant invasion significantly increases the risk of local recurrence and reduces survival rates [26, 27].

Instead, aggressive treatment is essential for patients with locally advanced colorectal cancer [3, 7, 8, 26–30]. For this reason, pelvic exenteration remains the treatment of choice, involving radical en-bloc resection of all pelvic organs, including the rectum, sigmoid colon, distal ureters, bladder, internal reproductive organs, surrounding lymph nodes, and pelvic peritoneum [3, 7, 8, 27–29]. Achieving an R0 resection is the strongest predictor of long-term survival, regardless of whether partial or total cystectomy is performed [3, 8, 11, 26–30].

Luo et al. investigated prognostic factors in colorectal cancer (CRC) adherent to the bladder treated with bladder-preserving en-bloc resection [3]. Among 84 patients with stage IIIC (T4bN0M0) colorectal cancer, preoperative colovesical fistula and positive CT findings were significantly associated with bladder invasion. Pathological bladder invasion independently predicted intravesical recurrence (HR 10.71) and distant metastasis (HR 4.85) [3]. The study concluded that bladder invasion increases the risk of recurrence and metastasis in patients undergoing

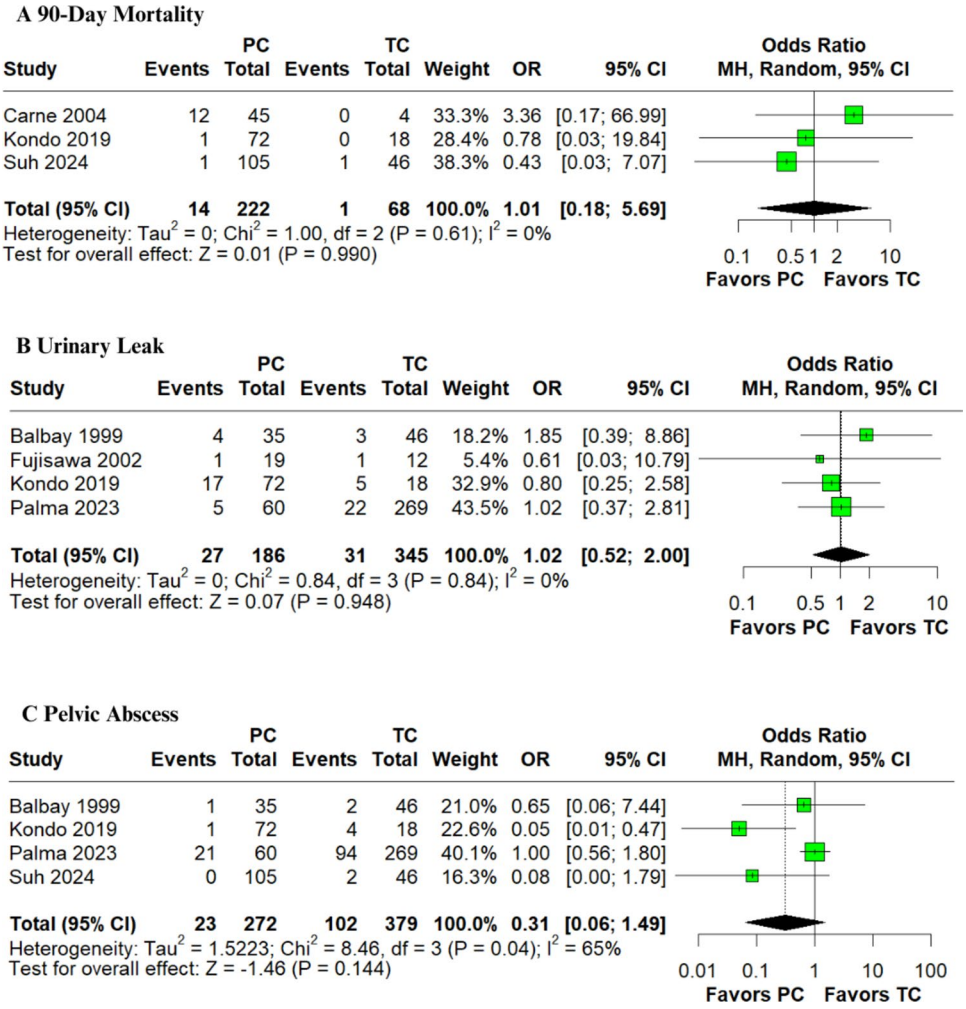

Fig. 3 Forest plots of comparison between partial vs. total cystectomy in advanced colorectal cancer: **A** 90-day mortality, **B** urinary leak, **C** pelvic abscess

bladder-preserving surgery for bladder-adherent CRC [3]. Aligned with these findings, Vuillermet et al. highlighted the role of bladder invasion in recurrence risk [26]. Their study reported a 14.5% local recurrence rate, with 65% occurring in the bladder, even without histological bladder invasion. The study also demonstrated that R1 resections significantly increased local recurrence rates compared to R0 resections (63% vs. 10%; $p < 0.0001$) [26]. While our meta-analysis could not evaluate outcomes related to adhesion, tissue invasiveness, or resection margins, no significant differences were observed in local recurrence rates between partial and total cystectomy. These findings suggest that achieving R0 resection margins remains the key factor for long-term oncologic control, regardless of the extent of bladder resection. It is noteworthy that with the advent of perioperative chemotherapy, recent evidence has shown promising results in the management of locally advanced colon cancer [31, 32]. This further supports the safety and rationale for partial cystectomy, as it increases the likelihood of tumor downstaging, thereby reducing the morbidity associated with extensive multivisceral procedures. These findings underscore the critical importance of achieving R0 resection margins, accurately confirming bladder invasion through histopathological evaluation, and adhering to T4b staging criteria to guide surgical decision-making and optimize oncologic outcomes, particularly in the context of advanced colorectal cancer amenable to curative surgical treatment.

Operative time is an important quality indicator in surgery, as longer operative times may be associated with an increased risk of postoperative complications [33]. Pelvic exenteration presents a significant challenge for surgeons, requiring extensive knowledge, experience, and meticulous

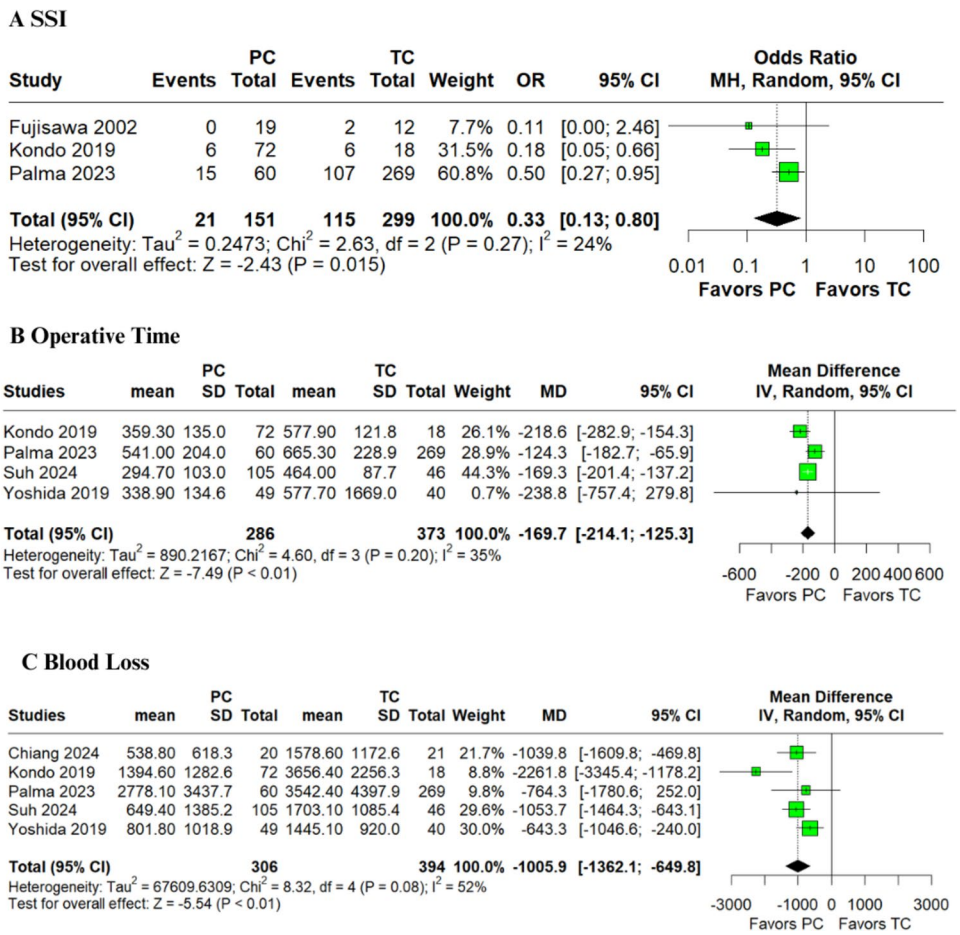

Fig. 4 Forest plots of comparison between partial vs. total cystectomy in advanced colorectal cancer: **A** SSI, **B** operative time, **C** blood loss

procedural planning [8, 27]. Despite the availability of advanced preoperative diagnostic tools, the decision to perform a partial or total cystectomy and the choice of urinary and intestinal reconstruction are often made intraoperatively based on the surgical findings [3, 7, 8, 26–30]. Dissection of the iliac vessels, combined with pelvic lymphadenectomy and multivisceral resection, is essential to achieve adequate R0 margins. However, these steps significantly contribute to the prolonged operative time. Notably, when feasible, a properly executed partial cystectomy reduces surgical complexity, leading to shorter operative time, decreased blood loss, and shorter hospital stays [21–23].

The reduction in SSI in partial cystectomies was also observed in a study by Croner et al., which analyzed multivisceral surgeries performed for locally advanced colorectal cancer. In their cohort, 25.8% of patients experienced postoperative complications, with surgical complications occurring in 11% [12]. The most common surgical complication was impaired wound healing (5.2%), reflecting the inherent challenges of extensive procedures [12]. Other complications, such as anastomotic leakage (2.8%), postoperative bleeding (2.3%), and less frequent events like fistulas and ureter injuries, further highlighted the complexity and risk associated with these surgeries [12].

This study has several limitations. First, the included studies were all retrospective observational studies, which cannot establish causality and are inherently subject to biases, including confounding. Although we used sensitivity analyses to address heterogeneity, these biases may still influence the results. Second, there was significant heterogeneity in some outcomes, particularly operative time, blood loss, and urinary tract infections, driven largely by individual studies. While sensitivity analyses confirmed the robustness of the findings, this variability underscores the need for caution in interpreting the results. Third, the study could not evaluate the influence of surgical margins on outcomes or the degree of bladder invasiveness, both of which are critical factors that could impact local and distant recurrence rates.

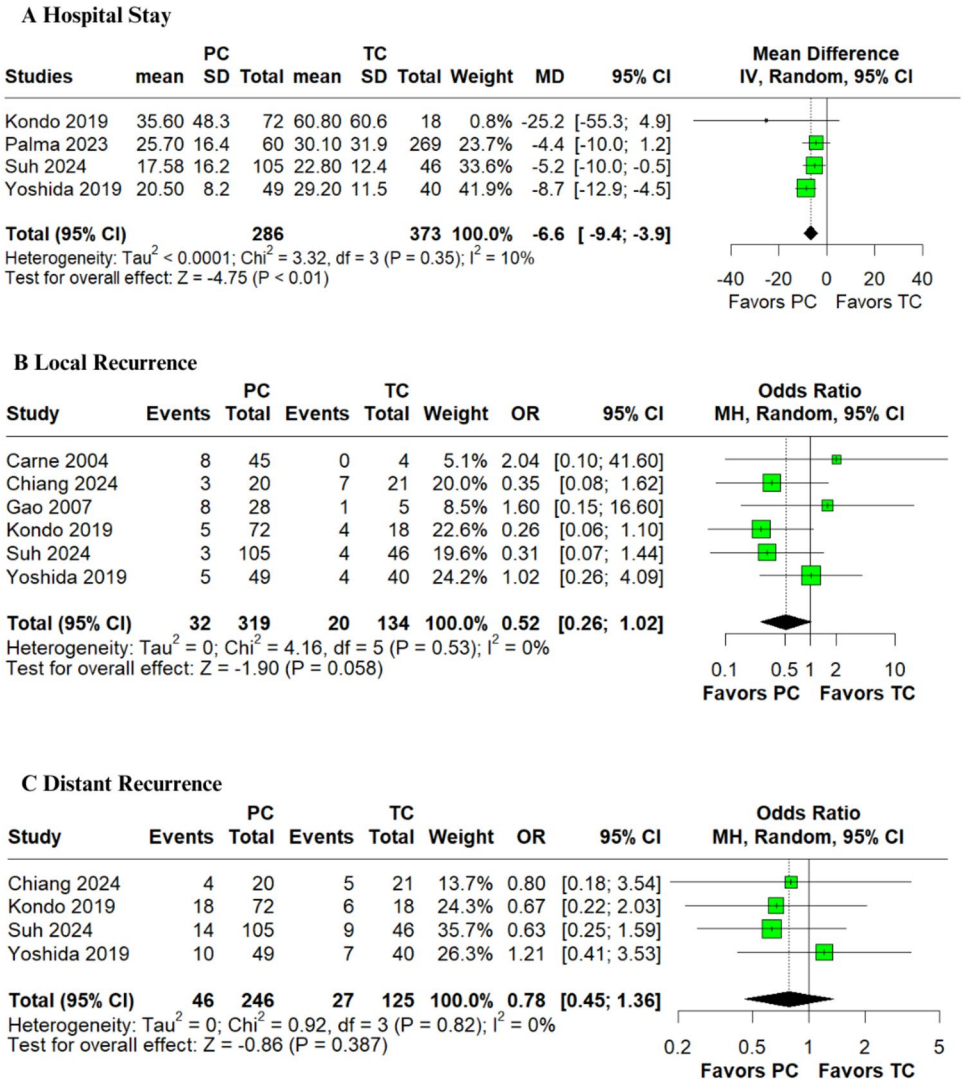

Fig. 5 Forest plots of comparison between partial vs total cystectomy in advanced colorectal cancer: **A** hospital stay, **B**, **C** local recurrence, **D** distant recurrence

Fourth, the patient selection criteria for partial cystectomy were not standardized across studies, potentially limiting the generalizability of the findings. Not all patients with bladder invasion may be suitable candidates for partial cystectomy, as decisions are often influenced by factors such as tumor location, extent of invasion, and surgeon experience, which were not consistently reported in the included studies. Fifth, the lack of standardized definitions for perioperative complications and the varying follow-up durations among studies introduce additional variability, particularly in long-term outcomes such as recurrence and survival rates. Finally, the absence of prospective, randomized controlled trials limits the strength of evidence supporting partial cystectomy as a definitive alternative to total cystectomy. To address these limitations, future studies should prioritize prospective, randomized designs with standardized methodologies, consistent definitions of interventions and outcomes, robust patient selection criteria, and comprehensive reporting of key factors such as surgical margins and bladder invasiveness. Such studies will be essential to validate these findings and guide clinical decision-making in the management of locally advanced colorectal cancer.

Conclusion

In this systematic review and meta-analysis of nine retrospective observational studies, including 894 patients undergoing partial or total cystectomy for advanced colorectal cancer, partial cystectomy was associated with reduced surgical site infection rates, shorter operative time, decreased blood loss, and a reduced duration of hospital stay. No significant differences were observed between the groups for local recurrence, distant recurrence, urinary leak, intestinal leak, pelvic abscess, ileus, urinary tract infection, or 90-day mortality.

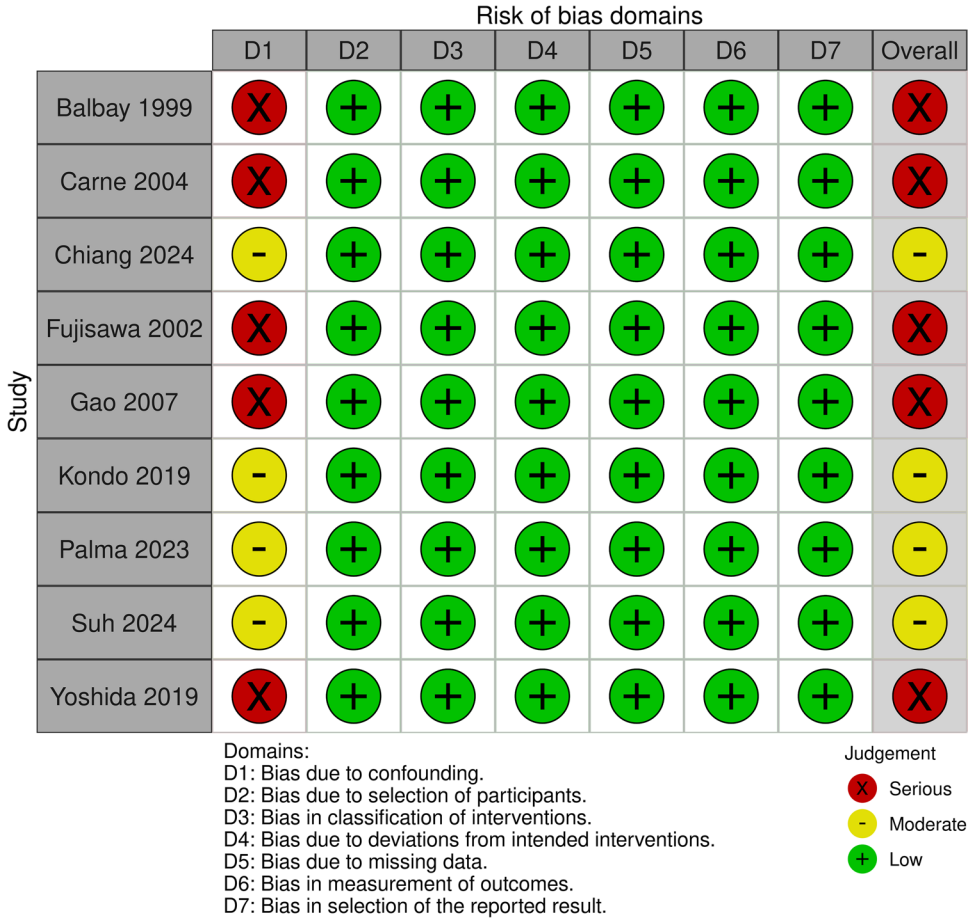

Fig. 6 Critical appraisal of studies according to the Cochrane Collaboration's tool for assessing risk of bias—ROBINS-I

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Declarations

Conflict of interest F.B.F. is a speaker for Janssen Brazil. All other authors report no relationships that could be construed as a conflict of interest. All authors take responsibility for all aspects of the reliability and freedom from bias of the data presented and their discussed interpretation.

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