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Risk factors for postoperative abdominal infection of colorectal cancer

A systematic review based on the PRISMA guidelines

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Abstract

Background: Intra-abdominal infections are a common complication of colorectal cancer surgery. Postoperative abdominal infections can cause systemic inflammatory response syndrome, which seriously affects the prognosis of patients. With the widespread application of antibiotics, the detection rate of drug-resistant bacteria has increased annually, resulting in increased pressure on antibiotic treatment selection. To improve the prognosis of postoperative patients with colorectal cancer, it is important to actively search for risk factors leading to postoperative abdominal infection and formulate effective intervention measures according to these risk factors.

Methods: A comprehensive search was conducted using several databases, including China National Knowledge Infrastructure, Wanfang Data, VIP, CBM, PubMed, Embase, and OVID, until September 2025. Case-control studies focusing on postoperative abdominal infections in colorectal cancer were conducted, and a meta-analysis was performed using the RevMan 5.4 software.

Results: A total of 21 case-control studies were included, and 42 risk factors for infection were identified. The results indicated that significant differences ($P < .05$) existed between the postoperative abdominal infection and non-infection groups concerning various factors, including diabetes mellitus, hypertension, cardiovascular disease, hypoproteinemia, tumor-node-metastasis stage I, tumor location, and several perioperative variables: operation time exceeding 150 minutes, hospital stay of 30 days or more, drainage tube indentation lasting over 10 days, serum albumin levels, preoperative hemoglobin levels, incision length > 15 cm, blood loss exceeding 300 mL, laparoscopic surgery, postoperative fistula, preoperative intestinal obstruction, anemia, anastomotic fistula, combined organ resection, preoperative ASA score, perioperative blood transfusion, and reoperation.

Conclusion: Given the multitude of identified risk factors for postoperative abdominal infections in colorectal cancer, medical institutions should prioritize the prevention and control of hospital infections. This includes developing targeted strategies based on identified risk factors, careful assessment of surgical indications for colorectal cancer patients during clinical diagnosis and treatment, strict adherence to surgical protocols, and enhancing organ function support for patients post-surgery to reduce the incidence of postoperative abdominal infections.

Abbreviations: ASA = American Society of Anesthesiologists, CRC = colorectal cancer, NOS = Newcastle–Ottawa Scale, OR = odds ratio, TNM = tumor-node-metastasis.

Keywords: abdominal infection, colorectal cancer, risk factors, systematic review

1. Introduction

Colorectal cancer (CRC) is a malignant tumor of the digestive system that predominantly affects middle-aged and elderly individuals. It is the third most common malignant tumor globally and the second leading cause of death among cancer patients.[1] Relevant studies indicate that over 7,00,000 patients succumb to CRC each year, with approximately 1 million new cases diagnosed.[2] The treatment and recovery processes for this disease have garnered increasing attention from society. Surgical intervention can effectively control disease progression and extend survival in patients with CRC.

JZ and XF contributed to this article equally.

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However, intra-abdominal infections are a frequent complication associated with CRC surgery. Epidemiological investigations have revealed that the postoperative abdominal infection rate can reach 30%.[3] Such infections can trigger a systemic inflammatory response syndrome and may even lead to sepsis, significantly hindering patient recovery and imposing a substantial economic burden on families and society. With the widespread use of antibiotics, the detection rate of drug-resistant bacteria in abdominal infections has increased annually, resulting in heightened challenges regarding antibiotic selection. Consequently, patients with CRC face the dual challenges of surgical intervention and infection. While addressing abdominal infections is crucial, the author posits that it is essential to actively identify the risk factors contributing to postoperative abdominal infections in patients with CRC and to develop targeted intervention measures based on these risk factors to reduce the incidence of such infections. Currently, some researchers have initiated research on the risk factors associated with postoperative abdominal infections in patients with CRC.[4] however, no systematic review has been identified. This study aimed to compile all pertinent clinical control studies, both domestically and internationally, and to systematically evaluate the risk factors contributing to postoperative abdominal infections in this patient population. These findings will serve as a reference for medical institutions and health administrative departments at various levels, aiding in the prevention and treatment of postoperative abdominal infections in patients with CRC.

2. Materials and methods

According to the PRISMA guidelines. This systematic review was registered with PROSPERO (registration no. CRD42024610042) according to the PRISMA guidelines.

2.1. Inclusion and exclusion criteria

The inclusion criteria for this study were as follows – Study design: a case-control study of the risk factors for postoperative abdominal infection of CRC. Subjects: patients with or without abdominal infection after CRC surgery. Patients with CRC whose diagnostic criteria meet the relevant diagnostic criteria in the Chinese Guidelines for the Diagnosis and Treatment of Colorectal Cancer (2017 Edition)[5] and whose diagnosis is confirmed by postoperative pathology; have complete clinical data; the diagnostic criteria for abdominal infection are in line with the Guidelines for Diagnosis and Treatment of Abdominal Infection in China (2019 Edition).[6] Outcome indicators: including the patient's age, gender, related underlying diseases, tumor stage, operation mode, operation time, blood loss and so on.

The exclusion criteria were as follows: reviews, case reports, and studies with invalid data; duplicate publications; no literature on the control group; and literature with inconsistent or unclear diagnostic criteria.

2.2. Search strategy

A case-control study of the risk factors for postoperative abdominal infection in patients with CRC was conducted using the China National Knowledge Infrastructure (cnki.net/), Wanfang Medical network (med.wanfangdata.com.cn), VIP (cqvip.com), Chinese Biomedical Literature Database (sinomed.ac.cn/), PubMed (Pubmed. ncbi. nlm. nih. gov/), Embase (embase.com), and OVID (ovidsp.ovid.com/). The search period was from the establishment of each database until September 2025. The following terms were searched: colorectal cancer OR colorectal cancer surgery AND abdominal infection AND risk factors AND "Intra-abdominal infections OR IAI." Terms were searched in both Chinese and English, using the same combination of heterogeneous words, a combination of subject words and free words, and the default database extended search.

2.3. Literature screening and data extraction

Two researchers (JZ and XD) carefully read and screened the literature according to the inclusion and exclusion criteria. A third researcher (XX) was asked for an opinion on controversial literature, and the final decision was made on whether to include it. The extracted information included relevant data of the investigator, publication year, region, number of cases in the experimental and control groups, and outcome measures (demography, combined underlying disease, tumor stage, surgical method, etc). In the process of information extraction, if you encounter literature with incomplete data, try to contact the author to obtain the complete data.

2.4. Literature quality evaluation

Literature quality evaluation was performed using the Newcastle–Ottawa Scale (NOS),[7] which included – Selectivity: representativeness of the exposed cohort (1 point), representativeness of the nonexposed cohort (1 point), certainty of the exposure factors (1 point), and whether any outcome event occurred before the study began (1 point); Comparability: whether confounding factors were controlled (1 or 2 points); and Outcome: evaluation of outcome events (1 point), adequacy of follow-up (1 point), and completeness of follow-up (1 point). With a full score of 9, NOS scores were divided into 3 grades: low, medium, and high-quality (<5, 5–<8, and 8–9, respectively). The maximum total score was 9 points, and a total score of ≥7 points was considered high-quality.

2.5. Statistical analysis

The meta-analysis was performed using RevMan 5.4 software (The Cochrane Collaboration).[8] The mean difference was used as the evaluation index for continuous variables, and the odds ratio (OR) was used as the evaluation index for bitaxonomic variables. The 95% confidence intervals were calculated for both variables using $\alpha = 0.05$. When $I^2 < 50\%$, the heterogeneity was small, and a fixed-effects model was used; when $I^2 \geq 50\%$, the heterogeneity was large, and the random-effects model was used to analyze and interpret the results carefully.

3. Results

3.1. Literature search results

A total of 2076 articles were retrieved, including 124 from China National Knowledge Infrastructure, 48 from Wanfang Medical Network, 27 from VIP, 17 from Chinese Biomedical Literature Database, 100 from PubMed, 34 from Embase, and 77 from OVID. 1730 pieces of literature were excluded by reading titles, abstracts, and keywords. After reading the full paper, 325 pieces of literature were excluded, including 26 case reports, 10 without full papers, 90 that did not meet the inclusion and exclusion criteria, 18 reviews, 93 self-controlled studies, and 67 with unclear outcome indicators. Finally, 21 literatures[9-29] were included, comprising 960 patients with postoperative abdominal infection and 4670 patients without postoperative abdominal infection for CRC. (Fig. 1).

3.2. Literature features

A total of 21 case-control studies[9-29] were included, comprising 6 in English[24-29] and 15 in Chinese.[9-23] NOS scores were used for 5 studies,[11,13,14,16,18-21,24-26,29] 7 studies,[10,15,22,27,28] 7 studies,[9,12,17,23] and 6 studies,[9,12,17,23] with no low-quality literature.

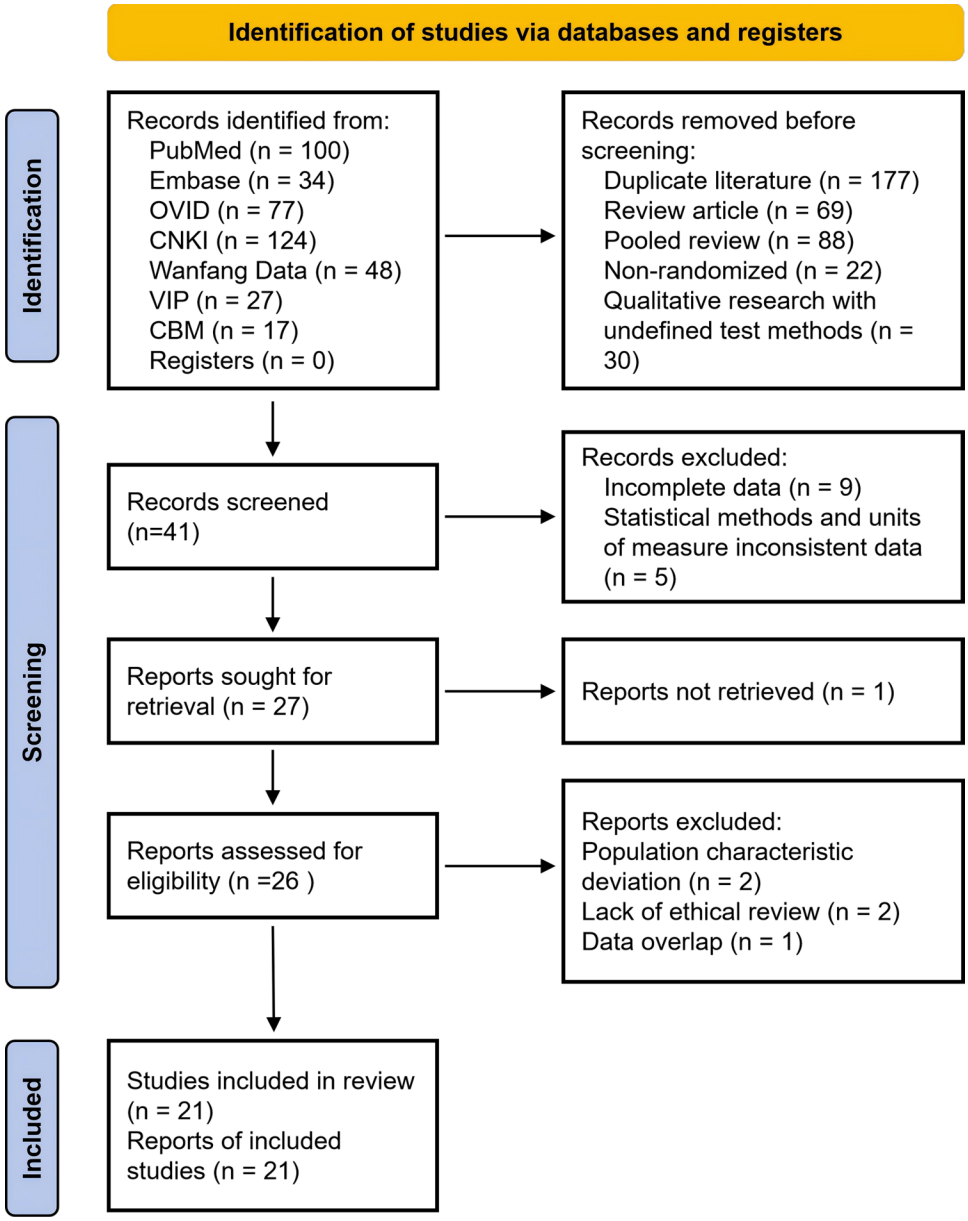

Figure 1. Flowchart of literature screening.

Risk factors included demographic statistics, underlying diseases, invasive procedures, source of infection, department of admission, antimicrobial therapy, and length of hospital stay (Table 1).

3.3. Meta-analysis results

Risk factors for postoperative abdominal infection of CRC were analyzed in a meta-analysis. The results showed that the patients were complicated with diabetes, hypertension, cardiovascular disease, hypoproteinemia, tumor-node-metastasis (TNM) stage I, tumor location in the colon, and perioperative relevant information: operation time > 150 minutes, hospital stay ≥ 30 days, drainage tube indentation ≥ 10 days, serum albumin content, preoperative hemoglobin content, incision length > 15 cm, blood loss > 300 mL, laparoscopic surgery, postoperative fistula, preoperative intestinal obstruction, anemia, anastomotic fistula, combined organ resection, preoperative American Society of Anesthesiologists (ASA) score, perioperative blood transfusion, and reoperation. The difference was statistically significant ($P < .05$). There were no significant differences in other risk factors ($P > .05$; Table 2; Details were shown in Supplementary Material S1–S42, Supplemental Digital Content).

3.4. Heterogeneity analysis

The heterogeneity in the meta-analysis included clinical, methodological, and statistical heterogeneity.[30] Some meta-analysis results in this study showed heterogeneity (Table 2). The experimental design and statistical methods of the included studies were consistent; therefore, the source of heterogeneity in this study was clinical. The combination of renal insufficiency, smoking history, serum hemoglobin content, preoperative use of antibiotics, and adjuvant chemotherapy was prone to heterogeneity owing to the small number of included studies and small sample size. The inability to achieve homogenization of infection prevention and control in various medical institutions, surgical level, preoperative evaluation, etc, is the main source of heterogeneity resulting from preoperative intestinal obstruction,

Table 1

Basic characteristics and NOS scores of literature on postoperative abdominal infections in colorectal cancer.

Study	Reference	Publication time	Area/Nation	Number of intervention cases/n		Risk factor	NOS score
				Observation	Control		
Li et al	[9]	2022	Henan China	33	33	01, 04–06, 13, 14, 16–19, 21	6
Quan et al	[10]	2018	Shanxi China	16	166	01, 03, 05, 15, 20, 26–30	7
Liang et al	[11]	2023	Shandong China	34	164	01, 02, 05, 06, 13, 16, 17, 20, 24, 25, 31–33	8
Yuan et al	[12]	2019	Guangdong China	31	194	01, 04, 05, 06, 12, 15, 20, 27, 28, 30, 33	6
Zhang	[13]	2020	Hainan China	122	674	01, 03, 05, 13, 16, 17, 20–23, 26–29, 33–36	8
Jia and Ma	[14]	2022	Henan China	25	188	01, 03, 05, 13, 20, 21, 23, 26, 27, 33	8
Xue et al	[15]	2024	Hebei China	23	239	01, 03, 05, 06, 13, 16–19, 27, 30, 31, 33	7
Zhang et al	[16]	2023	Neimenggu China	55	388	01, 02, 05–08, 15, 16, 18, 19, 30, 32, 37	8
Lin and Li	[17]	2022	Henan China	48	48	01, 02, 05, 13, 16, 17, 21, 22, 26–28, 34, 36	6
Zhang et al	[18]	2021	Zhejiang China	30	30	01, 02, 05, 14, 15	8
Jia et al	[19]	2016	Zhejiang China	110	663	01, 02, 05, 07–11, 13, 16, 17, 21, 23, 28, 31–36	8
Li et al	[20]	2022	Henan China	39	114	01, 03, 05, 06, 13, 16, 17, 22, 23, 29, 31–34, 36	8
Liu et al	[21]	2021	Chongqing China	45	45	01, 02, 14, 15	8
Liu et al	[22]	2023	Hebei China	52	44	01, 03, 05, 06, 12, 16, 17, 28	7
Cui	[23]	2022	Yunnan China	31	120	01, 05, 06, 07, 11, 16, 17, 24, 28, 31, 33, 35	6
Pei et al	[24]	2022	Jiangsu China	46	356	01, 05, 13–15, 17, 24, 25, 28, 31, 35, 36, 40	8
Alonso et al	[25]	2016	Spain	23	23	01, 05, 07, 09, 10, 13–19, 28, 36–39, 41	8
Alonso et al	[26]	2015	Spain	30	30	01, 02, 16, 17, 28, 36–39, 41, 42	8
Povsic et al	[27]	2016	Slovenia	68	132	01, 02, 05, 13–17, 28, 35, 36, 38	7
Sánchez-Velázquez et al	[28]	2018	Spain	37	326	01, 18, 19, 28, 37, 40–42	7
Sueda et al	[29]	2020	Japan	62	693	01, 05, 13, 14–16, 18, 28, 36, 40	8

01 = gender; 02 = age; 03 = ≥60 years old; 04 = >65 years old; 05 = diabetes; 06 = hypertension; 07 = cardiovascular disease; 08 = hypoproteinemia; 09 = renal insufficiency; 10 = respiratory disease; 11 = smoking history; 12 = body mass index < 23; 13 = TNM classified as stage I; 14 = TNM classified as stage II; 15 = TNM classified as stage III; 16 = colon; 17 = rectum; 18 = highly differentiated; 19 = moderately and poorly differentiated; 20 = treatment methods (radical treatment); 21 = operation time > 150 minutes; 22 = hospital stay < 30 days; 23 = drainage tube retention for ≥10 days; 24 = serum albumin content; 25 = preoperative hemoglobin content; 26 = incision length ≤ 15 cm; 27 = bleeding volume ≤ 300 mL; 28 = laparoscopic surgery; 29 = preoperative use of antibiotics; 30 = postoperative fistula; 31 = preoperative intestinal obstruction; 32 = anemia; 33 = occurrence of anastomotic fistula; 34 = use of stapler; 35 = combined organ resection; 36 = preoperative ASA score; 37 = perioperative blood transfusion; 38 = reoperation; 39 = carcinoembryonic antigen (mg/dL); 40 = adjuvant chemotherapy; 41 = lymphatic invasion; 42 = parasitic invasion.

NOS = Newcastle–Ottawa Scale.

anemia, laparoscopic surgery, the use of staplers, intraoperative blood loss > 300 mL, and combined organ resection.

4. Discussion

4.1. The significance of prevention of postoperative abdominal infection of colorectal cancer

At present, surgery is the main means of clinical treatment for CRC, which can significantly improve the cure rate; however, the occurrence of postoperative complications is often unavoidable, which puts heavy treatment pressure on clinicians and patients. Abdominal infection is one of the more serious complications, and it can extend patients' hospital stays and increase their medical costs.[31] It will affect patients' quality of life and even endanger their lives. If the incidence of abdominal infection can be reduced, the survival rate and quality of life of patients can be further improved, which has positive significance for patients and their families, medical institutions, and society.

4.2. Risk factor analysis

There were 42 risk factors for postoperative abdominal infection of CRC, including 5 demographic factors, 7 underlying diseases, 7 tumor stages, tumor location, and tumor differentiation degree, 18 perioperative risk factors, 5 body mass index, adjuvant chemotherapy, tumor invasion, and carcinoembryonic antigen content. In the presence of underlying diseases, diabetes, hypertension, cardiovascular diseases, and hypoproteinemia are high-risk factors for the occurrence of abdominal infection, because infection will cause the body's stress response and release adrenaline and cortisol, leading to increased heart rate and blood pressure; therefore, the proportion of patients with hypertension and cardiovascular diseases in the infected group is higher. Inflammation caused by infection leads to increased

Table 2

Meta-analysis results of postoperative risk factors for colorectal cancer.

Risk factor	Number of included articles	Observation (n/N)	Control (n/N)	Q test		Meta-analysis results				Reference
				P	I^2 %	Analysis model	OR/MD	95% CI	*P*	
Demographic statistics										
Sex	21	572/960	2633/4670	.64	0%	FEM	1.14	0.98, 1.32	.10	[9-29]
Age	8	–	–	.18	27%	REM	0.65	−0.78, 2.08	.37	[11,16-19,21,26,27]
Age ≥ 60	6	168/277	853/1425	.37	7%	FEM	1.22	0.92, 1.63	.17	[10,13-15,20,22]
Age > 65	2	44/64	171/227	.93	0%	FEM	0.71	0.37, 1.36	.30	[9,12]
Combined underlying disease										
Diabetes	18	230/848	613/4299	.04	41%	FEM	2.20	1.83, 2.66	<.00001	[9-20,22-25,27,29]
Hypertension	8	108/298	441/1296	.51	0%	FEM	1.34	1.01, 1.78	.04	[9,11,12,15,16,22,23]
Cardiovascular disease	4	67/219	286/1194	.77	0%	FEM	1.50	1.07, 2.09	.02	[16,19,23,25]
Hypoproteinemia	2	43/165	139/1051	.82	0%	FEM	2.28	1.54, 3.39	<.0001	[16,19]
Renal insufficiency	2	5/133	9/686	.04	75%	REM	1.22	0.05, 31.90	.91	[19,25]
Respiratory disease	2	8/133	25/686	.25	23%	FEM	0.88	0.36, 2.14	.78	[19,25]
Smoking	2	33/141	208/783	.12	58%	REM	0.71	0.27, 1.88	.49	[19,23]
BMI < 23	2	42/83	128/238	.27	18%	FEM	1.79	0.98, 3.28	.06	[12,22]
TNM staging										
Phase I	12	110/663	990/3327	.70	0%	FEM	0.50	0.40, 0.63	<.00001	[9,11,13-15,17,19,20,24,25,27,29]
Phase II	7	127/307	517/1312	.54	0%	FEM	0.81	0.61, 1.09	.17	[9,18,21,24,25,27,29]
Phase III	6	104/261	597/1535	.47	0%	FEM	1.04	0.78, 1.39	.79	[16,18,21,24,27,29]
Tumor location										
Colon	14	386/730	1970/3365	.04	44%	FEM	0.80	0.67, 0.96	.02	[9,11,13,15-17,19,20,22,23,25-27,29]
Rectum	13	329/659	1297/2640	.43	1%	FEM	1.14	0.95, 1.37	.16	[9,11,13,15,17,19,20,22-27]
Degree of tumor differentiation										
High	6	51/233	333/1702	.90	0%	FEM	0.90	0.61, 1.31	.57	[9,15,16,25,28,29]
Medium – low	5	125/171	723/1009	.88	0%	FEM	1.17	0.78, 1.77	.44	[9,15,16,25,28]
Treatment method (radical treatment)	5	150/228	848/1386	.52	0%	FEM	1.23	0.92, 1.66	.16	[10-14]
The perioperative period										
Operation time > 150min	5	214/338	753/1606	.63	0%	FEM	1.99	1.55, 2.55	<.00001	[9,13,14,17,19]
Length of stay ≥ 30 days	3	146/209	214/836	.87	0%	FEM	0.15	0.10, 0.21	<.00001	[13,17,20]
Drainage tube retention ≥ 10 days	4	230/296	856/1639	.78	0%	FEM	3.23	2.41, 4.32	<.00001	[13,14,19,20]
Serum albumin content	3	–	–	<.00001	97%	REM	−8.10	−13.33, −2.86	.002	[11,23,24]
Preoperative hemoglobin content	2	–	–	<.00001	47%	FEM	−19.55	−21.58, −17.53	<.00001	[11,24]
Incision length > 15cm	4	61/211	167/1076	.73	0%	FEM	0.33	0.22, 0.48	<.00001	[10,13,14,17]
Blood loss > 300mL	6	101/265	386/1509	.006	70%	REM	0.34	0.17, 0.66	.002	[10,12-15,17]
Non-laparoscopic surgery	13	481/676	2201/3469	<.00001	81%	REM	0.48	0.27, 0.86	.01	[10,12,13,17,19,22-29]
Antibiotics should be used before operation	3	30/110	210/668	.0002	89%	REM	1.08	0.23, 4.97	.92	[10,16,20]
Postoperative fistula	4	48/125	214/987	.29	21%	FEM	2.34	1.53, 3.57	<.0001	[10,12,15,16]
Preoperative intestinal obstruction	6	72/283	154/1656	.02	61%	REM	3.89	2.23, 6.80	<.00001	[11,15,19,20,23,24]
Anaemia	4	91/238	278/1329	.01	73%	REM	3.19	1.65, 6.15	.0005	[11,16,19,20]
Anastomotic fistula occurred	8	94/415	159/2356	.15	35%	FEM	4.60	3.41, 6.20	<.00001	[11-15,19,20,23]
No stapler was used	4	169/319	497/1499	.0008	82%	REM	0.54	0.28, 1.02	.06	[13,17,19,20]
Combined with organ resection	5	95/377	130/1945	.07	55%	REM	4.51	2.81, 7.26	<.00001	[13,19,23,24,27]
Preoperative ASA score (1–2)	9	383/548	2338/2713	.07	45%	FEM	0.48	0.38, 0.60	<.00001	[13,17,19,20,24-27,29]
Perioperative blood transfusion	4	47/145	232/767	.48	0%	FEM	1.59	1.05, 2.40	.03	[15,25,26,28]
Reoperation	3	51/121	0/185	.64	0%	FEM	103.34	18.18, 598.81	<.00001	[25-27]
Carcinoembryonic antigen content	2	–	–	.25	25%	FEM	1.49	−1.10, 4.07	.26	[25,26]
Adjuvant chemotherapy	3	49/145	366/1375	.005	81%	REM	1.32	0.51, 3.37	.57	[24,28,29]
Lymphatic invasion	3	25/90	98/379	.44	0%	FEM	0.95	0.54, 1.66	.85	[25,26,28]
Collateral aggression	2	22/67	93/356	.84	0%	FEM	1.55	0.84, 2.86	.16	[26,28]

ASA = American Society of Anesthesiologists, BMI = body mass index, CI = confidence interval, FEM = fixed effect model, MD = mean difference, OR = odds ratio, REM = random-effects model, TNM = tumor-node-metastasis.

vascular permeability and leakage of serum albumin into tissue space. Second, infection leads to increased consumption of protein by the body, further reducing serum albumin content. Patients with hypoproteinemia are relatively deficient in nutrients, affect the immune function of the body, and are more likely to develop abdominal infection. In addition, sugar is a nutrient for the survival and reproduction of pathogenic bacteria, so the abdominal cavity infection rate of diabetic patients is relatively high. The proportion of non-abdominal infection patients with TNM stage I was higher, suggesting that TNM stage I does not easily cause abdominal infection and is not a high-risk factor for abdominal infection. The tumor was located in the colon and closer to the abdominal cavity. Postoperative intestinal pathogens are more likely to translocate to the abdominal cavity and cause abdominal infection, which is a high-risk factor for postoperative abdominal infection in CRC. Operation time > 150 minutes, hospital stay ≥ 30 days, indentation drainage tube ≥ 10 days, incision length > 15 cm, non-laparoscopic surgery, postoperative fistula, anastomotic fistula, combined organ resection, and reoperation all increase the chances of patients' surgical site contact with pathogens and significantly increase the incidence of postoperative abdominal infection. It is a high-risk factor for abdominal infections after colon cancer surgery. Lower preoperative hemoglobin content and intraoperative blood loss > 300 mL will affect the function of oxygen transport in the body, resulting in relatively insufficient oxygen in the body, which cannot meet the needs of high stress response caused by surgery, and thus lead to a decline in the body's ability to resist pathogens, so it is more likely to lead to postoperative abdominal infection in patients with CRC. The higher the preoperative ASA score, the worse the basic condition of the patient, the more likely it is to have anesthesia complications, and the more serious the condition of the patients with a lateral reaction. Therefore, a higher preoperative ASA score is a high-risk factor for abdominal infection and such patients should be highly regarded.

4.3. Advantages and disadvantages of this study

Advantages of this study: focusing on the hot topic of "postoperative infection," this study conducted a meta-analysis on the risk factors of postoperative abdominal infection in patients with CRC and obtained the high-risk factors for postoperative abdominal infection in patients with CRC, avoiding the publication bias of a single study. The included case-control studies covered a wide range, and the case data were representative, which avoided clinical heterogeneity caused by the difference in medical service level in different regions to a certain extent. The quality of the included literature was generally high, the data sources were real and reliable, and the deviation risk analysis and stability verification of the results were carried out, which further improved the credibility of the research conclusions. Shortcomings: some risk factors were included in fewer studies, and the study conclusions need to be further verified by expanding the sample size. Due to the presence of clinical heterogeneity, meta-analysis results of some risk factors were heterogeneous, and such conclusions should be applied with caution.

5. Conclusion

Many risk factors lead to postoperative peritoneal infections in patients with CRC. In diagnosis and treatment activities, close attention should be paid to the risk factors that may lead to postoperative peritoneal infection in patients with CRC, and interventions should be conducted in advance when high-risk factors are found. Meanwhile, medical institutions should formulate sensory-control strategies according to risk factors to reduce the incidence of postoperative peritoneal infection in patients with CRC.

Author contributions

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References

[1] Patel SG, Karlitz JJ, Yen T, Lieu CH, Boland CR. The rising tide of early-onset colorectal cancer: a comprehensive review of epidemiology, clinical features, biology, risk factors, prevention, and early detection. Lancet Gastroenterol Hepatol. 2022;7:262–74.
[2] Nobuhara H, Matsugu Y, Soutome S, et al. Perioperative oral care can prevent surgical site infection after colorectal cancer surgery: a multicenter, retrospective study of 1,926 cases analyzed by propensity score matching. Surgery. 2022;172:530–6.
[3] Saus E, Iraola-Guzmán S, Willis JR, Brunet-Vega A, Gabaldón T. Microbiome and colorectal cancer: roles in carcinogenesis and clinical potential. Mol Aspects Med. 2019;69:93–106.
[4] Qiu QW, Ge ST, Zuo LG, et al. Prognostic value of peripheral blood inflammation indexes after laparoscopic radical resection of rectal cancer for intrabitoneal infectious complications. Chin J General Med. 2023;21:757–60. (In Chinese).
[5] Medical Administration Bureau, Health and Family Planning Commission of the People's Republic of China, Oncology Branch, Chinese Medical Association. Chinese diagnosis and treatment criteria for colorectal cancer (2017 edition). Chin J Surg. 2018;56:241–58. (In Chinese).
[6] Surgical Infection and Critical Care Medicine Group, Surgery Society of Chinese Medical Association, Intestinal Fistula Surgeons Professional Committee, Surgeons Society of Chinese Medical Association. Guidelines for diagnosis and treatment of abdominal infection in China (2019 edition). Chin J Pract Surg. 2020;40:1–16. (In Chinese).
[7] Xie X, Fan X, Fan L, Liu X, Zheng Y, Yu Z. The effects of methimazole combined with propranolol on heart rate, bone metabolism, and thyroid hormone levels in patients with hyperthyroidism: a systematic review and a meta-analysis of case-control studies. Medicine (Baltimore). 2024;103:e40495.
[8] Zhang J, Xie XX, Fan XD, et al. Systematic evaluation of risk factors for multidrug resistant Acinetobacter baumannii bloodstream infection and post-infection death. Drug Eval Res. 2023;46:663–70. (In Chinese).
[9] Li HJ, Zhao HJ, Sun CW. Influence factors of abdominal abscess in patients with colorectal cancer after laparoscopic radical surgery. Chin J Med Sci. 2022;34:11–3. (In Chinese).
[10] Quan FT, Zhang T, Yang WZ. Analysis of risk factors and countermeasures of postoperative abdominal infection in patients with colorectal cancer. J Pract Cancer. 2018;33:89–92. (In Chinese).
[11] Liang HF, Liu XY, Liang YX, et al. Pathogenic bacteria and risk factors of postoperative abdominal infection in patients with colorectal cancer. Chin J Hosp Infec. 2023;33:3099–103. (In Chinese).
[12] Yuan XY, Li QX, Gong SW, et al. Etiological characteristics and risk factors of postoperative abdominal infection in patients with colorectal cancer and its influence on prognosis. Adv Mod Biomed. 2019;19:3929–34. (In Chinese).
[13] Zhang MJ. Risk factors for postoperative abdominal infection of colorectal cancer. Chin Health Stat. 2020;37:926–28. (In Chinese).
[14] Jia XG, Ma DD. Expression of serum CRP/ALB and heparin-binding protein in patients with abdominal infection after colorectal cancer surgery and analysis of related influencing factors. Chin J Ano Dis. 2022;42:11–3. (In Chinese).
[15] Xue L, Wang C, Liang XJ, et al. Distribution characteristics of pathogenic bacteria in abdominal cavity infection after colorectal cancer surgery and analysis of quality nursing effect. Chin J Pathogen Biol. 2024;19:351–54. (In Chinese).
[16] Zhang WB, Zhao ZG, Li WH, et al. Construction of risk prediction model and expression of Hippo signaling pathway gene in postoperative abdominal infection of colorectal cancer. Chin J Nosocomiol. 2023;33:2656–60. (In Chinese).

[17] Lin WJ, Li Y. Analysis of risk factors related to postoperative abdominal infection of colorectal cancer. Henan J Sur. 2022;28:33–5. (In Chinese).
[18] Zhang JC, Lin HJ, Qiu KK, et al. Effects of peritoneal infection on anti-tumor pathway mRNA and prognosis in peripheral blood after colorectal cancer surgery. Chin J Nosocomial Infec. 2021;31:3162–66. (In Chinese).
[19] Jia L, Lu JQ, Ma XF, et al. Risk factors for postoperative abdominal infection of colorectal cancer. Chin J Gastrointest Sur. 2016;19:409–13. (In Chinese).
[20] Li A, Zhou BJ, Chen ZG, et al. Risk factors for postoperative abdominal infection of colorectal cancer and their association with UGT1A1*28 gene polymorphism. Chin J Nosocomiol. 2022;32:2015–19. (In Chinese).
[21] Liu Q, Xu R, Wang Q, et al. Effects of postoperative abdominal infection on HIPPO pathway gene, intestinal barrier and immune function in patients with colorectal cancer. Chin J Nosocomial Infect. 2021;31:3772–76. (In Chinese).
[22] Liu J, Zeng H, Wang GY, et al. Value of neutrophil CD64, CD11b combined with systemic immunoinflammatory index in predicting abdominal infection after colorectal cancer surgery. J Clin Expe Med. 2023;22:382–86. (In Chinese).
[23] Cui JX. Analysis of Risk Factors for Abdominal Infection After Radical Resection of Colorectal Cancer. Kunming Medical University; 2022.
[24] Pei G, Zhen S, Zhang B. A novel nomogram based on nutritional and immune status predicting postoperative intra-abdominal infection in colorectal cancer. Asia Pac J Clin Nutr. 2022;31:626–35.
[25] Alonso S, Mayol X, Nonell L, Salvans S, Pascual M, Pera M; Colorectal Cancer Research Group (Hospital del Mar Medical Research Institute). Peripheral blood leucocytes show differential expression of tumour progression-related genes in colorectal cancer patients who have a postoperative intra-abdominal infection: a prospective matched cohort study. Colorectal Dis. 2017;19:O115–25.
[26] Alonso S, Pascual M, Salvans S, et al. Postoperative intra-abdominal infection and colorectal cancer recurrence: a prospective matched cohort study of inflammatory and angiogenic responses as mechanisms involved in this association. Eur J Surg Oncol. 2015;41:208–14.
[27] Povsic MK, Beovic B, Ihan A. Perioperative increase in neutrophil CD64 expression is an indicator for intra-abdominal infection after colorectal cancer surgery. Radiol Oncol. 2017;51:211–20.
[28] Sánchez-Velázquez P, Pera M, Jiménez-Toscano M, et al. Postoperative intra-abdominal infection is an independent prognostic factor of disease-free survival and disease-specific survival in patients with stage II colon cancer. Clin Transl Oncol. 2018;20:1321–8.
[29] Sueda T, Tei M, Yoshikawa Y, et al. Prognostic impact of postoperative intra-abdominal infections after elective colorectal cancer resection on survival and local recurrence: a propensity score-matched analysis. Int J Colorectal Dis. 2020;35:413–22.
[30] Vere J, Gibson B. Evidence-based medicine as science. J Eval Clin Pract. 2019;25:997–1002.
[31] Zhao Z, Zhang S, Zheng T, Hu M. Geographical and temporal variations in availability of national price negotiated novel anticancer drugs: a spatial statistical study based on two cross-sectional datasets in China. Front Pharmacol. 2025;16:1604008.