Am J Transl Res 2024;16(6):2633-2644
www.ajtr.org /ISSN:1943-8141/AJTR0157111

Original Article

Application value of laparoscopic surgery in elderly patients (≥ 75 years) with colorectal cancer and prognostic factors influencing 5-year overall survival

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Received April 9, 2024; Accepted May 28, 2024; Epub June 15, 2024; Published June 30, 2024

Abstract: Objective: To investigate the application value of laparoscopic surgery in elderly patients (≥ 75 years) with colorectal cancer, and to identify the prognostic factors influencing the long-term survival in this demographic, and to establish a predictive nomogram model. Methods: A retrospective analysis was conducted on 146 elderly (≥ 75 years old) colorectal cancer patients who underwent radical surgery in Baoji People's Hospital from August 2016 to February 2018, including 55 patients who underwent laparotomy and 91 patients who underwent laparoscopic surgery. Survival curves were plotted using the Kaplan-Meier method, and differences in prognosis were assessed using the Log-rank test. Prognostic impacts of various factors on 5-year survival were analyzed using a Cox proportional hazards model. Significant predictors identified in the Cox model were used to construct a nomogram for predicting survival, which was then validated for accuracy and clinical utility. Results: Laparoscopic surgery was associated with shorter hospital stays ($P = 0.022$), although at a higher cost ($P = 0.011$). The laparoscopic group also had less intraoperative bleeding ($P < 0.001$), incision length ($P < 0.001$), time to first postoperative expectoration ($P < 0.001$), time to first postoperative feeding ($P = 0.002$), and time to postoperative peritoneal drainage ($P = 0.003$) compared to the open surgery group. Additionally, the rate of postoperative wound complications was also lower in the laparoscopic group ($P = 0.014$). There was no significant difference in the 5-year post-treatment survival between the two groups ($P = 0.150$). Multifactorial Cox regression analysis revealed that a history of diabetes mellitus ($P = 0.037$), vascular infiltration ($P = 0.026$), nerve bundle invasion ($P = 0.001$), and TNM stage ($P = 0.001$) were independent prognostic factors affecting the 5-year survival of patients with advanced colorectal cancer. The constructed nomogram showed high predictive accuracy for 1-, 3-, and 5-year survival, with AUC values of 0.91, 0.87, and 0.79, respectively. Calibration curves and decision curve analysis confirmed the model's clinical utility. Risk formula: History of diabetes mellitus * -0.696194503 + Vascular infiltration * -0.769736513 + Nerve bundle invasion * -1.1709777 + TNM staging * 1.201933691. Conclusion: Laparoscopic surgery can reduce intraoperative trauma and accelerate postoperative recovery in elderly colorectal cancer patients (≥ 75 years) compared to open surgery. The developed nomogram model based on independent prognostic factors such as diabetes history, vascular infiltration, nerve bundle invasion, and TNM staging, facilitates tailored prognostic assessment, enhancing individual patient management.

Keywords: Colorectal cancer, laparoscopy, open surgery, nomogram modeling

Introduction

Colorectal cancer (CRC) is a significant global health concern, ranking the third most common malignant tumor worldwide, with a high incidence and mortality rate [1, 2]. The situation is particularly severe in China, where the incidence of CRC is increasing annually by 4%, double the global average. This increase is attributed to higher living standards, medical advancements, and an aging population [3]. The disease is most prevalent among the elderly, with most cases diagnosed in the advanced stages, underscoring the urgency of early detection [4, 5]. Despite the availability of various treatments, surgery remains the cornerstone for managing resectable tumors, highlighting the critical need for innovative diagnostic and therapeutic strategies to improve patient outcome.

Over the past two decades, laparoscopic surgical techniques have become increasingly prevalent in China as a preferred method for

https://doi.org/10.62347/RDMB8197

colorectal cancer treatment [6]. This minimally invasive approach is celebrated for its significant benefits over traditional open surgery, including reduced surgical trauma, quicker postoperative recovery, and enhanced cosmetic outcomes [7, 8]. Consequently, it has gained widespread acceptance among surgeons as a treatment of choice. However, the application of laparoscopic surgery in elderly patients aged 75 and above is still debated. Concerns about the safety and feasibility of the procedure in this demographic are primarily due to the potential adverse effects of CO_2 pneumoperitoneum on their respiratory and circulatory systems [9, 10]. Moreover, this age group is often underrepresented in clinical trials, resulting in a scarcity of systematic data on the outcomes of laparoscopic surgery for older colorectal cancer patients in China. This research gap underlines the difficulties in establishing an optimal surgical protocol for elderly patients, considering factors like the increased risk of complications, varying health conditions, and physician treatment preferences [11].

The effective deployment of laparoscopic surgery for colorectal cancer necessitates a high level of technical proficiency, underscoring the importance of exceptional operating skills and wealth of clinical experience [12, 13]. As this technology evolves, further developments are expected to equip surgeons with better tools to address current challenges and controversies effectively. This is particularly pertinent for patients aged 75 and older, where there is a critical need to expand research, gather more comprehensive clinical data, and conduct in-depth analyses. Such efforts are crucial for assessing the suitability of laparoscopic surgery in this demographic.

This study retrospectively analyzed the clinical data of 146 colorectal cancer patients aged 75 years and above who were treated at Baoji People's Hospital, with an aim was to investigate the safety, minimally invasive nature, and clinical efficacy of laparoscopic radical colorectal cancer surgery in this age group.

Methods and data

Patient enrollment

One hundred and forty-six elderly (≥ 75 years old) colorectal cancer patients who underwent radical surgery at Baoji People's Hospital from August 2016 to February 2018 were retrospectively analyzed, including 55 patients who underwent open surgery (open group) and 91 patients who underwent laparoscopy (laparoscopic group). The study was conducted with the approval of Baoji People's Hospital's Medical Ethics Committee.

Inclusion exclusion criteria

Inclusion criteria: patients diagnosed with a single primary colorectal cancer by preoperative colonoscopy and biopsy pathologic analysis; patients meeting the indications for surgical treatment [14]; patients aged 75 years and above who underwent elective surgery; patients who had completed radical resection and had complete clinical data records.

Exclusion criteria: patients who underwent palliative resection due to conditions preventing complete tumor resection, such as extensive abdominal metastasis, where only bypass surgery was feasible; patients with preoperative distant metastasis or with multiple primary colorectal cancers; patients requiring emergency surgery due to bowel obstruction, perforation, bleeding, and other emergencies.

Clinical data collection

Clinical data of the patients were collected through the hospital case system and patient follow-up records. The baseline data included age, gender, history of abdominal surgery, American Society of Anesthesiologists (ASA) classification [15], history of hypertension, diabetes mellitus, coronary artery disease, hospitalization length, and hospitalization cost. Pathologic indicators included tumor diameter, disease staging, histologic staging, degree of differentiation, vascular infiltration, nerve bundle invasion, Tumor Node Metastasis (TNM) stage, and tumor location. Surgical indices included operative time, intraoperative bleeding, incision length, time to first postoperative expectoration, time to first postoperative feeding, and time to postoperative abdominal drainage. Postoperative complications included anastomotic leakage, anastomotic bleeding, abdominal infection, poor wound healing, pulmonary infection, and urinary tract infection. Note: Postoperative complications were counted until the patients were discharged.

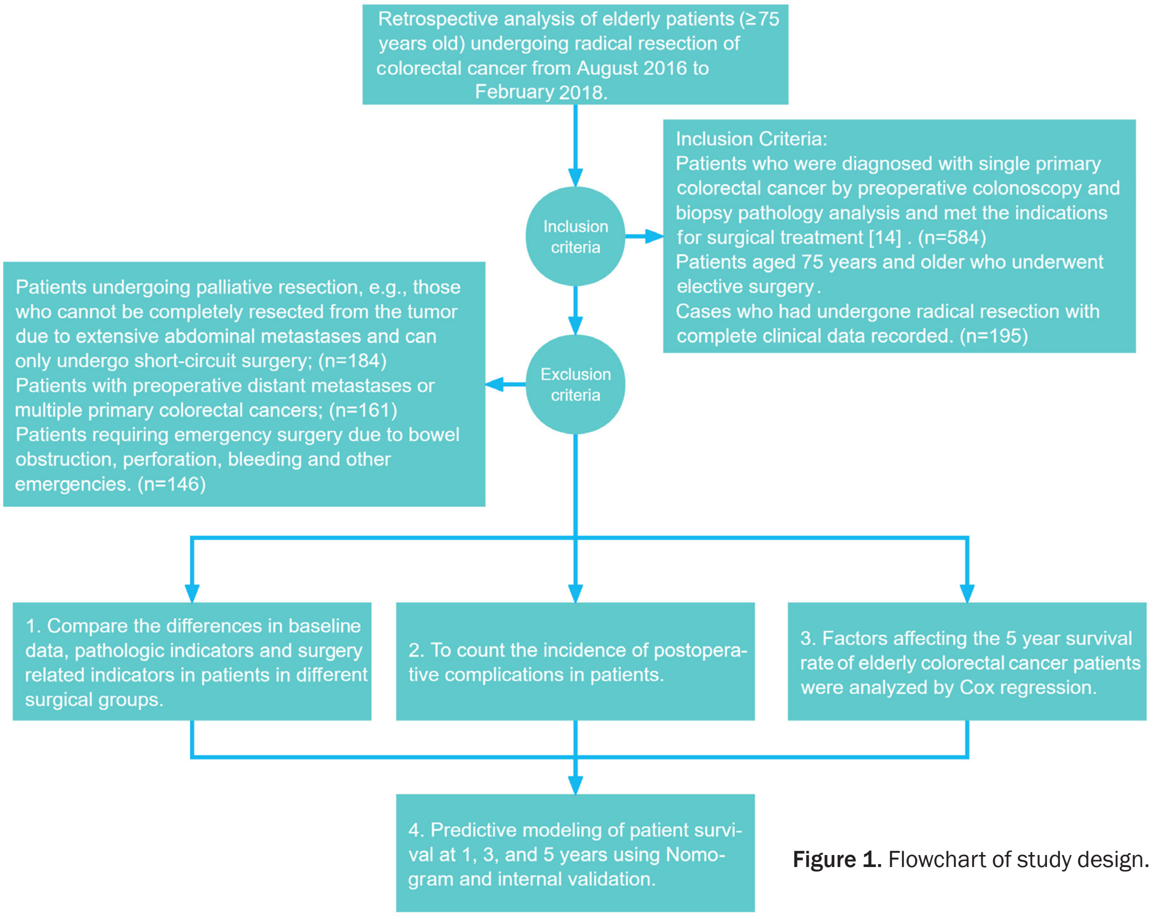

Figure 1. Flowchart of study design.

Follow up

All patients were followed up for 5 years. The follow-up primarily included hospital visits for chemotherapy or reexamination, and outpatient and telephone visits at the frequency of the 3rd, 6th, 9th, and 12th months after discharge. Follow-ups were conducted every 4 months for the first 2-3 years and every 6 months after 3 years. The survival time and prognosis of the patients were recorded.

Observation indicators

1. The differences in baseline data, pathologic indexes, and surgery-related indexes were compared between patients in the two groups. 2. The incidence of postoperative complications in patients was statistically calculated. 3. The factors affecting 5-year survival were analyzed using Cox regression. 4. A prediction model of 1-, 3-, and 5-year survival of patients was established using the nomogram, and the distinction, calibration and clinical utility of the nomogram model were evaluated by using calibration curves, time-dependent working curves for subject characteristics (ROCs), and decision-making (DCA) curves (**Figure 1**). 5. Decision making (DCA) curves were used to assess the discrimination, calibration, and clinical utility of the nomogram model (**Figure 1**).

Statistical analysis

SPSS 26.0 software was used to process the data. The K-S test was used to analyze the distribution of measured data. Normally distributed data were expressed as mean ± standard deviation, and independent samples t-test was used for comparison between groups. Non-normally distributed data were expressed as IQR, and the Mann-Whitney U test was used. Comparison of counted data (n, %) was performed using the χ^2 test. Cox regression was used to analyze the factors characterizing 5-year survival in patients with colorectal cancer. Time-dependent ROC curves were used to analyze the value of risk scores and risk factors

Table 1. Comparison of baseline data of patients between two groups

	Laparoscopic surgery group (n = 91)	Open surgery group (n = 55)	χ^2/t/Z value	*P*-value
Age (years)	80.00 [77.00, 83.00]	80.00 [78.00, 83.00]	-1.016	0.309
Gender				
Male	44	19	2.664	0.103
Female	47	36		
History of abdominal surgery				
Yes	13	9	0.116	0.734
No	78	46		
ASA classification				
I	15	11	3.768	0.152
II	46	34		
III	30	10		
History of hypertension				
Yes	57	30	0.932	0.334
No	34	25		
History of diabetes				
Yes	20	11	0.08	0.777
No	71	44		
History of coronary heart disease				
Yes	25	10	1.624	0.203
No	66	45		
Length of hospitalization (d)	17.00 [13.00, 20.00]	20.00 [12.00, 26.50]	-2.284	0.022
Hospitalization costs ($ million)	10.00 [7.50, 11.50]	8.00 [5.00, 11.00]	2.538	0.011

Note: American Society of Anesthesiologists (ASA) classification.

in predicting patients' emergence of 1-, 3-, and 5-year survival in patients with colorectal cancer. DCA curves, calibration curve plots, and the H-L test were used to evaluate the calibration and clinical utility value of the model. Nomogram was plotted using the rms package within R software, and P < 0.05 was considered a significant difference.

Results

Baseline information

Upon comparing the baseline data of patients undergoing different surgical methods, there was no significant difference in age, gender, history of abdominal surgery, ASA classification, tumor location, history of hypertension, diabetes mellitus, or coronary heart disease between the two groups (all P > 0.05, **Table 1**). However, the hospitalization time was significantly shorter (P = 0.022) while the hospitalization cost was significantly higher (P = 0.011) in patients of the laparoscopic surgery group than in those in the open surgery group (**Table 1**).

Pathologic indicators

Comparison of the pathological indicators of patients undergoing different surgical methods revealed no statistical differences in tumor diameter, disease staging, histological staging, degree of differentiation, choroidal infiltration, nerve bundle invasion, or TNM staging between the two groups (all P > 0.05, **Table 2**).

Surgery-related indicators

Comparison of the surgery-related indicators revealed that the operation time for patients in the laparoscopic surgery group was significantly longer (P < 0.001) than that of patients in the open surgery group. However, intraoperative bleeding (P < 0.001), incision length (P < 0.001), time to first postoperative expectoration (P < 0.001), time to first postoperative feeding (P = 0.002), and time to postoperative peritoneal drainage (P = 0.003) were all significantly less in the laparoscopic group than in the open group (**Table 3**).

Table 2. Comparison of pathologic indicators of patients between two groups

	Laparoscopic surgery group (n = 91)	Open surgery group (n = 55)	χ^2/t value	*P*-value
Tumor diameter	4.58±1.58	4.90±1.57	-1.182	0.240
Disease Typing				
Ulcerative	41	21	0.73	0.694
Convex	45	30		
Percolating	5	4		
Histologic typing				
Tubular cancer	70	37	1.848	0.397
Mucous adenocarcinoma	15	14		
Else	6	4		
Degree of differentiation				
High differentiation	14	10	0.195	0.659
Middle ground	77	45		
Vascular infiltration				
Yes	21	17	0.959	0.328
No	70	39		
Nerve bundle invasion				
Yes	15	9	< 0.001	0.985
No	76	46		
TNM staging				
I + II	55	36	0.367	0.545
III + IV	36	19		
Tumor location				
Rectum	20	17		
Colon cancer	25	13	1.518	0.678
Colon cancer	17	10		
Sigmoid colon cancer	29	15		

Note: Tumor Node Metastasis (TNM) staging.

Table 3. Comparison of surgery-related indexes between two groups

	Laparoscopic surgery group (n = 91)	Open surgery group (n = 55)	t/Z value	*P*-value
Surgical time (min)	210.00 [189.00, 240.00]	187.00 [171.00, 197.50]	4.739	< 0.001
Intraoperative bleeding (ml)	75.00 [36.00, 102.50]	102.00 [81.50, 125.00]	-4.000	< 0.001
Length of incision (cm)	5.99±0.47	17.50±3.42	-24.828	< 0.001
Time to first postoperative defecation (d)	3.00 [3.00, 4.00]	4.00 [3.00, 6.00]	-5.06	< 0.001
Time to first postoperative meal (d)	5.00 [5.00, 6.00]	7.00 [4.50, 8.50]	-3.114	0.002
Duration of postoperative abdominal drainage (d)	7.00 [6.00, 9.00]	9.00 [7.00, 11.50]	-2.93	0.003

Postoperative complications

Comparison of postoperative complications revealed that postoperative anastomotic leakage, anastomotic hemorrhage, abdominal infection, pulmonary infection, and urinary tract infection were not statistically different between the two groups (all P > 0.05, **Table 4**). However, the number of patients in the laparoscopic surgery group with poor postoperative wound healing was lower (P = 0.014) than in the open surgery group (**Table 4**).

Survival of patients after different surgical methods

The survival curves of patients with different surgical approaches were compared, showing

Table 4. Comparison of postoperative complications between two groups

	Laparoscopic surgery group (n = 91)	Open surgery group (n = 55)	χ^2-value	*P*-value
Anastomotic leakage				
Yes	4	3	0.084	0.772
No	87	52		
Bleeding from the anastomosis				
Yes	4	2	0.05	0.823
No	87	53		
Abdominal infection				
Yes	2	3	1.099	0.294
No	89	52		
Poor wound healing				
Yes	4	9	6.054	0.014
No	87	46		
Lung infection				
Yes	10	6	0.003	0.959
No	81	50		
Urinary tract infection				
Yes	3	2	0.012	0.913
No	88	53		

no statistical difference in the 5-year survival time after treatment between the two groups (P = 0.154, **Figure 2**).

Cox regression analysis

At the end of the study, we analyzed the factors affecting the 5-year survival of elderly CRC patients by Cox regression. The results showed that history of diabetes mellitus (P = 0.004), vascular infiltration (P < 0.001), nerve bundle invasion (P < 0.001), TNM stage (P < 0.001), and co-infections (P = 0.028) were the prognostic factors contributing to the 5-year survival of elderly CRC patients (**Table 5**). Subsequent multifactorial Cox regression analysis revealed that history of diabetes mellitus (P = 0.037), vascular infiltration (P = 0.026), nerve bundle invasion (P = 0.001), and TNM stage (P = 0.001) were independent prognostic factors affecting 5-year survival in elderly patients with colorectal cancer (**Table 6**).

Construction and internal validation of the nomogram model

We used the four prognostic factors (history of diabetes mellitus, vascular infiltration, nerve bundle invasion, and TNM staging) in Cox regression to construct a nomogram model. The nomogram highlighted that TNM staging had the most significant influence on the prognosis of elderly patients with colorectal cancer. The history of diabetes mellitus, vascular infiltration, and nerve bundle invasion also played critical roles in influencing patient prognosis (**Figure 3A**). Risk formula: History of diabetes mellitus * -0.696194503 + Vascular infiltration * -0.769736513 + Nerve bundle invasion * -1.1709777 + TNM staging * 1.201933691.

We evaluated the model's differentiation, calibration, and clinical utility using DCA curves, calibration curve plots, and ROC curves. The time-dependent ROC curve analysis revealed that the AUC of the risk score in predicting the prognosis of 1-, 3-, and 5-year survival of elderly patients with colorectal cancer was 0.91, 0.87, and 0.79, respectively. These results underscore the model's accuracy in predicting the 5-year survival of patients with advanced colorectal cancer (**Figure 3B**).

The DCA curves demonstrated that the risk prediction model had a high net benefit rate. The red line corresponding to the threshold probability was positioned in the upper right of the None line and the All line, indicating superior clinical utility (**Figure 3C**). In the calibration curve obtained by 1000 bootstraps, the red

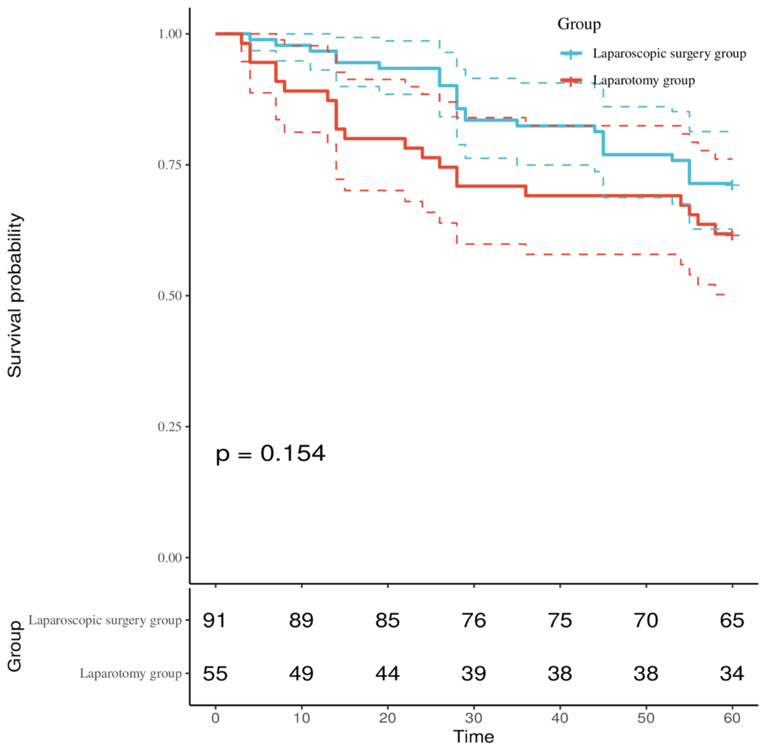

Figure 2. Comparison of survival curves for patients undergoing different surgical methods.

line overlapped with the black diagonal dashed line, indicating stable model performance (**Figure 3D**).

Case study

We randomized 2 patients, one with a survival time of 420 days (patient 1) and the other with a survival time of 1740 days (patient 2). By calculation, we found that the first patient had a score of 255, of which 76% survived 1 year, 23% survived 3 years, and 0% survived 5 years. At the same time, the second patient scored 57.5, with 100% survival at 1 year, 100% survival at 3 years, and 80% survival at 5 years (**Table 7**).

Discussion

Colorectal cancer poses a growing public health challenge exacerbated by societal advancements, population aging, and environmental deterioration [16]. Despite strides in increasing public health awareness and medical technology, enhancing early detection rates, the elderly, particularly those over 75, face heightened treatment risks due to prevalent comorbidities and diminished physiological resilience [17]. Our study reveals that over 74% of participants had comorbid conditions, with 83.5% in the laparoscopic group and 80% in the open surgery group scoring grade II or higher on the ASA scale, indicating a significant risk of surgery-related complications due to existing health issues [18]. This underscores the critical need for comprehensive preoperative and perioperative management to mitigate surgical risks. Laparoscopic surgery, noted for its safety and feasibility, emerges as a particularly viable option for this vulnerable group. The evolution of this minimally invasive technique has solidified its role as a standard treatment for high-risk patients across numerous healthcare settings, underscoring the ongoing quest for safer surgical intervention in colorectal cancer care.

In this study, we initially compared the baseline characteristics and pathologic indicators of two patient groups undergoing colorectal cancer surgery, identifying no significant differences. However, the operation time was notably longer for the laparoscopic group than the open surgery group. Despite this, the laparoscopic approach resulted in less intraoperative bleeding, shorter incision length, earlier postoperative excretion and feeding times, and reduced duration of postoperative abdominal drainage, underscoring its benefits in minimizing intraoperative trauma, expediting recovery, and lowering complication risks in elderly patients. The work of Hashida et al. corroborates these findings [19], as does Passuello [20], who similarly highlighted the reduced intraoperative bleeding and extended operative times associated with laparoscopic surgery without compromising overall patient survival. Furthermore, Passuello's research [20] indicates that patients aged 80 and above experienced shorter hospital stays following laparoscopic surgery, align-

Table 5. One-way Cox regression

Factor	β	SE	*P*-value	HR value	Lower	Upper
Surgical Program	0.418	0.294	0.154	1.519	0.854	2.700
Age	0.036	0.038	0.336	1.037	0.963	1.117
Surgical time (min)	-0.005	0.004	0.232	0.995	0.987	1.003
Intraoperative bleeding (ml)	-0.004	0.003	0.223	0.996	0.99	1.002
Incision length (cm)	0.024	0.023	0.292	1.025	0.979	1.072
Time to first postoperative defecation (d)	0.029	0.093	0.760	1.029	0.857	1.236
Time to first postoperative fluid intake (d)	0.022	0.081	0.788	1.022	0.872	1.198
Duration of postoperative abdominal drainage (d)	0.066	0.047	0.157	1.068	0.975	1.171
Tumor size (cm)	-0.112	0.093	0.225	0.894	0.745	1.072
Number of lymph nodes cleared (nos.)	-0.002	0.027	0.930	0.998	0.947	1.051
Length of hospitalization (days)	0.026	0.017	0.133	1.027	0.992	1.062
Hospitalization costs ($ million)	-0.052	0.046	0.261	0.949	0.867	1.040
Gender	-0.103	0.293	0.726	0.902	0.508	1.604
History of abdominal surgery	0.059	0.410	0.886	1.060	0.475	2.368
ASA classification	0.371	0.220	0.092	1.449	0.942	2.23
Tumor location	0.333	0.292	0.255	1.395	0.787	2.475
History of hypertension	-0.110	0.300	0.714	0.896	0.498	1.613
History of diabetes	-0.914	0.314	0.004	0.401	0.217	0.742
History of coronary heart disease	0.483	0.388	0.213	1.621	0.757	3.470
Disease typing	0.149	0.240	0.534	1.161	0.725	1.858
Histologic typing	0.024	0.245	0.921	1.025	0.634	1.656
Degree of differentiation	0.533	0.473	0.260	1.704	0.674	4.307
Vascular infiltration	-1.307	0.294	< 0.001	0.271	0.152	0.481
Nerve bundle violation	-1.475	0.310	< 0.001	0.229	0.124	0.420
TNM staging	1.762	0.321	< 0.001	5.826	3.106	10.929
Co-infection	-0.734	0.335	0.028	0.480	0.249	0.925

Note: American Society of Anesthesiologists (ASA) grading, Tumor Node Metastasis (TNM) staging.

Table 6. Multifactor Cox regression

Factor	β	SE	*P*-value	HR value	Lower	Upper
History of diabetes	-0.681	0.326	0.037	0.506	0.267	0.958
Vascular infiltration	-0.736	0.33	0.026	0.479	0.251	0.914
Nerve bundle invasion	-1.135	0.339	0.001	0.321	0.165	0.625
TNM staging	1.204	0.361	0.001	3.333	1.642	6.764
Co-infection	-0.226	0.35	0.518	0.798	0.402	1.583

Note: Tumor Node Metastasis (TNM) staging.

ing with our observations and suggesting enhanced recovery rates. However, this study also noted a higher complication rate among older laparoscopic patients compared to younger cohorts, emphasizing the importance of carefully considering patient age and health status in surgical decision-making.

Interestingly, Passuello found a higher overall survival rate in patients over 80 who underwent laparoscopic compared to open surgery, a result differing from ours, possibly due to their smaller sample size, which limit the generalizability of these results. Our larger sample size provides a more robust representation of the effectiveness of laparoscopic surgery for elderly colorectal cancer patients. Chok et al. [21] reported similar advantages of laparoscopic surgery for patients aged 80 and older, including shorter hospital stays, cost reduction, and comparable postoperative complication and survival rates to open surgery, reinforcing the procedure's value in this demographic.

We analyzed the prognostic factors affecting the 5-year survival of the patients. Resultsshowed that a history of diabetes mellitus, Laparoscopy vs. open surgery in elderly

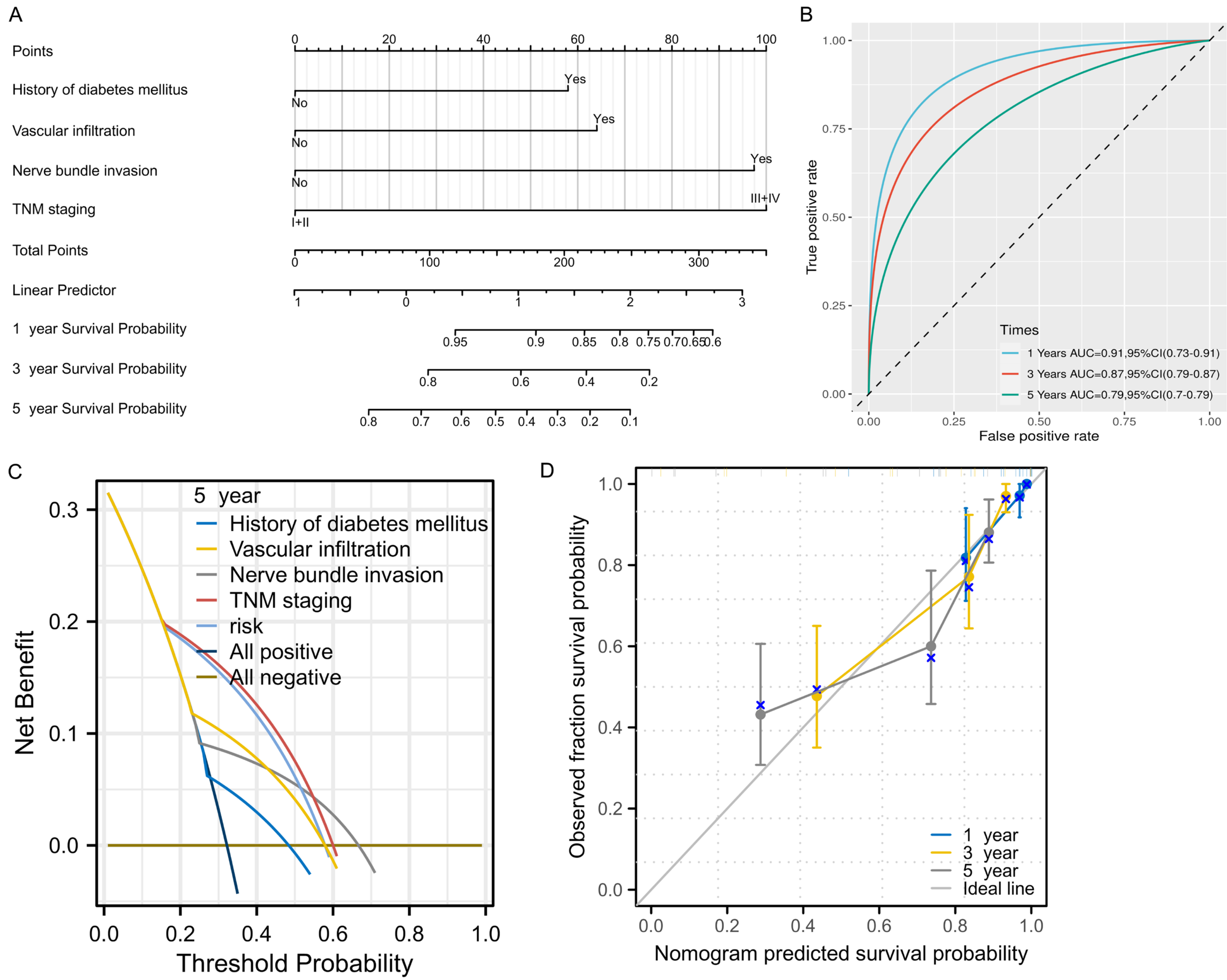

Figure 3. Nomogram model construction and internal validation. A. Construction of the Nomogram model. B. Time-dependent ROC curve analysis of risk score in predicting 1-, 3-, and 5-year survival. C. DCA curve for 5-year survival in elderly colorectal cancer patients. D. Correction curve for 5-year survival risk in elderly colorectal cancer patients.

Table 7. Patient information

Data	Patient 1 Basic Information	Score	Patient 2 Basic Information	Score
History of diabetes	Yes	57.5	Yes	57.5
Vascular infiltration	No	0	No	0
Nerve bundle invasion	Yes	97.5	No	0
TNM staging	III + IV	100	I + II	0
Totals	255 points		57.5	
1-year survival	76%		100%	
3-year survival	23%		100%	
5-year survival	0%		80%	

vascular infiltration, nerve bundle invasion, and TNM staging were independent prognostic factors affecting 5-year survival in elderly patients with colorectal cancer. Diabetic patients may have slow postoperative recovery and an increased risk of infection due to metabolic disorders, compromised immune functions, and microangiopathy, all of which are inherent complications of diabetes [22, 23]. In addition, diabetes is strongly associated with the development of specific cancer types and may exacerbate tumor aggressiveness and poor prognosis [24, 25]. Vascular infiltration, characterized by the invasion or spread of tumor cells along the walls of blood vessels or lymphatic vessels, is one of the most significant markers of tumor aggressiveness and metastatic potential [26]. The presence of vascular infiltration indicates that the tumor has a higher risk of metastasis and is directly associated with a worse prognosis [27]. Nerve bundle invasion is a marker of aggressive tumor behavior, suggesting that tumor cells are located along nerve sheaths or into nerve fibers. This facilitates easier tumor spread and recurrence [28]. In addition, nerve bundle invasion contributes to postoperative pain and decreased quality of life in patients, further affecting survival rates [29]. The TNM staging system, which evaluates tumor size, lymph node involvement, and distant metastasis, remains a crucial tool in prognostic assessments. A higher TNM stage implies a more aggressive tumor and a higher risk of metastasis, which is directly associated with poorer survival [30, 31]. The identification of these factors underscores the importance of considering individualized pathologic and clinical characteristics in treatment planning for colorectal cancer. It suggests the need for closer monitoring and aggressive combination therapy measures for high-risk patients to improve the survival prognosis of elderly colorectal cancer patients.

To advance individualized prognostic management for elderly patients with advanced colorectal cancer, we constructed a nomogram model incorporating four independent prognostic factors: history of diabetes, vascular infiltration, nerve bundle invasion, and TNM staging. The accuracy of this model in predicting 1-, 3-, and 5-year survival rates was validated through ROC curve analysis, which displayed robust AUC values. The DCA curve showed a high net benefit of the model, affirming the model's practical utility in clinical decision-making. The results of the calibration curves further confirmed the consistency between the predicted and actual observed values of the model, indicating stable model performance. This nomogram provides a powerful tool for individualized prognostic management of elderly colorectal cancer patients. By applying the model to specific patients, physicians can predict the long-term survival probability of patients based on their unique disease characteristics, leading to more targeted treatment planning and monitoring strategies.

Limitations of the study are as follows: its retrospective design, limited sample size, data from a single center, and lack of external validation of the prognostic model. These limitations may impact the accuracy, generalizability, and reliability of our findings. Future research should consider a prospective, multicenter, randomized controlled design with expanded sample size, and independent external validation of prognostic models to overcome these limitations, thus validating our findings.

In conclusion, laparoscopic surgery offers significant benefits over open surgery in reducing intraoperative trauma and accelerating postoperative recovery in elderly colorectal cancer patients (≥ 75 years). The use of a nomogram model, based on key prognostic factors, enables precise prognostic assessments and individualized management strategies, enhancing overall treatment outcomes.

Disclosure of conflict of interest

None.

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