REVIEW

Recent advances in computerized imaging and its vital roles in liver disease diagnosis, preoperative planning, and interventional liver surgery: A review

Horkaew P, Chansangrat J, Keeratibharat N, Le DC

MINIREVIEWS

Diagnosis and treatment of post-cholecystectomy diarrhoea

Huang RL, Huang WK, Xiao XY, Ma LF, Gu HZR, Yang GP

ORIGINAL ARTICLE

Retrospective Cohort Study

Trans-anal endoscopic microsurgery for non-adenomatous rectal lesions

Shilo Yaacobi D, Bekhor EY, Khalifa M, Sandler TE, Issa N

Retrospective Study

Effects of cytoreductive surgery combined with hyperthermic perfusion chemotherapy on prognosis of patients with advanced gallbladder cancer

Wu JX, Hua R, Luo XJ, Xie F, Yao L

Effect of laparoscopic sleeve gastrectomy on related variables of obesity complicated with polycystic ovary syndrome

Wang XT, Hou YS, Zhao HL, Wang J, Guo CH, Gual J, Ly ZG, Ma P, Han JL

Advantage of log odds of positive lymph nodes in prognostic evaluation of patients with early-onset colon cancer

Xia HB, Chen C, Jia ZX, Li L, Xu AM

Correlation between preoperative systemic immune inflammation index, nutritional risk index, and prognosis of radical resection of liver cancer

Li J, Shi HY, Zhou M

Correlation between pre-treatment serum total blood bilirubin and unconjugated bilirubin and prognosis in patients with colorectal cancer

Tong H, Xing P, Ji ZN

Correlation between the expressions of metastasis-associated factor-1 in colon cancer and vacuolar ATP synthase


Risk factors for anastomotic fistula development after radical colon cancer surgery and their impact on prognosis

Wang J, Li MH
## Contents

**World Journal of Gastrointestinal Surgery**  
Monthly Volume 15 Number 11 November 27, 2023

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
</table>
| 2482 | Effects and mechanisms of nutritional interventions on extradigestive complications in obese patients  
Jiang L, Xu LL, Lu Y, Gu KF, Qian SY, Wang XP, Xu X |
| 2490 | Hepatic venous pressure gradient: Inaccurately estimates portal venous pressure gradient in alcoholic cirrhosis and portal hypertension  
| 2500 | Nomogram for predicting early complications after distal gastrectomy  
Zhang B, Zhu Q, Ji ZP |
| 2513 | Application of CD34 expression combined with three-phase dynamic contrast-enhanced computed tomography scanning in preoperative staging of gastric cancer  
Liu H, Zhao KY |

**Observational Study**

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
</table>
| 2525 | Predictive value of frailty assessment tools in patients undergoing surgery for gastrointestinal cancer: An observational cohort study  
| 2537 | Multi-national observational study to assess quality of life and treatment preferences in patients with Crohn’s perianal fistulas  
| 2553 | Does gastric stump cancer really differ from primary proximal gastric cancer? A multicentre, propensity score matching-used, retrospective cohort study  

**SYSTEMATIC REVIEWS**

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
</table>
| 2564 | Global, regional, and national burden of gallbladder and biliary diseases from 1990 to 2019  
Li ZZ, Guan LJ, Ouyang R, Chen ZX, Ouyang GQ, Jiang HX |
| 2579 | Risk and management of post-operative infectious complications in inflammatory bowel disease: A systematic review  
Mowlah RK, Soldera J |
| 2596 | Effect of perioperative branched chain amino acids supplementation in liver cancer patients undergoing surgical intervention: A systematic review  
Yap KY, Chi H, Ng S, Ng DH, Shelat VG |

**CASE REPORT**

<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
</table>
| 2619 | Organ sparing to cure stage IV rectal cancer: A case report and review of literature  
| 2627 | Metachronous primary esophageal squamous cell carcinoma and duodenal adenocarcinoma: A case report and review of literature  
Huang CC, Ying LQ, Chen YP, Ji M, Zhang L, Liu L |
Contents

World Journal of Gastrointestinal Surgery

Monthly Volume 15 Number 11 November 27, 2023

2639 Isolated traumatic gallbladder injury: A case report
   Liu DL, Pan JY, Huang TC, Li CZ, Feng WD, Wang GX

2646 Comprehensive treatment and a rare presentation of Cronkhite–Canada syndrome: Two case reports and review of literature
   Lv YQ, Wang ML, Tang TY, Li YQ

2657 Gastric inflammatory myofibroblastic tumor, a rare mesenchymal neoplasm: A case report

2663 Systematic sequential therapy for ex vivo liver resection and autotransplantation: A case report and review of literature
   Hu CL, Han X, Gao ZZ, Zhou B, Tang JL, Pei XR, Lu JN, Xu Q, Shen XP, Yan S, Ding Y
ABOUT COVER
Editorial Board Member of World Journal of Gastrointestinal Surgery, Osman Nuri Dilek, FACS, Professor, Department of Surgery, Division of Hepatopancreatobiliary Surgery, Izmir Katip Celebi University School of Medicine, Izmir 35150, Turkey. osmannuridilek@gmail.com

AIMS AND SCOPE
The primary aim of World Journal of Gastrointestinal Surgery (WJGS, World J Gastrointest Surg) is to provide scholars and readers from various fields of gastrointestinal surgery with a platform to publish high-quality basic and clinical research articles and communicate their research findings online.

WJGS mainly publishes articles reporting research results and findings obtained in the field of gastrointestinal surgery and covering a wide range of topics including biliary tract surgical procedures, biliopancreatic diversion, colectomy, esophagectomy, esophagostomy, pancreas transplantation, and pancreatectomy, etc.

INDEXING/ABSTRACTING
The WJGS is now abstracted and indexed in Science Citation Index Expanded (SCIE, also known as SciSearch®), Current Contents/Clinical Medicine, Journal Citation Reports/Science Edition, PubMed, PubMed Central, Reference Citation Analysis, China National Knowledge Infrastructure, China Science and Technology Journal Database, and Superstar Journals Database. The 2023 Edition of Journal Citation Reports® cites the 2022 impact factor (IF) for WJGS as 2.0; IF without journal self cites: 1.9; 5-year IF: 2.2; Journal Citation Indicator: 0.52; Ranking: 113 among 212 journals in surgery; Quartile category: Q3; Ranking: 81 among 93 journals in gastroenterology and hepatology; and Quartile category: Q4.

RESPONSIBLE EDITORS FOR THIS ISSUE
Production Editor: Rui-Rui Wu; Production Department Director: Xiang Li; Editorial Office Director: Jia-Ru Fan.
Retrospective Study

Correlation between pre-treatment serum total blood bilirubin and unconjugated bilirubin and prognosis in patients with colorectal cancer

Hui Tong, Peng Xing, Zhao-Ning Ji

Hui Tong, Peng Xing, Department of Medicine Oncology, Anhui Jingxian Hospital, Xuancheng 242500, Anhui Province, China

Zhao-Ning Ji, Department of Medicine Oncology, The First Affiliated Hospital of Wannan Medical College-Yijishan Hospital, Wuhu 241000, Anhui Province, China

Corresponding author: Zhao-Ning Ji, Doctor, MD, Chief Doctor, Department of Medicine Oncology, The First Affiliated Hospital of Wannan Medical College-Yijishan Hospital, No. 2 Zheshan West Road, Wuhu 241000, Anhui Province, China. jzn18963705636@163.com

Abstract

BACKGROUND
Epidemiological studies have found that unconjugated bilirubin (UCB) levels are positively correlated with the incidence of colorectal cancer (CRC). Therefore, bilirubin may also play an important role in the prognosis of CRC.

AIM
To investigate the predictive value of total bilirubin (TBIL) and UCB in the prognosis of patients with CRC.

METHODS
A total of 142 CRC patients were selected as the research subjects in Jingxian Hospital, from October 2014 to May 2021. General and tumour-related clinical data at admission and the overall survival at 3 years after surgery were collected. The optimal cut-off values of TBIL and UCB were determined by receiver operating characteristic curve analysis. Univariate and multivariate Cox regression were used to analyse the effect of bilirubin level on the survival of CRC patients. The Kaplan–Meier method was used to assess the survival time.

RESULTS
The 3-year overall survival rate of CRC patients was significantly higher in the high TBIL (> 13.45 μmol/L) group than in the low TBIL (≤ 13.45 μmol/L) group (76.4% vs 37.1%; P < 0.05). The 3-year overall survival rate of CRC patients in the high UCB (> 10.75 μmol/L) group was significantly higher than that in the low UCB (≤ 10.75 μmol/L) group (83.3% vs 34.2%; P < 0.05). Multivariate Cox regression analysis showed that higher TBIL levels were an independent predictor...
of better prognosis in CRC patients (hazard ratio = 0.360, 95% confidence interval: 0.159-0.812, \( P = 0.014 \)).

CONCLUSION
TBIL levels can be used as a prognostic indicator for CRC patients.

Key Words: Bilirubin; Colorectal neoplasms; Prognosis

©The Author(s) 2023. Published by Baishideng Publishing Group Inc. All rights reserved.

Core Tip: In this study, we demonstrated that bilirubin levels may be used as a prognostic indicator in colorectal cancer (CRC) patients. Higher total bilirubin (TBIL) and unconjugated bilirubin levels were negatively correlated with 3-year survival in CRC patients. TBIL may be used as a protective prognostic indicator in patients with CRC.

INTRODUCTION
Colorectal cancer (CRC) is the third most common cancer worldwide and the second leading cause of cancer-related death[1]. The incidence of CRC is higher in men than in women. The CRC burden is expected to increase by 60%, with more than 2.2 million new cancer cases and more than 1.1 million cancer deaths, by 2030[2].

Some studies have reported that bilirubin, a product of haemoglobin catabolism, and particularly unconjugated bilirubin (UCB), has significant anti-inflammatory and anti-oxidant effects and that it plays a role in several oxidative stress-related diseases, including CRC[3]. Epidemiological studies have found that, in men, UCB levels are positively correlated with the incidence of CRC, while they are negatively correlated with the incidence of CRC in women[4,5].

However, clinical data on the relationship between UCB levels and CRC prognosis are lacking. Therefore, this study aimed to investigate the effect of serum total bilirubin (TBIL) and UCB levels on the prognosis of patients with CRC.

MATERIALS AND METHODS
General information
Patients with CRC who attended Jingxian Hospital between October 2014 and May 2021 were selected. The clinical data of 142 study subjects who met the inclusion criteria were retrospectively analysed. Patient inclusion criteria were as follows: (1) Age > 18 years without preoperative antitumor treatment; (2) radical resection of primary CRC; (3) histopathology-confirmed diagnosis of all patients with stage I–III CRC; and (4) complete clinical and pathological data. Patient exclusion criteria were as follows: (1) Colon perforation and peritonitis; (2) history of oncological disease and death from other causes during follow-up; (3) severe cardiovascular disease; (4) primary hepatobiliary diseases that may affect serum bilirubin levels; and (5) incomplete data.

Among the 142 patients finally included, 91 were male and 51 were female, with an average age of (64.11 ± 9.10) years and a follow-up period of (5 to 49 mo). Clinical data of the study subjects at the time of admission were collected by reviewing electronic records. These data included age, sex, smoking status, tumour differentiation, tumour size, tumour location, tumour, node, and metastasis (TNM) staging, and laboratory test data (imaging examination, etc). Fasting peripheral blood samples were obtained from patients before surgery to determine TBIL and UCB levels.

Follow-up methods
Patients included in the study were followed up by telephone, or at inpatient or outpatient visits, starting from the time of patient discharge, with a follow-up interval of once every 2 mo. Patient survival and other conditions were followed up until the patient’s death or the study endpoint (October 31, 2022).

Statistical analysis
SPSS v22.0 (IBM SPSS Inc., Armonk, NY, United States) was used for statistical analysis of the data. Normally distributed quantitative data are expressed as mean ± SD and were compared between the two groups using t-tests. Quantitative data with a skewed distribution are expressed as median (interquartile interval) and were compared between the two groups using the non-parametric Mann-Whitney U test. Count data were expressed as composition ratios and were compared using the Chi-Square test. Survival curves were plotted using the Kaplan-Meier method and differences in survival between groups were analysed using the log-rank test. A Cox regression model was used to analyse the risk
factors affecting disease prognosis. A $P$ value of less than 0.05 was considered statistically significant.

**RESULTS**

**Determination of optimal cut-off values for TBIL and UCB**

To determine the optimal cut-off values for TBIL and UCB, the area under the receiver operating characteristic (ROC) curve for prediction of survival in CRC patients was fitted. The area under the ROC curve predicted by TBIL was 0.660 [95% confidence interval (CI): 0.565-0.755; $P = 0.001$], with a sensitivity of 67.9% and specificity of 72.1%. The maximum Youden index value was 0.400 at a cut-off value of 13.45 μmol/L for TBIL for dividing CRC patients into high TBIL (> 13.45 μmol/L) and low TBIL (≤ 13.45 μmol/L) groups. The area under the ROC curve predicted by UCB was 0.735 (95% CI: 0.646-0.82; $P < 0.001$), with a sensitivity of 67.9% and a specificity of 82.0%. The maximum Youden index value was 0.499 at a cut-off value of 10.75 μmol/L for UCB for dividing CRC patients into high UCB (> 10.75 μmol/L) and low UCB (≤ 10.75 μmol/L) groups (Table 1).

**Relationship between TBIL level grouping and basic clinical characteristics**

The differences between the two groups in the degree of tumour differentiation, presence of lymph node metastasis and pathological TNM stage were statistically significant ($P < 0.05$). However, there were no statistically significant differences ($P > 0.05$) in age, sex, tumour diameter, tumour location, chemotherapy, and smoking ratio (Table 2).

**Survival curve analysis of the TBIL and UCB groups**

The 3-year overall survival rate was 37.1% (26/70) in the low TBIL group and 76.4% (55/72) in the high TBIL group, which was statistically significantly different ($P < 0.001$). The 3-year overall survival rate was 34.2% (26/76) in the low UCB group and 83.3% (55/66) in the high UCB group, with a statistically significant difference between the two groups ($P < 0.001$), as shown in Figure 1.

**Cox univariate regression analysis of factors affecting the prognosis of CRC patients**

Cox univariate regression analysis was performed on variables collected in this study that had the potential to affect the prognosis of patients, including age and sex. The analysis showed that the degree of tumour differentiation, tumour diameter, lymph node metastasis, pathological stage, smoking, TBIL, and UCB were associated with prognosis ($P < 0.05$). Variables with statistically significant differences were further included in the multivariate regression analysis. The results showed that the degree of tumour differentiation, lymph node metastasis, and TBIL were risk factors affecting the prognosis of patients ($P < 0.05$), as shown in Table 3.

**DISCUSSION**

In this study, we demonstrated that bilirubin levels may be used as a prognostic indicator in CRC patients. Higher TBIL and UCB levels were negatively correlated with 3-year survival in CRC. TBIL may be used as a protective prognostic indicator in patients with CRC.

Bilirubin is a product of secondary catabolism of haemoglobin, which is released during the breakdown of aging red blood cells. Bilirubin is present in the circulation mainly in the form of TBIL, direct bilirubin, and UCB. Although abnormally high concentrations of bilirubin are considered harmful, mildly to moderately elevated serum bilirubin concentrations can act as a potent endogenous anti-oxidant with anti-inflammatory, anti-oxygenizing, and anti-proliferative effects through the process of oxidation of bilirubin itself to biliverdin. Recent evidence suggests that mildly elevated levels of bilirubin, a novel metabolic hormone, may have a protective role in cardiovascular disease and cancer. Several studies have shown a close relationship between serum bilirubin levels and digestive system tumours. Sun et al. found that low TBIL levels were associated with poor prognosis in gastric cancer, but other studies have shown that high levels of TBIL are a risk factor for poor tumour prognosis.

Studies have reported inconsistent results regarding the relationship between circulating bilirubin levels and risk of CRC. In a Mendelian randomization study (67878 cases), TBIL levels were not associated with the risk of CRC, which was similar to the findings of a meta-analysis and a prospective survey. In an approximately 10-year follow-up study by He et al., baseline TBIL levels were found to be negatively correlated with the risk of CRC. On the other hand, a nested case-control study by McCullough et al. found a positive correlation between TBIL levels and the risk of CRC. Although the relationship between bilirubin levels and the risk of CRC remains inconclusive, its potential predictive value for the prognosis of CRC remains a hot topic in the field.

In a prospective study, combining preoperative albumin with bilirubin could predict postoperative complications and overall survival in CRC patients, particularly in stage III patients with tumour metastasis. In the present study, we found that CRC patients with lower levels of TBIL had a worse prognosis and that a lower TBIL level was an independent risk factor for poor survival outcomes in CRC patients, which was consistent with the findings of Sun et al. In the other hand, Yang et al. found that increased TBIL was associated with decreased overall survival in CRC patients. The difference between our study findings and those of Yang et al. may be related to the inclusion of different study subjects, as their study subjects consisted of stage IV CRC patients, while our study subjects did not include stage IV patients.
Table 1 Determination of optimal cut-off values for total bilirubin and unconjugated bilirubin (%)

<table>
<thead>
<tr>
<th>Cut-off (μmol/L)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Jordan index</th>
<th>Area</th>
<th>95%CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>TBIL</td>
<td>13.45</td>
<td>67.9</td>
<td>72.1</td>
<td>0.400</td>
<td>0.660</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.565-0.755</td>
</tr>
<tr>
<td>UCB</td>
<td>10.75</td>
<td>67.9</td>
<td>82.0</td>
<td>0.499</td>
<td>0.735</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.646-0.823</td>
</tr>
</tbody>
</table>

TBIL: Total bilirubin; UCB: Unconjugated bilirubin; CI: Confidence interval.

Table 2 Relationship between total bilirubin level grouping and basic clinical characteristics of patients (mean ± SD)

<table>
<thead>
<tr>
<th></th>
<th>TBIL ≤ 13.45 μmol/L (n = 70)</th>
<th>TBIL &gt; 13.45 μmol/L (n = 72)</th>
<th>t/χ²</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>65.21 ± 8.33</td>
<td>63.03 ± 9.73</td>
<td>1.437</td>
<td>0.153</td>
</tr>
<tr>
<td>TBIL (μmol/L)</td>
<td>10.65 ± 2.11</td>
<td>17.70 ± 4.43</td>
<td>12.163</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>UCB (μmol/L)</td>
<td>8.81 ± 2.42</td>
<td>13.48 ± 4.10</td>
<td>8.297</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>Female</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>49 (70.0)</td>
<td>42 (58.3)</td>
<td>2.099</td>
<td>0.147</td>
</tr>
<tr>
<td>Grade</td>
<td>High</td>
<td>Middle</td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20 (28.6)</td>
<td>16 (22.9)</td>
<td>34 (48.6)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>36.1</td>
<td>45.8</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td>Diameter</td>
<td>≤ 5 cm</td>
<td>≥ 5 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>26 (37.1)</td>
<td>34 (47.2)</td>
<td>3.505</td>
<td>0.061</td>
</tr>
<tr>
<td>Site</td>
<td>Rectum</td>
<td>Right</td>
<td>Left</td>
<td></td>
</tr>
<tr>
<td></td>
<td>26 (37.1)</td>
<td>20 (28.6)</td>
<td>24 (34.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>37.2</td>
<td>25.0</td>
<td>27.8</td>
<td></td>
</tr>
<tr>
<td>Lymph node metastasis</td>
<td>No</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>27 (38.6)</td>
<td>43 (61.4)</td>
<td>4.108</td>
<td>0.043</td>
</tr>
<tr>
<td>TNM</td>
<td>I</td>
<td>II</td>
<td>III</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23 (32.9)</td>
<td>22 (31.4)</td>
<td>25 (35.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>47.2</td>
<td>34.7</td>
<td>18.1</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>23 (32.9)</td>
<td>47 (67.1)</td>
<td>0.166</td>
<td>0.683</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td>Yes</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>42 (60.0)</td>
<td>28 (40.0)</td>
<td>0.753</td>
<td>0.386</td>
</tr>
</tbody>
</table>

T-test for age, total bilirubin, unconjugated bilirubin, χ² for gender, degree of tumour differentiation, tumour diameter, tumour location, presence of lymph node metastasis, pathological tumour, node, and metastasis stage, smoking, whether chemotherapy. TBIL: Total bilirubin; UCB: Unconjugated bilirubin; TNM: Tumor, node, and metastasis.

UCB, which is the most active anti-oxidant component of TBIL in vitro, comprises a large part of circulating bilirubin [18]. In the present study, lower UCB levels were associated with lower survival rates in CRC patients in univariate, but not in multivariate Cox regression analysis, similar to previous findings [19]. This suggests that UCB, as a prognostic factor, is influenced by other factors and is not suitable as an independent predictor in clinical practice.

In conclusion, our results indicate that circulating TBIL may be used as a prognostic indicator in CRC patients. However, due to the retrospective nature of this study and the small sample size, larger prospective studies are still needed to confirm these findings.
Table 3 Cox regression analysis affecting the prognosis of colorectal cancer patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Univariate analysis</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR</td>
<td>95%CI</td>
<td>P value</td>
</tr>
<tr>
<td>Age (yr)</td>
<td>1.017</td>
<td>0.989-1.046</td>
<td>0.234</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>0.805</td>
<td>0.468-1.384</td>
<td>0.433</td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>4.664</td>
<td>1.888-11.521</td>
<td>0.001</td>
</tr>
<tr>
<td>Low</td>
<td>39.435</td>
<td>16.469-94.427</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Diameter</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 5 cm</td>
<td>2.287</td>
<td>1.315-3.980</td>
<td>0.003</td>
</tr>
<tr>
<td>≥ 5 cm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lymph node metastasis</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>17.672</td>
<td>7.815-39.963</td>
</tr>
<tr>
<td>TNM</td>
<td>I</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>II</td>
<td>7.235</td>
<td>3.023-17.315</td>
</tr>
<tr>
<td></td>
<td>III</td>
<td>19.778</td>
<td>8.461-46.235</td>
</tr>
<tr>
<td>Smoking</td>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>2.357</td>
<td>1.424-3.093</td>
</tr>
<tr>
<td>TBIL (μmol/L)</td>
<td>≤ 13.45</td>
<td>0.282</td>
<td>0.160-0.495</td>
</tr>
<tr>
<td></td>
<td>&gt; 13.45</td>
<td>0.178</td>
<td>0.093-0.344</td>
</tr>
</tbody>
</table>

TBIL: Total bilirubin; UCB: Unconjugated bilirubin; TNM: Tumour, node, and metastasis; CI: Confidence interval; HR: Hazard Ratio.

CONCLUSION

TBIL levels can be used as a prognostic indicator for CRC patients.

ARTICLE HIGHLIGHTS

Research background

Epidemiological studies have found that unconjugated bilirubin (UCB) levels are positively correlated with the incidence of colorectal cancer (CRC).
**Research motivation**

Therefore, we speculate that bilirubin may also play an important role in the prognosis of CRC.

**Research objectives**

To investigate the predictive value of total bilirubin (TBIL) and UCB in the prognosis of patients with CRC.

**Research methods**

A total of 142 CRC patients were selected as the research subjects in Jingxian Hospital, from October 2014 to May 2021. General and tumour-related clinical data at admission and the overall survival at 3 years after surgery were collected. The optimal cut-off values of TBIL and UCB were determined by receiver operating characteristic curve analysis. Univariate and multivariate Cox regression were used to analyse the effect of bilirubin level on the survival of CRC patients. The Kaplan–Meier method was used to assess the survival time.

**Research results**

The 3-year overall survival rate of CRC patients was significantly higher in the high TBIL (> 13.45 μmol/L) group than in the low TBIL (≤ 13.45 μmol/L) group (76.4% vs 37.1%; \( P < 0.05 \)). The 3-year overall survival rate of CRC patients in the high UCB (> 10.75 μmol/L) group was significantly higher than that in the low UCB (≤ 10.75 μmol/L) group (83.3% vs 34.2%; \( P < 0.05 \)). Multivariate Cox regression analysis showed that higher TBIL levels were an independent predictor of better prognosis in CRC patients (hazard ratio = 0.360, 95% confidence interval: 0.159-0.812, \( P = 0.014 \)).

**Research conclusions**

TBIL levels can be used as a prognostic indicator for CRC patients.

**Research perspectives**

To investigate the role of TBIL and UCB in the prognosis of patients with CRC.

**FOOTNOTES**

**Author contributions:** Ji ZN designed the research; Tong H performed the research; Ji ZN and Xing P contributed new reagents or analytic tools; Tong H analyzed data and wrote the paper.

**Institutional review board statement:** This study was reviewed and approved by the Ethics Committee of Jingxian Hospital in Anhui Province.

**Informed consent statement:** As the study used anonymous and pre-existing data, the requirement for informed consent from patients was waived.

**Conflict-of-interest statement:** We have no financial relationships to disclose.

**Data sharing statement:** No additional data are available.

**Open-Access:** This article is an open-access article that was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution NonCommercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: https://creativecommons.org/Licenses/by-nc/4.0/

**Country/Territory of origin:** China

**ORCID number:** Zhao-Ning Ji 0009-0000-0440-3892.

**S-Editor:** Qu XL

**L-Editor:** Webster JR

**P-Editor:** Zhang YL

**REFERENCES**


Serum blood bilirubin predict CRC prognosis


