Validation of the Chinese version of the EORTC QLQ-CR29 in patients with colorectal cancer

Jin-Bo Lin, Lei Zhang, Dong-Wen Wu, Zhou-Huan Xi, Xue-Jun Wang, Yun-Shou Lin, Wakana Fujiwara, Jing-Ru Tian, Min Wang, Peng Peng, Ai Guo, Zhen Yang, Le Luo, Ling-Ya Jiang, Qia-Qia Li, Xue-Ying Zhang, Yun-Feng Zhang, Hou-Wei Xu, Bing Yang, Xin-Lin Li, Yi-Xiong Lei

performed data analysis and interpretation; Wang M and Peng P wrote the paper; Yang Z, Luo L, Jiang LY, Li QQ, Zhang XY, Zhang YF, Xu HW, Yang B and Li XL collected the data; Fujiwara W and Lei YX revised the article; all authors have approved the final version to be published.

Supported by Science & Technology Innovation Commission of Shenzhen (to Lin JB), No. 201404113000346 and No. JCYJ2014041150916744; and the Science & Technology Project of Shenzhen Longgang District, No. 201406063001007 and No. YLWS20140606101914846; and the Science & Technology Project of Shenzhen Longgang District, No. 20160607153104624 (to Zhang YF).

Institutional review board statement: The study was reviewed and approved by the Institutional Review Boards of the Third Xiangya Hospital of Central South University, the Affiliated Tumor Hospital of Central South University, the Longgang Central Hospital of Shenzhen, and the Affiliated Tumor Hospital of Guangzhou Medical University.

Informed consent statement: All study participants, or their legal guardian, provided informed written consent prior to study enrollment.

Conflict-of-interest statement: There is no conflict of interest related to this study.

Data sharing statement: The datasets in the current study are available from the corresponding author on reasonable request at colorectum@163.com.

Open-Access: This article is an open-access article which was selected by an in-house editor and fully peer-reviewed by external reviewers. It is distributed in accordance with the Creative Commons Attribution Non Commercial (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: http://creativecommons.org/licenses/by-nc/4.0/
INTRODUCTION

Colorectal cancer (CRC) is the third most common cancer and the fourth leading cause of cancer death worldwide. According to the latest data, almost 1.4 million people were diagnosed with CRC and 700,000 people died of CRC worldwide in 2012[2]. Moreover, the number of newly diagnosed CRC patients in China in 2012 was estimated to be 331,300, which accounted for approximately 24% of all cases in the world[2]. Therefore, it is important to prolong the lives of CRC patients and improve their quality of life.

The EORTC QLQ-CR29 questionnaire was developed by the European Organization for Research and Treatment of Cancer (EORTC) to evaluate the quality of life in CRC patients. It has already been validated in Holland, Spain, Poland and several other countries[3-8]. However, the dietary and cultural differences between China and Western countries may lead to different interpretations of quality of life. Therefore, it is essential to test the reliability and validity of the Chinese version of the EORTC QLQ-CR29 in patients with CRC, which has never been done in mainland China.

MATERIALS AND METHODS

Patients

A total of 356 patients with CRC in the Third Xiangya Hospital of Central South University, the Affiliated Tumor Hospital of Central South University, the Longgang Central Hospital of Shenzhen, and the Affiliated Tumor Hospital of Guangzhou Medical University were recruited between March 2014 and January 2015. Patients were included in the study if they were older than 18 years and had histological confirmation of colon or rectal cancer. Patients who had complications or who had been diagnosed with a cognitive disorder or psychonosema were excluded.

Core tip: This is the first study to examine the reliability and validity of the Chinese version of the EORTC QLQ-CR29 in patients with colorectal cancer in mainland China. The EORTC QLQ-CR29 exhibits high validity and reliability in Chinese patients with CRC, and can therefore be recommended as a valuable tool for the assessment of quality of life in these patients.

Lin JB, Zhang L, Wu DW, Xi ZH, Wang XJ, Lin YS, Fujiwara W, Tian JR, Wang M, Peng P, Guo A, Yang Z, Luo L, Jiang LY, Li QQ, Zhang XY, Zhang YF, Xu HW, Yang B, Li XL, Lei YX. Validation of the Chinese version of the EORTC QLQ-CR29 in patients with colorectal cancer. World J Gastroenterol 2017; 23(10): 1891-1898 Available from: URL: http://www.wjgnet.com/1007-9327/full/v23/i10/1891.htm DOI: http://dx.doi.org/10.3748/wjg.v23.i10.1891
All participants completed the Chinese version of the EORTC QLQ-C30 and EORTC QLQ-CR29 during the 11-mo recruitment period.

**Instruments**

**EORTC QLQ-C30:** The EORTC QLQ-C30 is the core questionnaire designed by the European Organization for Research and Treatment of Cancer, and has five functional dimensions: physical functioning (PF), role functioning (RF), cognitive functioning (CF), emotional functioning (EF) and social functioning (SF); three symptom scales: fatigue (FA), pain (PA), and nausea/vomiting (NV); six single items addressing various symptoms and perceived financial impact, and a global health-related quality of life (HRQOL) subscale. Among the 30 items, 29 have seven possible responses and are awarded a score of 1 to 7 points according to the answer; the other has a four-point answer scale: 1, Not at all; 2, A little; 3, Quite a bit; 4, Very much. The reliability and validity of C30 have already been verified in China.

**EORTC QLQ-CR29:** The EORTC QLQ-CR29 was specifically designed by the EORTC QL Group (The European Organization for Research and Treatment of Cancer Quality of Life Group) as the QLQ-C30 supplement for the evaluation of HRQOL in CRC patients. This combination has already been widely used in both clinical and basic research.

The QLQ-CR29 includes 29 items that evaluate symptoms (gastrointestinal, urinary, pain and others) and functional areas (sexual, body image and others) that are associated with CRC and its treatments. There are separate items for patients with and without a stoma (items 49 to 54, with item 55 only for patients with a stoma) and separate items to evaluate the sexual function of men and women. The questionnaires ask for all items in the past week except those pertaining to sexuality, which request the patients to evaluate the items in the past four weeks. Similar to the EORTC QLQ-C30, the QLQ-CR29 has a Likert scale of four response categories (item 48 requires a yes or no answer). All patient-rated scores are linearly converted into a scale from 0 to 100 for both the QLQ-C30 and QLQ-CR29.

According to the EORTC guidelines, two translators first translated EORTC QLQ-CR29 into Chinese (Simplified Chinese), then another two translators translated the Chinese version of the EORTC QLQ-CR29 into English and compared it with the original questionnaire to verify whether it fully reflected the contents of the original questionnaire. After several amendments, we then selected 20 female and 20 male patients (both male and female patients included 3 stoma patients) to determine if the questionnaire was easy to understand. According to the feedback, we finally developed the Chinese version of the EORTC QLQ-CR29.

**Karnofsky performance scale**

The Karnofsky performance scale (KPS) was determined by physicians according to the condition of the patient with respect to illness, self-care ability and daily activities. The total score of 100 was graded by 10 and the higher the score, the better the patient’s health.

**Ethics**

Approval for this study was obtained from the Ethics Committees of the four participating hospitals. Before the investigation, we asked patients to provide a signed informed consent, and confirmed their consent to participate in the study to protect their voluntary participation, right to know, and right of privacy.

**Statistical analysis**

We selected nurses on duty in the relevant departments as investigators in this study. After training, the investigators explained and introduced the protocol to the participants, and obtained basic information and KPS scores. Each participant completed the EORTC QLQ-CR29 and EORTC QLQ-C30 independently. Each scale score was converted based on standard formula, and the points ranged from 0 points (the worst) to 100 points (best).

All data were analyzed using SPSS 17.0 software. Numbers (percentages) were used to describe numerical data and the mean ± SD was adopted to describe measured data.

The internal consistency of the questionnaire was assessed using Cronbach’s α coefficient (α > 0.7 was considered acceptable).

Multitrait scaling analysis was used to assess the module structure. The convergent validity of each item was determined by calculating the correlation between each item and its own dimension (r > 0.40 was considered acceptable). For discriminant validity, we expected the correlation between each item and its own dimension to be greater than the correlation between the item and the other dimensions.

Correlations between all of the EORTC QLQ-CR29 and the EORTC QLQ-C30 areas were calculated based on the Spearman correlation coefficient (r > 0.4 was considered strongly correlated).

Known-groups validity was assessed by making comparisons between subgroups based on the presence of a stoma and KPS score (KPS ≤ 80; KPS > 80) using the Wilcoxon rank sum test.

The acceptability was evaluated by the completion ratio of the questionnaires and the miss rate of each item.

**RESULTS**

**Patient characteristics and compliance**

A total of 356 patients were enrolled in the study and no one declined the invitation to participate. The study
Correlations with the EORTC QLQ-C30: The correlations between other dimensions and their sub-items were all greater than their correlations with the correlations between other dimensions and their sub-items were all greater than 0.4. In addition to the finding that the correlation between item 28 for the patients with a higher than 0.4. In addition to the finding that the correlation between all dimensions and their sub-items were higher than 0.4. The correlations between the blood and mucus in the stool dimension and three dimensions of the C30 (quality of life, pain and diarrhea) were all greater than 0.4. Seven dimensions (body image, buttock pain, hair loss, bloating, fecal incontinence, sore skin and dyspareunia) had correlation coefficients with nausea/vomiting that were higher than 0.4, and the correlations between the stool frequency and diarrhea as well as taste and appetite loss were also greater than 0.4 (Table 3).

Known-groups validity: The differences between the CR29 and C30 scores are shown in Table 4, where the data are grouped based on the clinical parameters. In addition to items such as abdominal pain, dry mouth and stoma care problems (0.059, 0.170, and 0.941) and dimensions such as urinary frequency and body image (0.098 and 0.589), other areas in subgroups divided by the KPS scores (KPS ≤ 80; KPS > 80) also showed statistical significance (P < 0.05). As for patients with or without a stoma, body image and most single-item dimensions from the CR29 and only role, social as well as nausea and vomiting dimensions from the C30 showed statistically significant differences.

Acceptability
In the survey, 285 of 356 patients (80.1%) completed the EORTC (C30 and CR29) questionnaires, and a total of 265 patients (74.4%) completed the basic status questionnaire and the measurement questionnaires. The lowest response rates were associated with sexual problems, with a miss rate of 3.4% (12 cases). Overall, the questionnaire completion rate was higher than 90%, which shows that over 90% of the items were answered.

DISCUSSION
Due to improvements in curative therapy, doctors have started to pay more attention to HRQOL in CRC patients. In this study, we selected the EORTC QLQ-CR29 and EORTC QLQ-C30, and examined their reliability, validity, and acceptability in terms of assessing the quality of life in patients with CRC in mainland China. The overall goal of the study was to determine the feasibility of these instruments in the clinical setting in China.

The analysis of internal consistency showed that, regardless of whether a stoma was present, Cronbach'...
Table 2 Item convergent and discriminant validity for the EORTC QLQ-CR29 scales, and for patients with and without a stoma

| QLQ-CR29 scales                     | Total sample (n = 354) | Without a stoma (n = 298) | With a stoma (n = 56) |
|-------------------------------------|------------------------|---------------------------|-----------------------|
|                                     | Convergent  | Discriminant  | α       | Convergent  | Discriminant  | α       | Convergent  | Discriminant  | α       |
| Urinary frequency                   | 0.589-0.923 | 0.004-0.306 | 0.406   | 0.588-0.924 | 0.002-0.321 | 0.363   | 0.587-0.919 | 0.017-0.333 | 0.608   |
| Blood or mucus in stools            | 0.794-0.886 | 0.004-0.712 | 0.641   | 0.790-0.891 | 0.002-0.738 | 0.638   | 0.815-0.829 | 0.037-1.000 | 0.632   |
| Stool frequency                     | 0.698-0.965 | 0.003-0.641 | 0.679   | 0.696-0.967 | 0.001-0.669 | 0.716   | 0.645-0.957 | 0.003-0.389 | 0.423   |
| Body image                          | 0.628-0.826 | 0.060-0.405  | 0.715   | 0.614-0.859 | 0.039-0.422 | 0.718   | 0.703-0.792 | 0.004-0.504 | 0.676   |

*a* Two are missing.

Table 3 Correlations between the EORTC QLQ-C29 and the QLQ-C30

| CR29 scales          | QOL   | PF | RF | EF | CF | SF | FA | NV | PA | DY | SL | AP | CO | DI | FI |
|----------------------|-------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| EORTC-QLQ-C30        |       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| CR29 scales          |       |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Urinary frequency    | 0.004  | -0.071 | -0.111 | -0.083 | -0.163 | -0.159 | *0.107* | -0.130 | -0.033 | -0.046 | 0.061 | 0.023 | -0.131 | -0.022 | 0.063 |
| Blood or mucus in stool | -0.412 | -0.320 | -0.074 | -0.091 | -0.166 | 0.077 | 0.296 | 0.383 | 0.451 | 0.166 | 0.190 | 0.120 | 0.321 | 0.526 | -0.141 |
| Stool frequency      | -0.322 | -0.236 | -0.075 | -0.132 | -0.115 | -0.026 | 0.268 | 0.340 | 0.349 | 0.212 | 0.188 | 0.120 | 0.247 | 0.492 | -0.113 |
| Body image           | 0.254  | 0.179 | -0.052 | 0.051 | 0.100 | -0.172 | -0.303 | -0.485 | -0.363 | -0.251 | -0.185 | -0.279 | -0.240 | -0.224 | 0.132 |

s α coefficient in each dimension was satisfactory or near-satisfactory. In the original EORTC study, Cronbach’s α coefficients were greater than or almost equal to 0.7[^7](#). Our data mainly showed lower Cronbach’s α coefficients than those in a similar study by Nowak et al[^8](#), particularly in the urinary frequency dimension (0.363-0.608). Of note, in the studies by Arraras et al[^8](#), Nowak et al[^8](#) and Arraras Urdaniz et al[^24](#), Cronbach’s α coefficients below 0.7 were also obtained for the abdominal pain and blood and mucus in the stool dimensions. The differences between our findings and those of previous studies may be due to differences in the perceptions of quality of life in patients from different regions; however, the differences were still in the acceptable range. In addition, the reliability of the dimensions related to body image and stool frequency in patients without a stoma was higher than that in patients with a stoma, which is different from the studies reported by Nowak et al[^8](#) and Whistance et al[^9](#).

In agreement with the results reported by Whistance, the correlations between the EORTC
Table 4 Known group comparisons: scales and items in the QLQ-C30 and CR29 for clinically distinct groups

| CR29 scales | Stoma (n = 56) | No stoma (n = 298) | P value<sup>1</sup> | KPS ≤ 80 (n = 162) | KPS > 80 (n = 177) | P value<sup>1</sup> |
|-------------|---------------|-------------------|--------------------|--------------------|--------------------|--------------------|
| Urinary frequency | 6.5 ± 14.5 | 6.1 ± 13.5 | 0.856 | 6.7 ± 12.3 | 5.8 ± 14.9 | 0.098 |
| Blood and mucus in stool | 18.9 ± 25.9 | 10.3 ± 16.3 | 0.160 | 13.8 ± 19.7 | 7.3 ± 12.7 | 0.019 |
| Stool frequency | 8.0 ± 13.2 | 8.4 ± 14.8 | 0.960 | 11.2 ± 18.2 | 5.1 ± 9.6 | 0.017 |
| Body image | 81.7 ± 18.9 | 88.6 ± 14.7 | 0.004 | 87.7 ± 17.7 | 89.0 ± 11.9 | 0.589 |
| CR29 single items | | | | | | |
| Urinary incontinence | 7.7 ± 4.2 | 1.6 ± 7.1 | < 0.001 | 0.8 ± 0.7 | 4.2 ± 11.1 | 0.001 |
| Dysuria | 7.7 ± 16.8 | 1.5 ± 12.3 | 0.244 | 3.2 ± 11.2 | 8.0 ± 14.7 | < 0.001 |
| Abdominal pain | 11.9 ± 21.5 | 12.0 ± 18.7 | 0.651 | 13.5 ± 21.0 | 9.0 ± 16.1 | 0.059 |
| Buttock pain | 10.7 ± 15.7 | 5.4 ± 13.2 | 0.005 | 2.5 ± 8.8 | 9.0 ± 16.1 | < 0.001 |
| Bloating | 16.1 ± 16.8 | 20.9 ± 21.4 | 0.183 | 25.2 ± 23.9 | 15.0 ± 16.6 | < 0.001 |
| Dry mouth | 11.9 ± 17.3 | 7.2 ± 15.1 | 0.025 | 6.0 ± 14.4 | 8.0 ± 15.1 | 0.170 |
| Hair loss | 14.3 ± 18.9 | 9.6 ± 16.6 | 0.058 | 7.7 ± 17.2 | 11.1 ± 16.2 | 0.010 |
| Taste | 15.5 ± 22.9 | 23.8 ± 21.7 | 0.002 | 26.0 ± 25.0 | 18.8 ± 18.4 | 0.015 |
| Anxiety | 31.0 ± 31.0 | 44.6 ± 23.7 | < 0.001 | 52.1 ± 22.6 | 35.1 ± 24.1 | < 0.001 |
| Weight | 22.6 ± 21.2 | 44.6 ± 23.7 | 0.032 | 32.3 ± 19.9 | 21.6 ± 16.8 | < 0.001 |
| Fatulence | 14.3 ± 17.8 | 5.0 ± 13.4 | < 0.001 | 4.5 ± 14.6 | 7.0 ± 13.6 | 0.012 |
| Fecal incontinence | 15.5 ± 20.1 | 4.4 ± 11.9 | < 0.001 | 2.5 ± 10.2 | 8.0 ± 15.1 | < 0.001 |
| Sore skin | 26.2 ± 23.5 | 3.1 ± 10.1 | < 0.001 | 3.5 ± 12.7 | 9.7 ± 17.5 | < 0.001 |
| Embarrassment | 25.0 ± 20.4 | 2.8 ± 8.4 | < 0.001 | 4.1 ± 12.8 | 7.1 ± 14.6 | 0.019 |
| Stoma care problems | | | | | | |
| Sexual interest (men) | 74.4 ± 23.5 | 69.8 ± 25.5 | 0.333 | 76.3 ± 22.8 | 66.0 ± 26.0 | 0.020 |
| Impotence | 9.4 ± 17.0 | 8.5 ± 20.2 | 0.364 | 6.5 ± 19.2 | 10.7 ± 19.9 | 0.021 |
| Sexual interest (women) | 81.0 ± 17.8 | 77.1 ± 22.5 | 0.749 | 83.7 ± 16.8 | 71.2 ± 25.0 | 0.005 |
| Dyspareunia | 9.5 ± 16.3 | 4.3 ± 14.1 | 0.172 | 2.7 ± 15.0 | 6.5 ± 13.4 | 0.012 |
| QLQ-C30 scales | | | | | | |
| Physical | 85.5 ± 12.4 | 82.9 ± 16.5 | 0.335 | 77.6 ± 18.3 | 89.4 ± 10.7 | < 0.001 |
| Role | 84.8 ± 17.2 | 69.4 ± 20.6 | < 0.001 | 61.7 ± 20.6 | 81.2 ± 16.4 | < 0.001 |
| Emotional | 80.5 ± 17.7 | 74.4 ± 14.0 | 0.001 | 69.3 ± 14.4 | 81.2 ± 11.9 | < 0.001 |
| Cognitive | 79.5 ± 20.5 | 80.7 ± 20.0 | 0.397 | 75.4 ± 34.9 | 85.9 ± 14.6 | < 0.001 |
| Social | 60.0 ± 22.4 | 45.7 ± 25.5 | < 0.001 | 38.5 ± 24.9 | 55.7 ± 23.5 | < 0.001 |
| Overall quality of life | 67.9 ± 21.4 | 67.8 ± 17.4 | 0.636 | 59.5 ± 16.5 | 76.4 ± 14.4 | < 0.001 |
| Fatigue | 18.8 ± 18.2 | 22.8 ± 19.9 | 0.108 | 30.5 ± 20.3 | 13.2 ± 13.8 | < 0.001 |
| Nausea and vomiting | 11.6 ± 13.8 | 6.1 ± 14.4 | < 0.001 | 4.7 ± 15.7 | 8.1 ± 12.5 | < 0.001 |
| Pain | 13.0 ± 16.6 | 12.0 ± 17.3 | 0.427 | 13.3 ± 19.1 | 9.4 ± 13.8 | 0.211 |

<sup>1</sup>Wilcoxon rank sum test.

QLQ-CR29 items and their dimensions were greater than the correlation coefficients of other dimensions, suggesting that the EORTC QLQ-CR29 has great convergent validity and discriminant validity[5]. Item 28 was examined only in females. In this subgroup, there were 10 women, five of whom answered one survey, while the other five answered two surveys. The correlation coefficient between item 28 in the stoma group and the presence of blood and mucus in the stool was 1, probably due to the small number of cases in the sample. A similar finding was noted in the study by Arraras et al[9].

The correlation coefficients between the EORTC QLQ-CR29 and EORTC QLQ-C30 scales showed that similar dimensions of QLQ had high correlations, while unrelated dimensions were only weakly correlated, demonstrating the validity of the QLQ-CR29 and indicating that the two questionnaires had different points of emphasis.

A comparison of the results showed that there were different QLQ-CR29 dimension scores among the groups divided by the KPS scores (KPS ≤ 80; KPS > 80) and whether the patients had a stoma or not, which signified that the QLQ-CR29 had good clinical validity and can be used to measure different patients with different conditions. These results are consistent with those reported by Whistance and other foreign validity tests[8,9]. In addition, this study showed that patients with a KPS > 80 had higher scores in functional dimensions, but lower scores in the symptom dimensions, and those patients with a KPS ≤ 80 had a poorer quality of life. Statistically significant differences existed in numerous dimensions in groups divided by the KPS score (e.g., stool frequency, P = 0.017). Due to the impact of disease or treatment, sexual function in patients was significantly inhibited, similar to the findings in previous reports by other groups[5,6,24]. The studies by Song et al[25] and Peng et al[26] revealed that treatment of CRC may lead to impotence. However, this was not found in our study, probably because different countries perform different types of surgery, which result in different types of complications. In addition, compared with patients with a stoma, patients without a stoma had...
lower scores in the symptom dimensions, and higher scores in the functional dimensions, which indicated better quality of life. Moreover, in our study, the scope of the scores was wide in each dimension of the questionnaire, indicating that the Chinese version of the CR29 had good clinical validity.

People of different cultures often have a different understanding of quality of life. After adequate translation, the EORTC QLQ-CR29 was also proved to be suitable for Chinese patients. When Arraras performed research on a Spanish version of the survey, 4.7% of patients considered some of the items in the questionnaire to be difficult to understand or answer, or unrelated to quality of life[1]. In our study, few patients had such problems and there was a high compliance rate (with a low miss rate), both of which indicate that the Chinese version of the EORTC QLQ-CR29 had great acceptability. Compared with the studies by Arraras et al[2] and Whistance et al[3], the sexual dimension in our study had a higher miss rate (2.9% and 2.3% vs 3.4%). This may be due to the fact that Asians are more reticent when talking about sex than Western patients, and were not willing to tell the truth to doctors[4]. In order to address this problem and obtain a more accurate and comprehensive evaluation, a more detailed explanation from medical professionals is required when patients complete the questionnaire.

There are a few limitations in our study. Firstly, the subgroups were only segregated by the score on the Karnofsky Performance Scale, the presence of a stoma had more clinical significance than previously thought, and increased bias should not be ignored. In addition, the representativeness of our study should be treated cautiously due to the deficiency of larger cross-regional multicenter studies in mainland China. To obtain more rigorous results, we will pay more attention to these limitations in future studies.

In conclusion, the present study showed that the EORT QLQ-C29 (Chinese version) is a valid and reliable instrument for assessing the quality of life of patients with CRC in mainland China.

**REFERENCES**

1. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global cancer statistics, 2012. CA Cancer J Clin 2015; 65: 87-108 [PMID: 25651787 DOI: 10.3322/caac.21262]
2. Chen W, Zheng R, Zuo T, Zeng H, Zhang S, He J. National cancer incidence and mortality in China, 2012. Chin J Cancer Res 2016; 28: 1-11 [PMID: 27041927 DOI: 10.3978/j.issn.1000-9604.2016.02.08]
3. Gujral S, Conroy T, Fleissner C, Sezer O, King PM, Avery KN, Sylvester P, Koller M, Sprangers MA, Blazey JM. Assessing quality of life in patients with colorectal cancer: an update of the EORTC quality of life questionnaire. Eur J Cancer 2007; 43: 1564-1573 [PMID: 17521904 DOI: 10.1016/j.ejca.2007.04.005]
4. Stiggelbout AM, Kunneman M, Baas-Thuijsjen MC, Neijenhuis PA, Loor AK, Jägers S, Vree R, Marijnissen CA, Pieterveen AH. The EORTC QLQ-CR29 quality of life questionnaire for colorectal cancer: validation of the Dutch version. Qual Life Res 2016; 25: 1853-1858 [PMID: 26711791 DOI: 10.1007/s11136-015-1210-5]
5. Arraras JI, Suárez J, Arias de la Vega F, Vera R, Asín G, Arrazubi V, Rico M, Teijeira L, Azparren J. The EORTC Quality of Life questionnaire for patients with colorectal cancer: EORTC QLQ CR29 validation study for Spanish patients. Clin Transl Oncol 2011; 13: 50-56 [PMID: 21239355 DOI: 10.1007/s12094-011-0616-y]
6. Arraras Urdaniz JI, Vera Garcia R, Martinez Aguillo M, Mantorera Burgaleta A, Arias de la Vega F, Salgado Pascual E. Quality of Life assessment through the EORTC questionnaires of colorectal cancer patients in advanced disease stages. Clin Transl Oncol 2006; 8: 664-671 [PMID: 17005468]
7. Magaji BA, Moy FM, Roslani AC, Sagap J, Zakaria J, Blazey JM, Law CW. Health-related quality of life among colorectal cancer patients in Malaysia: a study protocol. BMC Cancer 2012; 12: 384 [PMID: 22937765 DOI: 10.1186/1471-2407-12-384]
8. Nowak W, Tobiszewicz-Damczyk B, Brzyski P, Sałówka J, Kulis D, Richter P. Adaptation of quality of life module EORTC QLQ-CR29 for Polish patients with rectal cancer: initial assessment of
validation and reliability. *Pol Przegl Chir* 2011; 83: 502-510 [PMID: 22166739 DOI: 10.2478/v10035-011-0078-5]

9. Whistance RN, Conroy T, Chie W, Costantini A, Sezer O, Koller M, Johnson CD, Pilkington SA, Arraras J, Ben-Josef E, Pulhyblank AM, Fayers P, Blazey JM. Clinical and psychometric validation of the EORTC QLQ-CR29 questionnaire module to assess health-related quality of life in patients with colorectal cancer. *Eur J Cancer* 2009; 45: 3017-3026 [PMID: 19765978 DOI: 10.1016/j.ejca.2009.08.014]

10. Borghede G, Sullivan M. Measurement of quality of life in localized prostate cancer patients treated with radiotherapy. Development of a prostate cancer-specific module supplementing the EORTC QLQ-C30. *Qual Life Res* 1996; 5: 212-222 [PMID: 8998490]

11. Zhao H, Kanda K. Translation and validation of the standard Chinese version of the EORTC QLQ-C30. *Qual Life Res* 2000; 9: 129-137 [PMID: 10983477]

12. Ward WL, Hahn EA, Mo F, Hernandez L, Tulsky DS, Cella D. Reliability and validity of the Functional Assessment of Cancer Therapy-Colorectal (FACT-C) quality of life instrument. *Qual Life Res* 1999; 8: 181-195 [PMID: 10472150]

13. Zolecki A, Bujko K, Kepka L, Oledeki J, Rutkowski A, Nowacki MP. Abdominoperineal resection or anterior resection for rectal cancer: patient preferences before and after treatment. *Colorectal Dis* 2006; 8: 575-580 [PMID: 16919109 DOI: 10.1111/j.1463-1318.2006.01000.x]

14. Uwer L, Rotonda C, Guillemin F, Miny J, Kaminsky MC, Mercier M, Tournier-Rangeard L, Leonard I, Montcuquet P, Rauch P, Conroy T. Responsiveness of EORTC QLQ-C30, QLQ-CR38 and FACT-C quality of life questionnaires in patients with colorectal cancer. *Health Qual Life Outcomes* 2011; 9: 70 [PMID: 21859485 DOI: 10.1186/1477-7525-9-70]

15. Blazey JM, Hall E, Aaronson NK, Lloyd L, Waters R, Kelly JD, Fayers P. Validation and reliability testing of the EORTC QLQ-NMIBC24 questionnaire module to assess patient-reported outcomes in non-muscle-invasive bladder cancer. *Eur Urol* 2014; 66: 1148-1156 [PMID: 24612661 DOI: 10.1016/j.eururo.2014.02.034]

16. Sprangers MA, Cull A, Bjordal K, Groenvold M, Aaronson NK. The European Organization for Research and Treatment of Cancer. Approach to quality of life assessment: guidelines for developing questionnaire modules. EORTC Study Group on Quality of Life. *Qual Life Res* 1993; 2: 287-295 [PMID: 8220363]

17. Yates JW, Chalmer B, McKeagney FP. Evaluation of patients with advanced cancer using the Karnofsky performance status. *Cancer* 1980; 45: 2220-2224 [PMID: 7370963]

18. Friendlander AH, Ettinger RL. Karnofsky performance status scale. *Spec Care Dentist* 2009; 29: 147-148 [PMID: 19573040 DOI: 10.1111/j.1754-4505.2009.00088.x]

19. Färkkilä N, Sintonen H, Saarto T, Järvinen H, Hänninen J, Taari K, Roine RP. Health-related quality of life in colorectal cancer. *Colorectal Dis* 2013; 15: e215-e222 [PMID: 23351057 DOI: 10.1111/codi.12143]

20. Fenech DS, Takahashi T, Liu M, Spencer L, Swallow CJ, Cohen Z, Macrae HM, McLeod RS. Function and quality of life after transanal excision of rectal polyps and cancers. *Dis Colon Rectum* 2007, 50: 598-603 [PMID: 17309002 DOI: 10.1007/s10515-006-0865-y]

21. Hendren SK, O’Connor BI, Liu M, Asano T, Cohen Z, Swallow CJ, Macrae HM, Gryfe R, McLeod RS. Prevalence of male and female sexual dysfunction is high following surgery for rectal cancer. *Ann Surg* 2005; 242: 212-223 [PMID: 16041212]

22. Pietrzak L, Bujko K, Nowacki MP, Kepka L, Oledzki J, Rutkowski A, Szmeja K, Klady J, Dymekci D, Wielczorek A, Pawlak M, Lesniak T, Kowalska T, Richter P. Quality of life, anorectal and sexual functions after preoperative radiotherapy for rectal cancer: report of a randomised trial. *Radiother Oncol* 2007; 84: 217-225 [PMID: 17692977 DOI: 10.1016/j.radonc.2007.07.007]

23. Tofthagen C, Donovana KA, Morgan MA, Shibata D, Yeh Y. Oxaliplatin-induced peripheral neuropathy’s effects on health-related quality of life of colorectal cancer survivors. *Support Care Cancer* 2015; 23: 3307-3313 [PMID: 23903798 DOI: 10.1007/s00520-013-1905-5]

24. Arraras Urdaniz JI, Arias de la Vega F, Vera Garcia R, Manterola Burgaleta A, Martinez Aguillo M, Villafranca Iturre E, Salgado Pascual E. Quality of Life assessment through the EORTC questionnaires of locally advanced rectal cancer patients treated with preoperative chemo-radiotherapy. *Clin Transl Oncol* 2006; 8: 423-429 [PMID: 16790395]

25. Song PH, Yun SM, Kim JH, Moon KH. Comparison of the erectile function in male patients with rectal cancer treated by preoperative radiotherapy followed by surgery and surgery alone. *Int J Colorectal Dis* 2010; 25: 619-624 [PMID: 20169350 DOI: 10.1007/s00384-010-0879-8]

26. Peng J, Shi D, Goodman KA, Goldstein D, Xiao C, Guan Z, Cai S. Early results of quality of life for curatively treated rectal cancers in Chinese patients with EORTC QLQ-CR29. *Radiat Oncol* 2011; 6: 93 [PMID: 21835046 DOI: 10.1186/1748-717X-6-93]

P- Reviewer: Hoensch HPP, Pellino G
S- Editor: Ma YJ
L- Editor: Ma YJ
E- Editor: Wang CH
