

Available online at www.sciencedirect.com

journal homepage: <http://www.elsevier.com/locate/medici>

Original Research Article

Short-term results of quality of life for curatively treated colorectal cancer patients in Lithuania

Paulius Lizdenis^{a,*}, Justas Birutis^a, Ieva Čelkienė^a, Narimantas Samalavičius^b, Justas Kuliavas^b, Vytautas Slunskis^b, Tomas Poškus^c, Valdemaras Jotautas^c, Eligijus Poškus^c, Kęstutis Strupas^c, Žilvinas Saladžinskas^a, Algimantas Tamelis^a

^a Department of Surgery, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania

^b Centre of Oncosurgery, National Cancer Institute, Vilnius University, Vilnius, Lithuania

^c Centre of Abdominal Surgery, Vilnius University, Vilnius, Lithuania

ARTICLE INFO

Article history:

Received 20 March 2014

Accepted 18 January 2015

Available online 28 January 2015

Keywords:

Colorectal cancer

Resection

Quality of life

EORTC-QLQ-C30

EORTC-QLQ-CR29

ABSTRACT

Background and objective: Treatment options for colorectal cancer patients create the need to assess the quality of life (QoL) of colorectal cancer patients in the early postoperative period when changes are potentially greatest. The aim of the current study was to assess the QoL of colorectal cancer patients following open and laparoscopic colorectal surgery.

Materials and methods: A total of 82 consecutive patients requiring elective open or laparoscopic colorectal surgery were recruited to the study for 3 months in the three colorectal surgery centers of Lithuania. Patients completed the EORTC QLQ-C30 (version 3.0) questionnaire before surgery, 2 and 5 days, 1 and 3 months after operation. The EORTC QLQ-CR29 questionnaire was completed before surgery and at 1 and 3 months after operation. Analysis was done according to the manual for each instrument.

Results: EORTC QLQ-C30 reflected the postoperative recovery of QoL. The global health status, cognitive and emotional functioning came back to the preoperative level in one month after operation. Physical and role functioning for laparoscopic group was significantly improved in 1 month after operation and in 3 months for open surgery group respectively. Colorectal module EORTC-QLQ-CR29 found that future perspective increased significantly in laparoscopic group 1 month after operation.

Conclusions: The present study showed that majority of functional scale scores came back to the preoperative level during the first 3 months after colorectal cancer surgery. Differences in QoL according to surgical approach are mostly expressed on this period.

© 2015 Lithuanian University of Health Sciences. Production and hosting by Elsevier Urban & Partner Sp. z o.o. All rights reserved.

* Corresponding author at: Department of Surgery, Medical Academy, Lithuanian University of Health Sciences, Eivenių 2, 50161 Kaunas, Lithuania.

E-mail address: pauliuslizdenis@yahoo.com (P. Lizdenis).

Peer review under responsibility of Lithuanian University of Health Sciences.



<http://dx.doi.org/10.1016/j.medici.2015.01.006>

1010-660X/© 2015 Lithuanian University of Health Sciences. Production and hosting by Elsevier Urban & Partner Sp. z o.o. All rights reserved.

1. Introduction

Modern approach to the treatment options for colorectal cancer patients creates the need of consideration of quality of life (QoL) in the short terms as well as in long terms after treatment. QoL should be included along with the assessment of survival, local or distant recurrence, treatment morbidity, toxicity, because it reflects the cost effectiveness of treatment. The European Organization for Research and Treatment of Cancer (EORTC) QoL questionnaire (QLQ) is an integrated system for assessing the health-related QoL of cancer patients. The QLQ-C30 is the core questionnaire for evaluating the QoL of cancer patients [1–3]. At the same time the EORTC-QLQ-C30 has been reported as more sensitive than other questionnaires in detecting the impairment of QoL in the early postoperative period [4]. This greater sensitivity was the main reason for us to use the EORTC-QLQ-C30 as an instrument to assess early postoperative changes of QoL in patients undergoing colorectal surgery. The QLQ-CR29 was developed after revising the QLQ-CR38 for a few years [5], and was demonstrated internationally to have both sufficient validity and reliability to support its use as a supplement to the EORTC QLQ-C30 to assess patient-reported outcomes during treatment for colorectal cancer in clinical trials and other settings [6]. However, most of the studies are focused on the evaluation of the QoL of colorectal cancer patients in long terms (3, 6, 12 months) after surgical treatment, especially those who are assessing the different approaches of surgery – open and laparoscopic [7,8]. It is expected that patients recover their preoperative conditions much earlier and most expressed differences between surgical approaches with respect to QoL are potentially greatest in the early postoperative period. There are some studies that analyzed QoL in the early postoperative period after colorectal surgery [9,10], but they use different instruments for the assessment of self-reported health status.

The primary aim of current study was to assess the QoL of colorectal cancer patients in the early postoperative period, including different treatment modalities in a prospectively collected cohort, using EORTC QLQ-C30 and QLQ-CR29.

2. Materials and methods

Consecutive patients requiring elective colorectal surgery were recruited to the study for 3 months between September 1, 2012, and December 1, 2012, in the Centre of Abdominal Surgery, Vilnius University Hospital Santariškių Klinikos; Centre of Oncosurgery, Institute of Oncology Vilnius University; and Hospital of Lithuanian University of Health Sciences Kauno Klinikos. Informed consent was taken, and baseline demographic information was collected by means of patient interview preoperatively. Clinical and operative details, American Society of Anesthesiologists (ASA) grade, diagnosis, operation type (right, left, or rectal procedure), and presence of a stoma (or not) were also recorded. All patients with endoscopically and histologically confirmed colorectal cancer were eligible for the study, except those admitted as an emergency, younger than 18 years, or unable to consent. Surgery consisted of laparoscopic or open resection procedure

including right hemicolectomy, left hemicolectomy, sigmoid colectomy, anterior rectal resection, abdominoperineal resection or subtotal colectomy.

Validated Lithuanian translations of the EORTC QLQ-C30 (version 3.0) and QLQ-CR29 questionnaires were used in current study. For both instruments individual scores were converted to a score ranging from 0 to 100, according to the EORTC manuals. A high score for the symptom/item scales represented a high level of symptoms/problems related to specific colorectal surgery, whereas a high score for the functional scales and the global health/general quality-of-life index represented a high level of functioning, overall health and quality of life. For items without a response, at least 75% of items completed by patients were considered assessable in the current study, and the mean was imputed for missing items in assessable cases according to EORTC scoring guidelines.

Patients were asked to complete the EORTC QLQ-C30 questionnaire one day before surgery, 2 and 5 days, 1 and 3 months postoperatively.

The QLQ-CR29 questionnaire was completed one day before surgery, 1 and 3 months after operation, respectively, because some functions such as sexual, defecation problems are unavailable to evaluate correctly during first week after operation.

For indicative purposes the results of EORTC QLQ-C30 and QLQ-CR29 questionnaires were evaluated for all patients and separately compared between laparoscopic and conventional approach groups.

2.1. Statistical analysis

All statistical analysis of relevant clinical outcome measures and differences between EORTC questionnaire scores in the different time points was carried out using SPSS 12 software (IBM, Armonk, New York, USA). Means and SD were calculated for parametric data. Baseline demographic and clinical characteristics of patients in the laparoscopic and open surgery groups were compared by using the chi-square test and the Mann Whitney *U* test. Mean QoL scores were compared within groups at the different time points using the Wilcoxon test. $P < 0.05$ was considered statistically significant. Missing data were handled as instructed in the EORTC scoring manual.

3. Results

From September 2012 to November 2012, 82 patients undergoing elective colorectal cancer resection in three surgical centers were included in this study. There were 43 men and 39 women with a mean age of 64.75 years. The mean preoperative ASA score was 2.1. Complications occurred in 14 (17%) cases, and the mean hospitalization stay was 10.55 ± 5.28 days. There were no differences between groups at baseline with respect to ASA grade, gender, and TNM stage of cancer. Laparoscopic procedures were performed significantly more frequently for younger patients. Stoma was constructed significantly more often in the patients of the open group (Table 1). After open procedures, patients stayed longer in the hospital, but the difference was not significant. There were no differences in the postoperative complication rate between

Table 1 – Characteristics of the study population undergoing elective open or laparoscopic resection of colorectal carcinoma.

Characteristics	Open (n = 55)	Laparoscopic (n = 27)	P
Age, mean, years	67.7	57.8	0.035
ASA grade, mean	2.1	2.1	0.745
Male	29 (52.7)	14 (51.8)	0.55
Female	26 (47.3)	13 (48.2)	
T stage			
T1	2 (3.6)	4 (14.8)	0.136
T2	10 (18.2)	8 (29.6)	
T3	33 (60)	12 (44.4)	
T4	10 (18.2)	3 (11.1)	
N stage			
N0	28 (50.9)	15 (55.6)	0.588
N1	25 (45.5)	12 (44.4)	
N2	2 (3.6)	0	
M stage			
M0	52 (94.5)	27 (100)	0.216
M1	3 (5.5)	0	
Pathological G			
G1	13 (23.5)	4 (14.8)	0.586
G2	39 (71)	22 (81.5)	
G3	3 (5.5)	1 (3.7)	
Type of resection			
Right colectomy	15 (27.3)	2 (7.4)	0.800
Left colectomy	3 (5.5)	8 (29.6)	
Sigmoidectomy	8 (14.5)	6 (22.3)	
Rectal resection	25 (45.5)	10 (37)	
Abdominoperineal resection	4 (7.2)	1 (3.7)	
Complications	10 (18)	4 (14)	
Hospital stay, mean, days	11.7	8.6	
Stoma	16 (29)	2 (7.4)	0.025

Values are n (percentage) unless otherwise indicated. Percentages were compared using χ^2 test; means were compared using the Mann-Whitney U test.

groups. The dynamics of quality of life scores was assessed for all patients and evaluated separately within two groups of patients according to surgical approach: open and laparoscopic (data are given in Tables 2 and 3). Laparoscopic procedures were performed in 27 patients (32.9%) and a conventional open approach was applied in 55 patients (67.1%). Characteristics

of the patients and comparison across groups are given in Table 1.

The response rate of EORTC QLQ-C30 and EORTC-QLQ-CR29 questionnaires on postoperative days 2 and 5 was 100%, and after 1 and 3 months, for both questionnaires was 79.2% (65 patients) and 65.8% (54 patients), respectively.

EORTC-QLQ-C30 reflected the expected post-operative reduction of QoL on days 2 and 5 after operation (Table 2). Changes of QoL were also assessed in comparison to the second postoperative day when all functions are on the lowest level and specific symptoms are mostly expressed. The global health status, cognitive and emotional functioning came back to the preoperative level in 1 month after operation, while the physical, role and social functioning in 3 months respectively (Table 2). Specific symptoms/items were mostly expressed on days 2 and 5 after operation and returned to preoperative level or were reduced (nausea and vomiting, insomnia, constipation, diarrhea) in 1 month, but only the pain score decreased significantly in 1 month after operation. In evaluation of QoL for all patients, no significant changes of EORTC-QLQ-CR29 scores were observed during the first 3 months after operation (Table 3).

EORTC-QLQ-C30 outcomes were evaluated separately within open and laparoscopic groups (data are given in Table 2). Comparison between groups was excluded because there were significant differences in factors which are known to have impact in QoL: age and stoma. The global health status (GHS) score came back to the preoperative values at the same time points in both laparoscopic and open surgery groups (Table 2). Physical and role functioning was significantly improved in one month after operation for laparoscopic group and in 3 months for open surgery group respectively (Table 2). Emotional functioning was significantly increased in laparoscopic group 3 months after operation (Table 2). Meaningful differences within groups after operation were observed in many symptom scales and they reached significant differences mostly at 3 months (Table 2).

Colorectal module EORTC-QLQ-CR29 found that future perspective increased significantly in laparoscopic group 1 month after operation (Table 3). Sexual function was significantly decreased after 3 months in laparoscopic group in comparison with preoperative status (Table 3).

Table 2 – EORTC QLQ30 outcomes for open and laparoscopic operations.

	Preoperative	Day 2	Day 5	1 month	3 months
I. Global health status					
Open	43.97 ± 22	34.23 ± 21	40.90 ± 22	51.39 ± 19	55.00 ± 18
Laparoscopic	61.33 ± 19	51.11 ± 19	59.44 ± 23	66.27 ± 21	72.27 ± 19
All patients	57 ± 17.34	48 ± 18.7	50.8 ± 23.15	60 ± 12.49	66.67 ± 13.52
II. Functional scales					
1. Physical functioning					
Open	72.72 ± 26	44.52 ± 31	49.81 ± 28	65.31 ± 24	77.14 ± 23 [†]
Laparoscopic	79.73 ± 22	48.89 ± 20	65.33 ± 17	82.22 ± 26 [†]	86.35 ± 29 [†]
All patients	74.23 ± 22.6	46.4 ± 26.7	52.73 ± 17.2	68.7 ± 19.8	78.8 ± 15.7 [†]
2. Role functioning					
Open	72.66 ± 32	44.85 ± 36	44.00 ± 34	56.79 ± 32	75.40 ± 30 [†]
Laparoscopic	80.67 ± 22	36.67 ± 14	57.14 ± 22	70.63 ± 25 [†]	81.75 ± 32 [†]

Table 2 (Continued)

	Preoperative	Day 2	Day 5	1 month	3 months
All patients	74.17 ± 27	41.33 ± 25.9	46.17 ± 28.1	59.5 ± 27.3	76.33 ± 24.6*
3. Emotional functioning					
Open	70.38 ± 25	63.94 ± 24	68.11 ± 28	72.84 ± 21	75.07 ± 31
Laparoscopic	69.67 ± 22	70.56 ± 25	70.56 ± 27	85.71 ± 28	93.65 ± 29*
All patients	69.17 ± 26.8	59.67 ± 28.5	60.67 ± 32.5	74.25 ± 22.3	80.17 ± 9.9
4. Cognitive functioning					
Open	81.79 ± 21	74.84 ± 22	75.62 ± 23	80.86 ± 25	82.14 ± 35
Laparoscopic	82 ± 22	82 ± 28	84.44 ± 27	88.1 ± 25	90.06 ± 32
All patients	80.67 ± 23.5	68.3 ± 25.4	69.17 ± 26.3	81.67 ± 19.8	84.3 ± 17.9
5. Social functioning					
Open	74.87 ± 28	60.91 ± 32	58.64 ± 32	65.74 ± 31	79.00 ± 25
Laparoscopic	88 ± 22	63.17 ± 24	72.22 ± 21	80.16 ± 29	89.68 ± 29
All patients	77 ± 22.3	68 ± 18.7	67.67 ± 16	68.5 ± 23.3	81.17 ± 17.8
III. Symptom scales/items					
1. Fatigue					
Open	37.9 ± 28	55.2 ± 29	50.4 ± 20	39.4 ± 25	25.7 ± 20*
Laparoscopic	40 ± 26	52.3 ± 25	37.7 ± 25	27.51 ± 19	17.46 ± 22*
All patients	38 ± 27.7	55.1 ± 27.4	50.44 ± 21.7	39.33 ± 23.2	25.67 ± 16.3
2. Nausea and vomiting					
Open	9.9 ± 10	7 ± 12	4.2 ± 13	6.4 ± 13	9.6 ± 15
Laparoscopic	8 ± 18	3.3 ± 12	1.1 ± 8	1.5 ± 10	4.8 ± 8
All patients	8.6 ± 14.4	6.6 ± 9.3	3.3 ± 7	5.5 ± 8.7	8.1 ± 10.1
3. Pain					
Open	23.5 ± 22	52.6 ± 20	47.6 ± 29	27.3 ± 25	14.9 ± 22*
Laparoscopic	21.3 ± 25	50 ± 26	41.1 ± 21	14.5 ± 22*	1.6 ± 7*
All patients	22.5 ± 24.1	52 ± 24.3	45.67 ± 27.3	24.2 ± 19.6*	11.17 ± 7.3*
4. Dyspnea					
Open	13.5 ± 26	23.3 ± 21	16.9 ± 20	11.4 ± 19	13.4 ± 19
Laparoscopic	14.4 ± 27	17.8 ± 25	11.1 ± 26	7.9 ± 22	7.9 ± 23
All patients	13.3 ± 27.3	21.3 ± 24.7	16.67 ± 20.5	11.3 ± 18	13.3 ± 18
5. Insomnia					
Open	36.5 ± 32	50.8 ± 37	44.6 ± 22	28.1 ± 24	26.9 ± 22
Laparoscopic	37.33 ± 36	37.78 ± 38	31.1 ± 39	14.29 ± 31	7.9 ± 18*
All patients	36.67 ± 35.1	49.3 ± 35.4	44.3 ± 32	28 ± 24.9	27 ± 14.5
6. Appetite loss					
Open	21 ± 22	33.3 ± 28	31.7 ± 20	20.8 ± 15	18.13 ± 18
Laparoscopic	20 ± 19	31.1 ± 22	20 ± 22	6.3 ± 22*	9.5 ± 22
All patients	21 ± 20	31.17 ± 27.6	29 ± 17	18 ± 21.4	17 ± 20.4
7. Constipation					
Open	24.1 ± 20	7.6 ± 39	21 ± 28	21.7 ± 26	23.4 ± 20
Laparoscopic	14.67 ± 25	28.9 ± 35	17.78 ± 29	17.46 ± 27	22.2 ± 22
All patients	20 ± 23.7	27.6 ± 39.6	21 ± 27.8	20.7 ± 25	23.3 ± 22
8. Diarrhea					
Open	26.9 ± 20	21 ± 24	20 ± 22	21.4 ± 26	19.4 ± 22
Laparoscopic	18.67 ± 30	4.4 ± 10	11.11 ± 14	19.05 ± 22	9.5 ± 17
All patients	26.67 ± 29	14 ± 11.7	18 ± 20.5	21 ± 27	16 ± 18.7

Values are mean ± SD.

* P < 0.05 compared to day 2 postoperatively (Wilcoxon test).

4. Discussion

The intension of this study was to analyze the change of QoL during the first 3 months after surgical treatment of colorectal cancer and to find the approximate terms when their functional status comes back to the preoperative level.

Our study demonstrated that the EORTC QLQ-C30 questionnaire was able to provide additional information about patient outcomes in short terms after curatively treated colorectal cancer. It also showed the utility of the questionnaire to identify the differences in changes of QoL using different surgical approaches for colorectal cancer – open and laparoscopic – notwithstanding that groups of patients were not randomly allocated and not homogenous.

Table 3 – EORTC QLQ-CR29 outcomes for open and laparoscopic operations.

Future perspective	Preoperative	1 month	3 months
Open	42.93 ± 32	47.06 ± 28	57.94 ± 34
Laparoscopic	31.58 ± 39	64.29 ± 30*	69.23 ± 25*
All patients	39.22 ± 24.19	49.75 ± 29.80	60.12 ± 32.27
Body image			
Open	75.42 ± 24	73.72 ± 25	80.76 ± 23
Laparoscopic	87.72 ± 19	85.71 ± 27	94.87 ± 10
All patients	77.65 ± 23.73	76.14 ± 26.41	84.24 ± 22.09
Defecation problems			
Open	20.1 ± 20	18.65 ± 12	16.67 ± 16
Laparoscopic	18.06 ± 16	12.63 ± 9	10.61 ± 7
All patients	19.07 ± 18.01	17.22 ± 12.07	15.14 ± 14.28
Sexual function			
Open	17.49 ± 23	16.31 ± 21	19.51 ± 24
Laparoscopic	27.19 ± 25	23.08 ± 25	14.29 ± 24*
All patients	18.96 ± 23.28	17.49 ± 22.03	17.86 ± 23.26

Values are mean ± SD.

* P < 0.05 compared to the preoperative status (Wilcoxon test).

Studies, evaluating outcomes up to 5 years after surgery have shown no consistent advantages to QoL for either open or laparoscopic approach [11–14]. Some authors report that QoL after rectal cancer surgery is substantially reduced for up to 6 months, indicating the need for a high level of healthcare support for several months after operation [15]. On the other hand, many studies have previously demonstrated that patients having laparoscopic colorectal surgery have less postoperative pain, an earlier discharge from hospital, and a faster recovery in terms of returning to normal activities [4,8,15–19]. Therefore it is to be expected that differences between groups would be largest during this time. There are possible explanations for why the studies have not been able to demonstrate a difference in HRQoL between laparoscopic and open approaches: the QoL instruments used may not be sensitive enough to pick up significant differences. The lack of robust data on the early postoperative period may have concealed real differences in HRQoL between the laparoscopic and open approaches.

It was not possible to demonstrate in this study significantly different QoL outcomes between conventionally and laparoscopically operated patients due to not homogenous groups. The preoperative characteristics of patients in open and laparoscopic groups demonstrate that laparoscopic approach was chosen for selected patients. Assessments of changes in QoL were performed within each group separately on alternative days, enabling a thorough analysis of the recovery period. Previous studies have been limited by measuring QoL at a small number of time points within the early postoperative period [7,20], or only at later points after surgery (4,6 weeks, 6 months) [3,4,8,15–17,21], although they were using the same EORTC QLQ-C30 and EORTC QLQ-CR29 questionnaires. Also there are studies which use different QoL scales [9,10] for short-term QoL evaluation of curatively treated colorectal cancer patients. Dowson et al. [9] evaluated the QoL every 2 days first 6 weeks for curatively treated colorectal cancer patients demonstrating significantly better QoL up to 4 weeks after laparoscopic operations. Their study shows that

QoL recovers approximately in 3 weeks for laparoscopic operations and in 5 weeks for open operations respectively, but they used the EQ-5D questionnaire, which is a standardized non-disease-specific (generic) diary based instrument for assessing self-reported health status. The study that used EORTC QLQ-C30 [4] as an instrument showed that median of scores came back to the preoperative level in 30 days after operation in many functional scales. Nevertheless, those studies [4,9] showed the similar dynamics of QoL in the early postoperative period. In addition, our study demonstrated the sensitivity of EORTC QLQ-C30 questionnaire, because some functions for laparoscopic group of patients recovered to the preoperative level earlier than for open surgery group. This can be particularly explained by younger age and less stoma for laparoscopic group. Thus, the findings in this QoL study do not mirror the improved short-term clinical outcomes after laparoscopic colorectal surgery, but shows that differences in QoL are potentially biggest in first 3 months after operation. In regard to EORTC QLQ-C30, there are studies [22], which have examined the minimal important change of QoL (MID) implicating a change that is clinically meaningful to the patient. This study demonstrates that the MID is in the range of 5–10 points on the 100-point scale, whereas more than 20 points indicates a substantial change. The present study showed clinically meaningful changes of mean change of scores for most functional and symptom scales in both EORTC QLQ-C30 and EORTC QLQ-CR29 by 1 or 3 months after surgery.

The EORTC QLQ-CR29 questionnaire appeared to be limited for early evaluation of QoL, because some functions such as sexual, are unavailable to score during the first month after operation. Significantly improved future perspective in laparoscopic group in 1 month after operation could be explained by significantly younger age of patients in this group, as younger patients have a longer life expectancy. By the way, the other studies [17] did not refer the better future perspectives for patients after laparoscopic colorectal surgery.

This study presented some methodological drawbacks: it was not possible to randomize patients into different

treatment groups. While not conforming to randomization procedures, there was an element of chance involved in whether most patients were operated on through laparoscopic or open means. The proportion of younger patients was, however, higher in the laparoscopic group, and more patients in the open group had a stoma. Other limitation of this study was patients response rate: after 1 and 3 months for both questionnaires it was 79.2% (65 patients) and 65.8% (54 patients), respectively.

5. Conclusions

Our study provided additional information in the evaluation of early postoperative changes of QoL of Lithuanian colorectal cancer patients with currently widely used EORTC QLQ-C30 and EORTC QLQ-CR29 questionnaires. The present study showed that the majority of functional scale scores came back to the preoperative level during the first 3 months after colorectal cancer surgery. Differences in QoL according to the surgical approach are mostly expressed during this period.

Conflict of interest

The authors declare no conflict of interest.

Acknowledgments

This quality of life study was funded by a grant (no. LIG-01/2011) from the Research Council of Lithuania.

REFERENCES

- [1] Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst* 1993;85:365–72.
- [2] Fayers P, Aaronson NK, Bjordal K, Sullivan M. EORTC QLQ-C30 scoring manual. Brussels: EORTC Quality of Life Study Group; 1995.
- [3] Theodoropoulos GE, Karantanos T, Stamopoulos P, Zografos G. Prospective evaluation of health-related quality of life after laparoscopic colectomy for cancer. *Tech Coloproctol* 2013;17(1):27–38.
- [4] Schwenk W, Neudecker J, Haase O, Raue W, Strohm T, Müller JM. Comparison of EORTC quality of life core questionnaire (EORTC-QLQ-C30) and gastrointestinal quality of life index (GIQLI) in patients undergoing elective colorectal cancer resection. *Int J Colorectal Dis* 2004;19(6):554–60.
- [5] Gujral S, Conroy T, Fleissner C, Sezer O, King PM, Avery KN, et al. Assessing quality of life in patients with colorectal cancer: an update of the EORTC quality of life questionnaire. *Eur J Cancer* 2007;43(10):1564–73.
- [6] Whistance RN, Conroy T, Chie W, Costantini A, Sezer O, Koller M, et al. 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(17):3017–26.
- [7] Breukink SO, van der Zaag-Loonen HJ, Bouma EM, Pierie JP, Hoff C, Wiggers T, et al. Prospective evaluation of quality of life and sexual functioning after laparoscopic total mesorectal excision. *Dis Colon Rectum* 2007;50:147–55.
- [8] Fuji S, Ota M, Ichikawa Y, Yamagishi S, Watanabe K, Tatsumi K, et al. Comparison of short, long-term surgical outcomes and mid-term health-related quality of life after laparoscopic and open resection for colorectal cancer: a case-matched control study. *Int J Colorectal Dis* 2010;25:1311–23.
- [9] Dowson HM, Ballard K, Gage H, Jackson D, Williams P, Rockall TA. Quality of life in the first 6 weeks following laparoscopic and open colorectal surgery. *Value Health* 2013;16(2):367–72.
- [10] Weeks JC, Nelson H, Gelber S, Sargent D, Schroeder G. Short-term quality-of-life outcomes following laparoscopic-assisted colectomy vs open colectomy for colon cancer: a randomized trial Clinical Outcomes of Surgical Therapy (COST) Study Group. *JAMA* 2002;287(3):321–8.
- [11] Dowson H, Cowie A, Ballard K, Gage H, Rockall T. Systematic review of quality of life following laparoscopic and open colorectal surgery. *Colorectal Dis* 2008;10:757–68.
- [12] Murray A, Lourenco T, de Verteuil R, Hernandez R, Fraser C, McKinley A, et al. Clinical effectiveness and cost-effectiveness of laparoscopic surgery for colorectal cancer: systematic reviews and economic evaluation. *Health Technol Assess* 2006;10:1–160.
- [13] Bartels SA, Vlug MS, Ubbink DT, Bemelman WA. Quality of life after laparoscopic and open colorectal surgery: a systematic review. *World J Gastroenterol* 2010;16:5035–41.
- [14] Harinath G, Shah PR, Haray PN, Foster ME. Laparoscopic colorectal surgery in Great Britain and Ireland – where are we now? *Colorectal Dis* 2005;7:86–9.
- [15] Wilson TR, Alexander DJ, Kind P. Measurement of health-related quality of life in the early follow-up of colon and rectal cancer. *Dis Colon Rectum* 2006;49:1692–702.
- [16] Braga M, Vignali A, Gianotti L, Zuliani W, Radaelli G, Guarini P, et al. Laparoscopic versus open colorectal surgery: a randomized trial on short-term outcome. *Ann Surg* 2002;236:759–66.
- [17] Andersson J, Angenete E, Gellerstedt M, Angerås U, Jess P, Rosenberg J, et al. Health-related quality of life after laparoscopic and open surgery for rectal cancer in a randomized trial. *Br J Surg* 2013;100(7):941–9.
- [18] Guillou PJ, Quirke P, Thorpe H, Walker J, Jayne DG, Smith AM, et al. Short-term endpoints of conventional versus laparoscopic-assisted surgery in patients with colorectal cancer (MRC CLASICC trial): multicentre, randomised controlled trial. *Lancet* 2005;365:1718–26.
- [19] Schwenk W, Haase O, Neudecker J, Muller JM. Short term benefits for laparoscopic colorectal resection. *Cochrane Database Syst Rev* 2005;(Issue 3). Art. No.: CD003145.
- [20] King PM, Blazeby JM, Ewings P, Franks PJ, Longman RJ, Kendrick AH, et al. Randomized clinical trial comparing laparoscopic and open surgery for colorectal cancer within an enhanced recovery programme. *Br J Surg* 2006;93:300–8.
- [21] Theodoropoulos GE, Papanikolaou IG, Karantanos T, Zografos G. Post-colectomy assessment of gastrointestinal function: a prospective study on colorectal cancer patients. *Tech Coloproctol* 2013;17(5):525–36.
- [22] Osoba D. Interpreting the meaningfulness of changes in health-related quality of life scores: lessons from studies in adults. *Int J Cancer Suppl* 1999;12:132–7.