Quality indicators and outcomes in colorectal cancer

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Abstract

Aims. Some quality indicators of proper health care in patients with colorectal cancer have been established. Our goal was to evaluate the outcomes of performing certain procedures or treatments, included as quality indicators, in the follow-up of colorectal cancer patients. Methods. This was a prospective cohort study of patients diagnosed with colorectal cancer who underwent surgery and were followed at 1, 2, 3 and 5 years. CT scanning, colonoscopy, chemotherapy and radiotherapy were evaluated in relation to various clinical outcomes and PROM changes over five years. Multivariable generalized linear mixed models were used to evaluate their effect on mortality, complications, recurrence, and PROM changes (HAD, EQ-5D, EORTC-Q30) at the next follow-up. Results. CT scanning or colonoscopy was related to a decrease in the risk of dying, while chemotherapy at a specified moment was related to an increased risk. In the case of recurrence, CT scanning and chemotherapy showed statistically increased the risk, while all the procedures and treatments influenced complications. Regarding PROM scales, CT scanning, colonoscopy and radiotherapy showed statistically significant results with respect to an increase in anxiety and decrease in quality of life measured by the EORTC. However, undergoing radiotherapy at a specified moment increased depression levels, and overall, receiving radiotherapy decreased the quality of life of the patients, as measured by the EuroQol-5d. Conclusions. After adjustment for sociodemographic factors, comorbidities and severity of the disease, performing certain quality indicators of proper health care in patients with colorectal cancer was related to less mortality but higher adverse outcomes.

INTRODUCTION

Different diagnostic procedures or treatments employed in colorectal cancer patients have been included as indicators of the quality of care[1,2]. However, the fulfillment of those indicators and their relationship with different outcomes, not only clinical but also patient-reported outcome measures (PROMs), has not been established thus far. The goal of this study was to select four main procedures (CT scanning and colonoscopy) or treatments (chemotherapy or radiotherapy) usually indicated for colorectal cancer patients in their diagnosis, treatment and follow-up and to see how their performance was related to various robust clinical outcomes and some PROMs in a long follow-up of five years.

METHODS

This prospective cohort study included patients with colon or rectal cancer who were scheduled to undergo surgery. Only patients who provided informed consent were allowed to participate. The institutional review boards of the participating hospitals approved the study, and all study data were kept confidential. A detailed description of the study protocol has been published previously.[3]

Patients were eligible for this study if they were on the surgical waiting list of one of the participating hospitals and had a diagnosis of surgically resectable colon or rectal cancer. The exclusion criteria were in situ cancer, an unresectable tumor, terminal disease, and inability to respond to questionnaires for any reason or any severe mental or physical conditions that might prevent the patient from responding to questionnaires, as well as a lack of consent to participate.

Data collection

Data collected at hospital admission included sociodemographic and clinical data, including information about comorbidities based on the Charlson Comorbidity Index [4]), preoperative data, pathology data including TNM stage and infiltrated lymph nodes, and data related to the period of admission after surgery. Data were collected at 1, 2, 3 and 5 years after surgery. The information collected at those points in time included the need for radiation therapy and/or chemotherapy, performance of CT scanning, colonoscopy, laboratory test results, diagnostic tests performed, any complications, tumor recurrence, readmission or reoperation, and death.

Patients completed the following questionnaires before surgery and at 1, 2, 3 and 5 years after surgery: the Hospital Anxiety and Depression Scale (HADS) [5], the EuroQol-5D (EQ-5D)[6], and the European Organisation for Research and Treatment of Cancer (EORTC) QLQ-Q30 [7]. The HADS is a screening tool for anxiety and depression in nonpsychiatric clinical populations [8]. The EQ-5D is a generic health-related quality of life (HRQoL) questionnaire that has good psychometric properties. It allows comparison with other populations, as well as re-evaluations [9]. The EORTC QLQ-C30 is a questionnaire for evaluating the HRQoL of cancer patients undergoing treatment.

The main outcomes of the study were mortality, complications (as defined elsewhere [3]) and tumor recurrence, all at 1, 2, 3 and 5 years, and patient-reported outcomes (changes in the EQ-5D, EORTC QLQ-C30, and HADS scores from baseline to 1, 2, 3 and 5 years after the intervention). The main independent variables included were CT scanning, colonoscopy, chemotherapy and radiotherapy performed at each time point.

Statistical analysis

Descriptive statistics of sociodemographic and clinical data and quality-of-life questionnaires (EORTC and EuroQol-5d) and anxiety and depression scales (the HAD questionnaire) were measured as means and standard deviations and as frequencies and percentages for continuous variables and categorical data, respectively. To evaluate the influence of CT scanning, colonoscopy, chemotherapy and radiotherapy performed throughout the follow-up on the different outcomes, univariable generalized linear mixed models were used. Furthermore, multivariable generalized linear mixed models were used to evaluate the effect of those variables on mortality, complications, and recurrence at the next follow-up visit.

In the same way, univariable and multivariable generalized linear mixed models were used to evaluate the influence of the different quality indices in the health-related quality of life and anxiety and depression scales of the patients in the same follow-up period.

All the models were adjusted by sex, age, TNM stage, Charlson comorbidity index, tumor location (colon or rectum) and hospital. The variability explained by each model was determined by the coefficient of determination ($R2$).

All effects were considered significant at $p<0.05$. All statistical analyses were performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA).

RESULTS

The study sample included 2180 patients: 72% had colon cancer, and 28% had rectal cancer; 1375 (63%) were men, with a mean age of 67.8 years (SD 10.9), and 6% of the sample had TNM stage IV.

After adjusting for other variables (sex, age, TNM stage, Charlson comorbidity index and location of the tumor), colonoscopy or CT scanning within a year prevents death in the next period of follow-up, while chemotherapy at a specified moment increases the risk of death in the next follow-up period. However, in the case of recurrence, having CT scanning or chemotherapy increases the risk. In fact, having CT scanning at a specified moment increases the risk of recurrence of the tumor in the next year (OR=2.55, 95% confidence interval (CI) = 1.93 – 3.37, p<0.0001), as does receiving chemotherapy (OR=2.07, 95% CI = 1.69 – 2.54, p<0.0001). Complications in a specified moment were conditioned or influenced by having CT scanning, colonoscopy, chemotherapy and/or radiotherapy in the previous follow-up moment, increasing the risk of adverse events in all cases (OR=1.25, p=0.0028; OR=1.13, p=0.0329; OR=1.20, p=0.0126; OR=1.31, p=0.0244, respectively).

In relation to health-related quality-of-life questionnaires and anxiety and depression scales, undergoing CT scanning, colonoscopy or radiotherapy within a period of follow-up yielded statistically significantly increasing scores with respect to anxiety, that is, higher anxiety levels in the next period. In relation to health-related quality of life, as measured by the EORTC-Q30, CT scanning, colonoscopy, chemotherapy and radiotherapy resulted in a statistically significant decrease in the scores, while having radiotherapy in a specified moment also decreased the quality of life of the patients, as measured by the EuroQol-5d, at the same timepoint of follow-up (Table 1).

DISCUSSION

This study, which had a relatively large cohort of patients who underwent surgery for colorectal cancer and were followed up for five years, showed a relationship between the fulfillment (or lack thereof) of some accepted diagnostic procedures or treatments employed during follow-up for this disease with certain adverse outcomes, such as mortality, recurrence, complications or changes in certain PROM scales.

The yearly performance of CT or colonoscopy in the follow-up of these patients is related to a lower risk of mortality but, on the other hand, a higher presence of complications and recurrences as well as further CT scanning, which may be explained because this type of diagnostic procedure continues to be used in surviving patients. Regarding PROM scales, a relationship was also seen with an increase in anxiety and a decrease in the total EORTC scores, which may reflect a deterioration in the HRQoL in the evolution of these surviving patients. On the other hand, the use of chemotherapy was related to higher mortality and increased presentation of complications or recurrences; radiotherapy, in this case, was only related to a higher risk of complications, perhaps due to a smaller sample size in which this treatment was employed. These treatments are expected to be used in patients with more severe degrees of the disease, which may explain the higher risk of mortality, recurrence or complications. In the case of radiotherapy, the four PROM questionnaires included detected losses in the patients' health-related quality of life, while for chemotherapy, losses were found only in the EORTC-Q30. In any case, losses, as reflected by the beta parameter of the models, seem to be low losses and, from a clinical point of view, it seems that the deterioration in their quality of life is minor but the increase in their chances of surviving is high, but with a greater risk of complications and recurrences. By using these multivariable models, we try to show the influence of each of the procedures and treatments realized at each timepoint of follow-up on the clinical outcomes and PROMs of the next year of follow-up. Indeed, as different clinical outcomes and PROMs, as well as the main covariates, changed throughout the follow-up, an analysis that included all the repeated measurements and considered the longitudinal design was required to provide robustness to our results.

Our study tried to correlate just four (but some of the most relevant and common) quality indicators established for colorectal cancer patients with specific outcomes [1,10]. Although we attempted in the analysis to control for some of the most relevant confounders, others could not be included. In any case, it is difficult to establish a clear cause-and-effect relationship between the study quality indicators and the outcomes, but we have tried to show that there are relationships between some of them and that those relationships are, in

these pathologies, complex to interpret since, performing them are, on the one hand, saving lives, but, on the other hand, introducing the risk of different adverse outcomes, such as complications, recurrences or losses in patients' quality of life[11]. In summary, the validation of these quality indices seems difficult to interpret because of complex results; therefore, the use of these diagnostic procedures or treatments as quality indices should be interpreted cautiously[10,12].

Conflicts of interest/Competing interests

No financial, consultant, institutional and other relationships that might lead to bias or a conflict of interest exist for any of the authors of this study.

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Table 1 . Relationship of the performance of various diagnostic procedures and treatments in the follow-up of colorectal cancer patients.

	CT scanning (yes *vs.* no)	CT scanning (yes *vs.* no)	Colonoscopy (yes *vs.* no)	Colonoscopy (yes
	OR (95% CI)	p-value	OR (95% CI)	p-value
Clinical outcomes	**Clinical outcomes**			
Mortality	0.649 (0.528 − 0.799)	<0.0001	0.554 (0.465 − 0.659)	<0.0001
Complications	1.253 (1.081 − 1.452)	0.0028	1.126 (1.010 − 1.256)	0.0329
Recurrence	2.550 (1.932 − 3.365)	<0.0001	1.064 (0.889 − 1.273)	0.4985
	β (95% CI)	p-value	β (95% CI)	p-value
PROMs				
HAD Anxiety	0.441 (0.206 − 0.676)	0.0002	0.643 (0.487 − 0.800)	<0.0001
HAD Depression	0.125 (-0.090 − 0.34)	0.2547	-0.044 (-0.187 − 0.10)	0.5496
EuroQol-5d	0.002 (-0.01 − 0.01)	0.7897	0.001 (-0.01 − 0.01)	0.8102
EORTC-Q30	-0.90 (-1.68 − -0.12)	0.0237	-1.28 (-1.80 − -0.76)	<0.0001

OR: odds Ratio, %: percentage, CI: confidence Interval. β: parameter estimation.

A higher score on the anxiety and depression scales from the HADS questionnaire indicates a higher level of anxiety and depression.

A higher score on the EuroQol-5d or EORTC-Q30 questionnaire indicates a higher level of quality of life assessed by the respective questionnaire.

All models were adjusted by age, sex, Charlson comorbidity Index, tumor location and TNM stage.