The impact of surgical modality on self-reported body image, quality of life and survivorship after anterior resection for colorectal cancer – a mixed methods study

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Background: There is growing enthusiasm for robotic and transanal surgery as an alternative to open or laparoscopic surgery for colorectal cancer (CRC). We examined the impact of surgical modality on body image and quality of life (QOL) in patients receiving anterior resection for CRC.

Methods: We used a mixed-methods approach, consisting of a chart review and semi-structured interviews with CRC patients, at least 8 months after surgery. We assessed cosmetic outcomes and QOL using validated questionnaires.

Results: Thirty patients were stratified into open (n = 8), laparoscopic (n = 12) and robotic (n = 10) groups. Mean body image scores were significantly higher (i.e., poorer body image) in patients receiving open surgery (mean difference [MD] +5.7 with laparoscopy, $p < 0.001$). Open surgery was more detrimental to physical function, including strenuous activities, prolonged ambulation and self-care (MD –11.6 with laparoscopy, $p = 0.039$). Patients receiving laparoscopic surgery reported superior role (MD +27.6 with open surgery, $p = 0.002$) and social function (MD +13.7 with open surgery, $p = 0.042$), including the ability to enjoy hobbies, family life and social activities. Surgical modality did not impact emotional and cognitive function or symptoms including genitourinary function, pain and defecation.

Conclusion: The negative impact of open surgery on body image and physical function warrants further educational interventions for patients. The protective effect of laparoscopy on role and function may be associated with "tumour factors" that are unaccounted for in the European Organization for Research and Treatment of Cancer questionnaires. Open surgery is detrimental to body image and physical function in patients receiving anterior resection for CRC. Prospective randomized studies are required to validate these findings.

Contexte : On observe un intérêt croissant pour la chirurgie transanale robotique comme solution de rechange à la chirurgie ouverte ou laparoscopique dans les cas de cancer colorectal (CCR). Nous avons analysé l'impact de la modalité chirurgicale sur l'image corporelle et la qualité de vie (QdV) chez les patients ayant subi une résection antérieure pour CCR.

Méthodes : Nous avons utilisé une approche à méthodologie mixte, composée d'une revue des dossiers et d'entrevues semi-structurées avec des patients atteints de CCR, au moins 8 mois après la chirurgie. Nous avons évalué les résultats cosmétiques et la QdV au moyen de questionnaires validés.

Résultats : Trente patients ont été stratifiés en 3 groupes : chirurgie ouverte (n = 8), laparoscopique (n = 12) et robotique (n = 10). Les scores moyens pour l'image corporelle ont été significativement plus élevés (c.-à-d., image corporelle plus négative) chez les patients ayant subi une chirurgie ouverte (différence moyenne [DM] +5,7 avec la laparoscopie, $p < 0{,}001$). La chirurgie ouverte a été plus nuisible au fonctionnement physique, y compris aux activités exigeantes, à la déambulation prolongée et à l'autosoin (DM –11,6 avec la laparoscopie, $p = 0{,}039$). Les patients soumis à une chirurgie laparoscopique ont fait état d'un rôle (DM +27,6 avec la chirurgie ouverte, $p = 0{,}002$) et d'un fonctionnement social meilleurs (DM +13,7 avec la chirurgie ouverte, $p = 0{,}042$), y compris la capacité d'apprécier les loisirs et les activités familiales et sociales. La modalité chirurgicale n'a pas exercé d'impact sur le fonctionnement émotionnel et cognitif ou sur les symptômes, y compris la fonction urogénitale, la douleur et la défécation.

Conclusion : L'impact négatif de la chirurgie ouverte sur l'image corporelle et le fonctionnement physique justifie que l'on renseigne plus adéquatement nos patients. L'effet protecteur de la laparoscopie aux plans du rôle et du fonctionnement serait associé à des « facteurs tumoraux » qui n'entrent pas en ligne de compte dans les questionnaires de l'Organisation européenne pour la recherche et le traitement du cancer. La chirurgie ouverte nuit à l'image corporelle et au fonctionnement physique chez les patients qui subissent une résection antérieure pour CCR. Des études prospectives randomisées sont nécessaires pour valider ces résultats.

Colorectal cancer (CRC) is the third most common cancer and the third leading cause of death from cancer in the world.[1] In the past decade, extraordinary progress in prevention, diagnosis and management of CRC has led to a reduction in CRC incidence and mortality.[2] This has allowed patients to live longer, but with treatment-related consequences, including postoperative pain, fatigue and impaired bowel, sexual and urinary function[3] as well as the burden of invasive cancer surgery on body image and mental health.[4]

Rectal and sigmoid cancer surgery is particularly complex owing to technical and anatomical considerations. The natural barriers of the bony pelvis, in addition to the presence of critical organs and neurovascular structures, render pelvic dissection challenging, regardless of surgical modality.[5] Anterior resections, therefore, may have a considerable long-term impact on patients' postoperative function and quality of life (QOL). The impact of a permanent stoma after surgery as well as the longitudinal changes in QOL after surgery have been described previously.[6–8]

Growing enthusiasm for robotic and transanal surgery as an alternative to open or laparoscopic surgery warrants further investigation into the impact of surgical modality on body image, survivorship and QOL. Previous studies, including a prospective comparison by Li and colleagues[9] as well as the COLOR II trial[10] have limited their discussion to open and laparoscopic approaches. A recent study of QOL in 36 patients who had laparoscopic versus robotic anterior resection found that patients in the robotic group reported lower pain, insomnia and male impotence scores than those in the laparoscopy group.[11] Nonetheless, there remains a relative paucity of studies using qualitative interviews to explore the issue of survivorship from the patients' perspective. There have also been limited data exploring the impact of rectal cancer surgery on body image and cosmesis in this vulnerable patient population. Therefore, the objective of this study was to examine the impact of surgical modality — open, laparoscopic or robotic surgery — on self-reported body image, function and QOL in patients receiving anterior resection for CRC.

Methods

Participants

Adult patients (> 18 yr) who underwent surgical resection for pathologically confirmed rectal and/or sigmoid cancer and who were at least 8 months from surgery, had no signs of disease recurrence and were on no active treatment were eligible to participate. We limited selection to patients whose anastomosis was formed between 2 cm and 12 cm from the anal verge. We used convenience sampling, a form of nonprobability sampling,[12] to identify patients for prospective recruitment from 2 surgeons' (F.A.Q. and C.O.) clinical practices at 2 major academic hospitals (Toronto General Hospital and Toronto Western Hospital) in the University Health Network (UHN; Toronto, Ontario) between January 2015 and July 2016. The UHN is a multi-institution tertiary academic centre located in a large urban city, serving a culturally diverse and complex patient population. All patients approached to take part in the study were fully aware of their diagnosis and were considered physically and psychologically able to cope with the interview process. We obtained informed consent from all patients before their participation in the study. The protocol was approved by the University Health Network Research Ethics Board before study initiation.

Data collection

An interdisciplinary team, including a surgical oncologist and nurse navigator, developed a semistructured interview guide exploring the issue of body image, survivorship and QOL after surgery. The interview guide, consisting of both open-ended questions and question probes used to facilitate the discussion, allowed flexibility to elicit individual views and descriptions of experiences.

All interviews were conducted by telephone. Patients were first asked to briefly recount their health care experiences since receiving the diagnosis of CRC. This provided an overview of preoperative and postoperative care, including therapies received, and enabled subsequent in-depth exploration of body image and survivorship.

These questions were followed by a series of closed-ended probing questions from previously validated and reliable questionnaires: the Body-Image Questionnaire (BIQ) and the European Organization for Research and Treatment of Cancer (EORTC) QLQ-C30 and QLQ-CR29 questionnaires. The BIQ consists of 8 items evaluating body image and cosmesis after surgery. The body image scale measures patients' perception of and satisfaction with their own body and explores patients' attitudes toward their bodily appearance (items 1–5). The cosmetic scale assesses the degree of satisfaction with respect to the physical appearance of the scar (items 6–8).[13] A higher body image score signifies poorer body image, whereas a higher cosmesis scores signifies a greater degree of satisfaction with cosmetic outcomes. The EORTC QLQ-30 questionnaire consists of 30 questions that combine to make 5 functional scales (physical, emotional, cognitive, social and role functioning); a global QOL measure; and symptom assessment, including pain, fatigue, diarrhea and constipation.[14] The QLQ-CR29 has 29 questions divided into 4 functional scales (body image, anxiety, weight and sexual interest) and numerous symptoms scales exploring urinary, bowel and sexual outcomes.[15] We used linear transformation of raw data to standardize the scores on a scale of 0–100, as described by the standard EORTC scoring system. Higher scores signified a better level of function and a greater severity of symptoms.[16]

We collected demographic data from patients, and specific tumour staging information and surgical procedure type were obtained from electronic patient records.

Statistical analysis

Interviews were audio-recorded and transcribed verbatim by an independent transcriptionist. All identifying information was removed from transcripts before analysis to maintain anonymity. Transcripts were hand-coded following each interview to allow iterative data collection and analysis, whereby new and emerging concepts could be further explored in subsequent interviews. Descriptive coding was used to identify distinct concepts, which were later grouped into categories. The research team met consistently to discuss emerging ideas and categories. Upon achieving data saturation (the point at which no new information that was relevant to the research question emerged), these categories were further analyzed and refined to identify overarching themes in the attitudes, perceptions and experiences of patients.[17–20]

Sociodemographic and clinical data were summarized using descriptive statistics. We compared the 3 surgical modality cohorts with respect to aggregate body image and QOL scores. We used the Shapiro–Wilk test to assess data normality and the Levene test to assess for equality of variance. Parametric data were analyzed using 1-way analysis of variance (ANOVA). Nonparametric data were analyzed using the Kruskal–Wallis test. Data not meeting assumptions for equality of variance were assessed with the Welch ANOVA. Statistically significant outcome measures were subsequently assessed with pairwise comparisons to determine the association between surgical modalities and the outcome measure. To account for multiple comparisons, we performed a Bonferroni correction. The significance level for all group comparisons was maintained at $p < 0.05$. Statistical analysis was conducted using IBM SPSS Statistics version 21.0 (IBM Corp.).

Results

Thirty patients were stratified into open ($n = 8$), laparoscopic ($n = 12$) and robotic ($n = 10$) surgery groups. Group differences in sociodemographic characteristics, including sex ($p = 0.117$), age ($p = 0.751$), ethnicity ($p = 0.532$), education level ($p = 0.299$), employment status ($p = 0.421$) and net annual income ($p = 0.456$) are detailed in Table 1. Table 2 details the oncologic variables of our patient population. Notably, patients undergoing robotic surgery were significantly more likely to have their tumour localized to the rectum (90%, $p = 0.001$), with a shorter distance to the anal verge (mean 6.5 cm, $p = 0.002$), requiring neoadjuvant therapy (80%, $p = 0.037$) and stoma creation (90%, $p = 0.008$). Notably, 78% ($n = 7$) of patients in the robotic group who received a stoma ultimately underwent reversal to re-establish gastrointestinal continuity. The 3 groups were comparable with respect to other oncologic features, including preoperative American Joint Committee on Cancer (AJCC) stage ($p = 0.253$), median follow-up ($p = 0.323$), stoma reversal rates ($p = 0.431$), and need for adjuvant therapy ($p = 0.163$; Table 2).

Descriptive thematic analysis yielded 3 overarching themes in the data that remained consistent with our quantitative findings.

Perception of body image after surgery

Patients undergoing open surgery for rectal and sigmoid cancer had differing perceptions of body image and cosmesis than those receiving laparoscopic or robotic operations. A majority of patients reported a high degree of dissatisfaction with the presence of midline laparotomy scars as well

Table 1. Demographic characteristics of the patient cohort

Characteristic	Group; no. (%) or mean ± SD			*p* value
	Open surgery ($n = 8$)	Laparoscopic surgery ($n = 12$)	Robotic surgery ($n = 10$)	
Sex				0.117
Male	6 (75)	6 (50)	9 (90)	
Female	2 (25)	6 (50)	1 (10)	
Age, yr	59.8 ± 15.6	56.3 ± 9.1	59.2 ± 8.7	0.751
Education				0.299
Elementary	1 (12.5)	0 (0)	1 (10)	
High school	3 (37.5)	2 (16.7)	2 (20)	
College	1 (12.5)	8 (66.7)	6 (60)	
Postgraduate	3 (37.5)	2 (16.7)	1 (10)	
Employment				0.421
Not working	5 (62.5)	4 (33.3)	4 (40)	
Employed	3 (37.5)	8 (66.7)	6 (60)	
Annual income	75 600 ± 33 100	96 000 ± 36 800	85 600 ± 30 800	0.456

SD = standard deviation.

Table 2. Oncologic metrics of the patient cohort

Characteristic	Group; no. (%) or mean ± SD			*p* value
	Open surgery (*n* = 8)	Laparoscopic surgery (*n* = 12)	Robotic surgery (*n* = 10)	
Location				0.001
Rectum	1 (12.5)	2 (16.7)	9 (90)	
Rectosigmoid	1 (12.5)	5 (41.7)	1 (10)	
Sigmoid	6 (75)	5 (41.7)	0 (0)	
Stage				0.253
I	3 (37.5)	5 (41.7)	2 (20)	
II	3 (37.5)	1 (8.3)	6 (60)	
III	1 (12.5)	4 (33.3)	2 (20)	
IV	1 (12.5)	2 (16.7)	0 (0)	
Distance from anal verge, cm	25.6 ± 14.3	18.8 ± 11.3	6.5 ± 4.1	0.002
Neoadjuvant therapy				0.037
Yes	4 (50)	3 (25)	8 (80)	
No	4 (50)	9 (75)	2 (20)	
Time since operation, mo	14.8 ± 3.7	16.3 ± 2.3	14.6 ± 2.5	0.323
Stoma creation				0.008
Yes	5 (62.5)	3 (25)	9 (90)	
No	3 (37.5)	9 (75)	1 (10)	
Stoma reversed				0.431
Yes	3 (60)	3 (100)	7 (78)	
No	2 (40)	0 (0)	2 (22)	
Adjuvant therapy				0.163
Yes	3 (37.5)	6 (50)	8 (80)	
No	5 (62.5)	6 (50)	2 (20)	

SD = standard deviation.

as incisional hernias. Incisional hernias, for instance, were reported by 38% of patients in the open group, 17% in the laparoscopy group and 0% in the robotic surgery group. Many of these patients expressed concern with enlargement of their incisional hernias over time. Hypertrophic scars and keloid formation was also worrisome for patients treated with midline laparotomies. These patients expressed significantly less satisfaction with their body image and cosmetic outcome than those treated with minimally invasive surgery.

"The huge lump [incisional hernia] on my abdomen is disgusting and disfiguring…gone are the days when all my clothes used to fit me perfectly and I could take my shirt off without giving it a second thought." — Patient 3

"The bottom of my belly hangs out and that's what bothers me the most. This was not the case before the operation. Now I'm embarrassed when I know someone is judging the way my belly shows through some of my tops. The big scar right through it doesn't help either." — Patient 4

"The port sites healed really well. There were times where I couldn't even count the number of cuts a few months after the [robotic] operation." — Patient 12

This perception of body image and cosmesis was reflected in the body image and cosmesis questionnaires, where patients receiving open surgery had significantly higher (i.e., poorer) mean body image scores (12.0) and lower cosmesis scores (9.6) than those receiving laparoscopic (BIQ 6.3, cosmesis 16.4, $p < 0.001$) and robotic surgery (BIQ 5.8, cosmesis 15.2, $p < 0.001$; Table 3). Comparison of body image and cosmesis scores between laparoscopic and robotic approaches identified no statistical difference between cohorts (both $p > 0.99$).

Surgical modality and physical function

Patients undergoing open surgery also reported a significant impairment in physical function. This included deficits in basic actions (self-care required to maintain independence) and complex actions, such as strenuous activities and prolonged ambulation. This type of functional decline had a detrimental impact on self-perceived QOL and function scores.

"I used to love walking my dog on a daily basis. The pain, discomfort and general fatigue after the surgery prevents me from doing this…it's impossible to carry anything moderately heavy and I have to continuously rely on others to help me do the things I used to do independently." — Patient 1

"I am definitely slower and sloppier after the operation. I spend a lot more time in my chair or bed 'resting.' This is unusual for me but I really have no choice." — Patient 2

Table 4 details the functional outcomes of patients among the 3 groups. Patients undergoing open surgery had lower mean physical function scores (83.3) than those

Table 3. Body image and cosmetic scores across surgical modalities

Score	Group, mean ± SD			*p* value
	Open surgery (*n* = 8)	Laparoscopic surgery (*n* = 12)	Robotic surgery (*n* = 10)	
Body image	12.0 ± 1.8	6.3 ± 0.9	5.8 ± 2.5	< 0.001
Cosmetic	9.6 ± 1.9	16.4 ± 2.2	15.2 ± 4.8	0.001

SD = standard deviation.

[a]Higher scores signify poorer body image but greater degree of satisfaction with cosmetic outcomes.

in the laparoscopic (94.9) and robotic groups (94.3). Pairwise comparisons showed that open surgery was associated with significantly lower physical function scores than laparoscopic surgery (p = 0.026) and robotic surgery (p = 0.045). There was no significant difference between robotic and laparoscopic surgery (p > 0.99).

Effect of laparoscopy on role and social function

Pairwise comparison of role function identified higher scores for the laparoscopic approach (98.6) than the open approach (71.0, p = 0.019) and the robotic approach (71.8, p = 0.015). Similarly, comparison of social function across cohorts showed higher scores for the laparoscopic approach (93.1) than the open approach (79.4, p = 0.306) or the robotic approach (73.4, p = 0.046). This included the ability to enjoy hobbies, activities and time with colleagues, family and friends (Table 4). The physical stress of undergoing open surgery also permeated into the personal and professional lives of many patients; they reported deficits in their ability to fulfill household chores and/or work proficiently at a job.

"The bag makes it impossible to do anything spontaneous. I've had poop running down my leg at restaurants… nevermind the odor. Sometimes I also get depressed when my wife has to change my bag." — Patient 11

"I've also had embarrassing leakage of gas, like while doing yoga with other people…all this has really taken a toll on my personal life and has robbed me of the opportunity to enjoy the things I loved doing." — Patient 15

It is important to note that emotional and cognitive function did not seem to vary with surgical modality (Table 4). Surgical modality also did not have a considerable impact on fatigue (p = 0.155) and/or symptom scales

Table 4. Impact of surgical modality on EORTC scores*

Characteristic	Group, mean ± SD			*p* value
	Open surgery (*n* = 8)	Laparoscopic surgery (*n* = 12)	Robotic surgery (*n* = 10)	
Function				
Physical	83.3 ± 12.8	94.9 ± 8.2	94.3 ± 6.7	0.039
Role	71.0 ± 21.4	98.6 ± 4.9	71.8 ± 29.4	0.002
Emotional	84.5 ± 15.0	79.7 ± 23.5	82.5 ± 20.2	0.991
Cognitive	95.9 ± 11.7	93.1 ± 13.1	80.0 ± 21.9	0.091
Social	79.4 ± 17.1	93.1 ± 13.1	73.4 ± 22.5	0.042
Symptom scores				
Gastrointestinal†	20.8 ± 13.4	23.6 ± 4.8	25.8 ± 4.7	0.105
Defecation‡	15.4 ± 14.3	8.7 ± 10.1	18.3 ± 11.0	0.112
Sexual§	56.3 ± 23.5	32.0 ± 27.1	50.1 ± 31.4	0.083
Urinary¶	3.5 ± 5.0	7.8 ± 10.7	15.0 ± 10.8	0.061
Psychological**	45.8 ± 19.5	45.9 ± 14.5	50.1 ± 15.7	0.793
Pain††	14.6 ± 28.8	9.7 ± 19.5	25 ± 27.5	0.263
Other				
Body image	41.5 ± 13.4	92 ± 12.5	89.1 ± 16.3	< 0.001
Global QOL	65.6 ± 15.1	81.1 ± 12.3	74.9 ± 14.6	0.065
Fatigue	31.6 ± 3.9	15.1 ± 21.8	18.8 ± 16.4	0.155

EORTC = European Organization for Research and Treatment of Cancer; QOL = quality of life; SD = standard deviation.

*Higher scores signify better function and increasing severity of symptoms.

†Aggregate of nausea/vomiting, bloating, weight loss, appetite scores.

‡Aggregate of gas incontinence, fecal incontinence, constipation, diarrhea, stool frequency, blood/mucus in stool, sore skin scores.

§Aggregate of impotence, dyspareunia, sexual interest scores.

¶Aggregate of urinary frequency, dysuria, urinary incontinence scores.

**Aggregate of embarrassment, anxiety scores.

††Aggregate of buttock pain, abdominal pain scores.

assessing gastrointestinal (GI) function (p = 0.105), defecation (p = 0.112), psychological symptoms (p = 0.793) and pain (p = 0.263; Table 4).

There was a trend toward significance for global QOL (p = 0.065), sexual function (p = 0.083) and urinary function (p = 0.061). Pairwise comparisons were conducted to assess for significance across cohorts. With regards to sexual function, no association was found between open versus laparoscopic (p = 0.197), open versus robotic (p > 0.99) and laparoscopic versus robotic (p = 0.418) cohorts. Group comparisons for urinary function showed a trend toward significance between robotic and open surgery (p = 0.053). There were no group differences with respect to urinary function between robotic versus laparoscopic (p = 0.281) or open versus laparoscopic surgery (p = 0.979). Group comparisons for global QOL showed an association toward significance between open versus laparoscopic surgery (p = 0.065). There were no group differences with respect to global QOL scores between open versus robotic (p = 0.511) and laparoscopic versus robotic surgery (p = 0.922).

Discussion

Using a mixed-methods design, we explored the impact of surgical modality on self-reported body image and QOL among patients undergoing anterior resection for CRC. Three major themes were identified through detailed semistructured interviews and validated questionnaires over a follow-up period of approximately 14 months. First, open surgery was found to be detrimental to body image and cosmesis scores. In particular, patients expressed dissatisfaction with the presence of midline laparotomy scars and incisional hernias. Second, open surgery was found to negatively affect physical function, including the ability to engage in arduous activities of daily living. Finally, while laparoscopy was found to be protective in preserving role and social function in comparison to open and robotic surgery, these findings require prospective validation. Global QOL and sexual, urinary and GI function remained unaffected by surgical modality.

A total of 30 patient interviews were completed, at which time data saturation was achieved. A recent study using 60 qualitative interviews found that saturation occurred within the first 12 interviews and that elements for meta-themes were present as early as the first 6 interviews.[21] Therefore, we believe that our sample size was sufficient for thematic exploration of this topic.

Our study expands on the limited body of literature exploring the topic of cosmesis and functional outcomes of anterior resections from the patients' perspective. Self-reported body image and cosmetic outcomes have yet to be independently explored in this patient population. All previous reports, to our knowledge, have investigated the topic of body image using a limited set of 3 questions in the context of the EORTC QLQ-CR29 questionnaire. For instance, a recent study by Kamali and colleagues[11] found no significant difference in mean body image scores between patients undergoing laparoscopic (96.3) or robotic surgery (92.9) for rectal cancer (p = 0.85). Similarly, in the COLOR II trial, 12 months after undergoing open surgery, patients had comparable mean body image scores (80.8) to those undergoing laparoscopic surgery (78.8, p = 0.65).[10] While our study also did not find a meaningful difference in body image and cosmesis scores between patients undergoing laparoscopic and robotic surgery, patients undergoing open surgery had significantly poorer cosmetic outcomes than those receiving minimally invasive operations. This outcome was evident using a targeted BIQ as well as 3 probing questions about body image in the EORTC QLQ-CR29 questionnaire. This finding is important, given that, to our knowledge, ours is the first initiative exploring self-reported body image and cosmesis using a detailed, previously validated BIQ. Merit of the BIQ has been previously demonstrated among patients receiving surgery for Crohn disease, where body image and cosmesis was also rated more highly after laparoscopic than open surgery.[13] Our qualitative data provide further validation of our quantitative findings, where a significant proportion of patients in the open surgery cohort expressed concern over the presence of incisional hernias, wound infection and midline laparotomy scars. Poor wound healing (i.e., hypertrophy and keloid formation) and enlargement of hernias with time were added concerns for this subset of patients. It is therefore possible that their body image scores would diminish further over time with a more longitudinal analysis of cosmetic outcomes. It is important to note that ventral incisional hernia is a common and well-characterized complication of transabdominal surgery. The incidence ranges from 2% to 20% and varies greatly from one series to another as well as by surgical modality. Previous reviews of studies comparing laparotomy to minimally invasive surgery have reported a significantly higher incidence of incisional hernia after laparotomy, as seen in our series (p = 0.001).[22]

That open surgery may significantly hinder perception of body image, cosmesis and physical function warrants further study. Future studies exploring this outcome may inform additional educational interventions for patients being considered for anterior resection. For instance, brochures, infographics and images of postoperative abdomens can be used to educate patients before surgery. Our previous study exploring decision-making preferences found that patients with CRC often perceived a lack of information in the decision-making process. Therefore, one must remain sensitive to the unique decision-making preferences of each patient to align their expectations with known or possible postoperative outcomes.[20]

It is also important to note that while QOL after rectal cancer surgery has been a topic of numerous studies,[6,8,23–28] specific comparisons of all 3 surgical modalities and their

impact on survivorship are yet to mature. In our study, surgical modality did not have a considerable impact on emotional and cognitive function, or symptom scales assessing GI function, defecation, psychological symptoms and pain. While there was a trend toward significance, differences in genitourinary function and global QOL did not achieve statistical significance. Several other studies, though limited to 2 of the 3 surgical modalities compared in the present study, have reported modality-related differences in sexual function. For instance, Kamali and colleagues'[11] comparison of 34 patients revealed lower male impotence scores in patients who had robotic anterior resection than laparoscopic resection (7 ± 21 v. 33 ± 35, $p = 0.03$). Similarly, a systematic review and meta-analysis by Broholm and colleagues[29] reported a lower incidence of sexual dysfunction in patients undergoing robotic rectal cancer surgery than laparoscopy. While the CLASSIC trial found a higher rate of sexual dysfunction after laparoscopy than open surgery,[30] the COLOR II trial did not report any significant modality-related differences in health-related QOL.[10] Similarly, the recently published ROLARR trial did not reveal a statistically significant difference in bladder and sexual dysfunction between patients undergoing conventional laparoscopic versus robotic-assisted surgery for rectal cancer.[31]

Interestingly, our results also suggest that laparoscopy may be protective toward preserving role and social function in comparison to open and robotic surgery. This effect, however, is likely explained by "tumour factors," which are unaccounted for in the EORTC questionnaires. Patients receiving robotic surgery were significantly more likely to have a diagnosis of low-lying rectal cancer, demanding stoma creation. This likely skewed the role and social functioning scores to favour those with a lower likelihood of stoma creation, namely patients with rectosigmoid or upper-to-mid rectal cancer amenable to laparoscopic resection. This protective effect of laparoscopy on social function, also reported by Kamali and colleagues,[11] was not reflected in the COLOR II trial.[10] It is possible that the relatively low role and social function scores reported by patients receiving robotic surgery would recover over time, as 78% of these patients ultimately underwent stoma reversal surgery to re-establish GI continuity. Robotic surgery, notwithstanding the cost, can help in overcoming the technical challenges associated with laparoscopy and has been shown to offer comparable short-term oncologic outcomes and anastomotic leak rates.[31–33]

Comprehensive longitudinal and randomized data comparing emerging (transanal total mesorectal excision) and current modalities (laparoscopy, robotic surgery) in CRC are yet to materialize. The ongoing COLRAR (NCT01423214) and COLOR III (NCT02736942) trials are expected to provide more information on the topic of QOL in this vulnerable patient population.

Limitations

Our study is limited by its nonrandomized design and accompanying selection bias. For instance, the use of convenience sampling may limit the generalizability of our results, as the findings represent the views of patients under the care of only 2 surgical oncologists at a tertiary academic centre. Future studies should aim to recruit a diverse cross-section of patients undergoing anterior resections with unique treatment experiences to further explore the themes presented in this study. As patients were at least 8 months from surgery at the time of the interviews, some of our results may also be limited by recall bias. Moreover, the relatively small sample size and heterogeneous nature of the patient cohort did not allow for the balancing of all potential confounders present within the sample. It also precluded a detailed multivariate analysis to independently assess the association between surgical modality and QOL. It is also possible that the cosmetic and QOL benefits described above may diminish over time; therefore, a longitudinal analysis would have provided a more thorough understanding of trends in self-reported body image, function and QOL after anterior resection for CRC. This underscores the importance of future prospective studies to further elucidate the intricacies of how surgical modality may impact survivorship among patients with CRC.

Conclusion

Quality of life is an important outcome measure to be considered when deciding on a treatment strategy for CRC. To our knowledge, this is the first study of its kind, which adds to the limited body of patient-centred qualitative data, on the impact of open, laparoscopic and robotic surgery on cosmetic and functional outcomes. In our series, patients selected for open surgery for rectal and/or sigmoid cancers had lower self-reported body image and physical function than those undergoing minimally invasive surgery. Additionally, patients chosen for laparoscopic surgery reported fewer deficits in role and social function than those underdoing open and robotic operations.

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References

1. National Center for Health Statistics, Division of Health Interview Statistics. (2011). *National Health Interview Survey Public Use Data File 2010*. Hyattsville (MD). Centers for Disease Control and Prevention.
2. Welch HG, Robertson DJ. Colorectal cancer on the decline — why screening can't explain it all. *N Engl J Med* 2016;374:1605-7.
3. Cotrim H, Pereira G. Impact of colorectal cancer on patient and family: implications for care. *Eur J Oncol Nurs* 2008;12:217-26.
4. Fife B, Wright E. The dimensionality of stigma: a comparison of its impact on the self of persons with HIV/AIDS and cancer. *J Health Soc Behav* 2000;41:50-67.
5. Chen P, Lee J. Treatment of locally advanced low rectal cancer. *Formosan J Surg* 2016;49:83-8.
6. Fucini C, Gattai R, Urena C, et al. Quality of life among five-year survivors after treatment for very low rectal cancer with or without a permanent abdominal stoma. *Ann Surg Oncol* 2008;15:1099-106.
7. Kasparek MS, Hassan I, Cima RR, et al. Quality of life after coloanal anastomosis and abdominoperineal resection for distal rectal cancers: sphincter preservation vs quality of life. *Colorectal Dis* 2010;13:872-7.
8. Gervaz P, Bucher P, Konrad B, et al. A prospective longitudinal evaluation of quality of life after abdominoperineal resection. *J Surg Oncol* 2007;97:14-9.
9. Li J, Chen R, Xu Y, et al. Impact of a laparoscopic resection on the quality of life in rectal cancer patients: results of 135 patients. *Surg Today* 2010;40:917-22.
10. Andersson J, Angenete E, Gellerstedt M, et al. Health-related quality of life after laparoscopic and open surgery for rectal cancer in a randomized trial. *Br J Surg* 2013;100:941-9.
11. Kamali D, Omar K, Imam SZ, et al. Patient quality of life and short-term surgical outcomes between robotic and laparoscopic anterior resection for adenocarcinoma of the rectum. *Tech Coloproctol* 2017;21:355-61.
12. Silverman D. (2000). *Doing qualitative research: a practical handbook*. London: Sage Publications Ltd.
13. Dunker MS, Stiggelbout AM, Van Hogezand RA, et al. Cosmesis and body image after laparoscopic-assisted and open ileocolic resection for Crohns disease. *Surg Endosc* 1998;12:1334-40.
14. Fayers P, Bottomley A. Quality of life research within the EORTC — the EORTC QLQ-C30. *Eur J Cancer* 2002;38:125-33.
15. Gujral S, Conroy T, Fleissner C, et al. Assessing quality of life in patients with colorectal cancer: an update of the EORTC quality of life questionnaire. *Eur J Cancer* 2007;43:1564-73.
16. Fayers PM, Aaronson NK, Bjordal K, et al. *The EORTC QLQ-C30 Scoring Manual 3rd Edition*. Brussels: European Organization for Research and Treatment of Cancer; 2001.
17. Boyatzis RE. *Transforming qualitative information: thematic analysis and code development*. Thousand Oaks (CA): Sage Publications Inc.; 1998.
18. Kuzel A. Sampling in qualitative inquiry. In: Crabtree BMW, editor. *Doing qualitative research. 2nd ed*. Thousand Oaks (CA): Sage Publications Inc.; 1999.
19. Mays N, Pope C. Rigour and qualitative research. *BMJ* 1995;311:109-12.
20. Hirpara DH, Cleghorn MC, Sockalingam S, et al. Understanding the complexities of shared decision-making in cancer: a qualitative study of the perspectives of patients undergoing colorectal surgery. *Can J Surg* 2016;59:197-204.
21. Guest G, Bunce A, Johnson L. How many interviews are enough? An experiment with data saturation and variability. *Field Methods* 2006; 1:59-82.
22. Le Huu Nho R, Mege D, Ouaissi M, et al. Incidence and prevention of ventral incisional hernia. *J Visc Surg* 2012;149(Suppl):e3-14.
23. Jehle EC, Haehnel T, Starling MJ, et al. Level of the anastomosis does not influence functional outcome after anterior rectal resection for rectal cancer. *Am J Surg* 1995;169:147-52.
24. Varpe P, Huhtinen H, Rantala A, et al. Quality of life after surgery for rectal cancer with special reference to pelvic floor dysfunction. *Colorectal Dis* 2011;13:399-405.
25. Lewis WG, Holdsworth PJ, Stephenson BM, et al. Role of the rectum in the physiological and clinical results of coloanal and colorectal anastomosis after anterior resection for rectal carcinoma. *Br J Surg* 1992;79:1082-6.
26. Traa MJ, Orsini RG, Oudsten BL, et al. Measuring the health-related quality of life and sexual functioning of patients with rectal cancer: Does type of treatment matter? *Int J Cancer* 2013;134:979-87.
27. Mcleod RS. Comparison of quality of life in patients undergoing abdominoperineal extirpation or anterior resection for rectal cancer. *Ann Surg* 2001;233:157-8.
28. Kasparek MS, Hassan I, Cima RR, et al. Quality of life after coloanal anastomosis and abdominoperineal resection for distal rectal cancers: sphincter preservation vs quality of life. *Colorectal Dis* 2010;13:872-7.
29. Broholm M, Pommergaard H, Gögenür I. Possible benefits of robot-assisted rectal cancer surgery regarding urological and sexual dysfunction: a systematic review and meta-analysis. *Colorectal Dis* 2015;17:375-81.
30. Green BL, Marshall HC, Collinson F, et al. Long-term follow-up of the Medical Research Council CLASICC trial of conventional versus laparoscopically assisted resection in colorectal cancer. *Br J Surg* 2012;100:75-82.
31. Jayne D, Pigazzi A, Marshall H, et al. Effect of robotic-assisted vs conventional laparoscopic surgery on risk of conversion to open laparotomy among patients undergoing resection for rectal cancer — the ROLARR randomized clinical trial. *JAMA Surg* 2017;318:1569-80.
32. Feinberg AE, Elnahas A, Bashir S, et al. Comparison of robotic and laparoscopic colorectal resections with respect to 30-day perioperative morbidity. *Can J Surg* 2016;59:262-7.
33. Dat AD, Poon F. Robotic surgery for rectal cancer. *Cochrane Database Syst Rev* 2011;CD009214. doi: 10.1002/14651858.CD009214.