Int J Colorectal Dis (2013) 28:679–688
DOI 10.1007/s00384-013-1683-z

ORIGINAL ARTICLE

Quality of life of patients after low anterior, intersphincteric, and abdominoperineal resection for rectal cancer—a matched-pair analysis

Julia Konanz · Florian Herrle · Christel Weiss · Stefan Post · Peter Kienle

Accepted: 18 March 2013 / Published online: 10 April 2013

Abstract
Purpose Limits for sphincter preservation in rectal cancer have been expanded under the assumption that patients with a permanent colostomy have worse quality of life (QoL). Incontinence and painful defecation are common problems; therefore, this study compares functional outcome and QoL after sphincter-sparing intersphincteric resection (ISR), low anterior resection (LAR), and abdominoperineal resection (APR) for rectal cancer.
Methods From a prospective database, three matched groups of patients after surgery for rectal cancer between 1999 and 2009 were extracted. Median follow-up was 59 months. Of 131 patients receiving a questionnaire, 95 % could be analyzed further. Generic and disease-specific validated QoL (European Organization for Research and Treatment in Cancer QLQ-C30, CR38) and Wexner incontinence score were used.
Results Global QoL was comparable between the groups. Physical functioning was significantly better after sphincter preservation surgery than APR ($p<0.05$). Symptom scores for diarrhea (DIA) and constipation (CON) were higher after sphincter-preserving surgery (ISR: DIA 45.4, CON 20.2; LAR: DIA 34.1, CON 25.2) compared to APR (DIA 16.6, CON 12.0) ($p<0.05$ and <0.01, respectively). Disease-specific QoL assessment showed significantly worse QoL regarding to male sexual function after APR (80.8) than after ISR (53.6) ($p<0.005$). Regarding defecation, the ISR group showed significantly higher symptom scores than patients after LAR ($p<0.05$). Wexner scores were significantly higher after ISR (12.9) than after LAR (9.5) ($p<0.005$).

Keywords Quality of life · Rectal cancer · Resection

Introduction

Colorectal cancer is a major cause of morbidity and mortality in the western part of the world. Radical resection of the primary tumor including regional lymph nodes and the preservation of continence by nerve and anal sphincter-sparing surgery are cornerstones of modern surgical therapy for rectal cancer. Low anterior resection (LAR) including total mesorectal excision is the treatment of choice for mid or low rectal cancer. Abdominoperineal resection (APR) is generally indicated for low rectal cancers with invasion of the sphincter complex or in sphincter insufficiency [1, 2].

As many studies suggest that patients with a stoma have a poorer quality of life (QoL) than those without a stoma [3, 4] and as many patients consider life with a permanent colostomy unacceptable, the limits of continence preserving surgery have been expanded in the past decades. Advances in the surgical technique with the introduction of intersphincteric resection and better knowledge of the necessary distal safety margins have resulted in more sphincter-preserving surgery even in very low tumors. This development was pushed under the assumption that QoL would be improved by avoidance of a permanent stoma in low rectal cancer [5].

However, after radical resection of rectal cancer, sexual and urinary dysfunction and fecal incontinence frequently occur [6]. And patients with very low anastomoses are especially prone to develop a condition termed “low anterior resection syndrome,” which incorporates a number of

Julia Konanz and Florian Herrle are equal first author.

J. Konanz (✉) · F. Herrle · S. Post · P. Kienle
Department of Surgery, University Medical Centre Mannheim, Medical Faculty Mannheim of the University of Heidelberg, 68167, Mannheim, Germany
e-mail: julia.konanz.@umm.de

C. Weiss
Institute of Medical Statistics and Biometry, University Medical Centre Mannheim, Medical Faculty Mannheim of the University of Heidelberg, 68167, Mannheim, Germany

unpleasant symptoms such as frequent defecation, urgency, and stool incontinence [7], and severely impairs QoL.

QoL assessment is nowadays regarded as a critically important patient outcome parameter in addition to traditional oncological end points, such as overall survival, tumor relapse, and procedural morbidity. Yet, QoL is often poorly assessed in studies or its importance underestimated by physicians [8]. And there still is a paucity of studies investigating QoL of patients with a stoma compared to patients with a distal anastomosis after rectal resection. The main objective of the present study was therefore to compare long-term quality of life and functional outcome in patients having undergone abdominoperineal, intersphincteric, or low anterior resection for rectal cancer with standardized specific questionnaires.

Methods

One hundred thirty-one patients with rectal cancer having undergone resection in curative intent (R0 resection) and who had a minimal follow-up of 12 months were identified from a prospective database of all surgically treated rectal cancer patients since 1999 (n=849) at the Surgical Department of the University Medical Centre Mannheim. The following exclusion criteria were then applied: presence of a stoma (ileostomy or colostomy) in the ISR and LAR group and status post-anastomotic leakage, as the latter was expected to significantly influence QoL. Three matched groups of patients were finally extracted who had undergone surgery for rectal cancer between 1999 and 2009 and were still alive. First, 33 consecutive patients after ISR fulfilling the inclusion criteria were identified; subsequently, patients after LAR and APR were selected according to the following matching criteria: sex, age, tumor staging, and time elapsed since surgery. Further refinement of the matching criteria was not feasible as this would have prevented a relevant sample size. In the LAR group, there were 9 patients with upper rectal cancer (≥12 cm from the anal verge), 30 patients with middle rectal cancer (6 until <12 cm from the anal verge), and 2 with low rectal cancer (<6 cm from the anal verge). In the ISR and APR group, all patients had low rectal cancer.

Surgery was performed by senior surgeons using a standardized technique. All patients underwent total mesorectal excision as previously described [9]. Patients undergoing deep anterior resection were generally reconstructed with an end to end anastomosis (n=23) or with a short colonic pouch (n=18).

Quality of life data were collected by postal self-assessment with the European Organization for Research and Treatment in Cancer (EORTC) QLQ-C30 questionnaire and its colorectal cancer module (QLQ-CR38). EORTC QLQ-C30 and QLQ-CR38 scores were calculated by using the recommended EORTC scoring manual [10]. Each patient's scores are expressed on a scale of 0 to 100, in which 0 denotes the worst and 100 the best on the functioning scale, and 0 denotes the best and 100 the worst on the symptoms scales. In the case of missing responses within a scale, the scale score was calculated by using only those values, which were available, provided at least half of the items in the scale were completed.

Continence was assessed with the Wexner incontinence score. Univariate and multiple analyses based on the Wexner incontinence score were used to identify factors associated with poor sphincter function after intersphincteric and low anterior resection. A score of 0 point is equivalent to full continence and 20 points to total incontinence [11]. EORTC questionnaires were sent by mail to all patients, the Wexner score questionnaire only to the patients without a stoma.

All statistical calculations were done with the SAS system, release 9.2 (SAS Institute Inc., Cary, NC, USA). In order to compare three groups, Chi^2 test, Fisher's exact test, one-way ANOVA, or Kruskal–Wallis test were used, as appropriate. Each scale was evaluated with the Kruskal–Wallis test. In the case of a significant overall result, pair wise comparisons were made with Mann–Whitney U tests. Each test for two samples sample was performed two sided. A test result was considered as statistically significant when $p<0.05$.

Results

One hundred thirty-one patients after curative surgery for rectal cancer between 1999 and 2009 were eligible according to the inclusion criteria. Baseline characteristics of the matched groups are shown in Table 1. Of 131 patients receiving a questionnaire, 95 % responded (41 LAR, 33 ISR, and 50 APR) and could be analyzed further. The stated reason for declining participation was lack of interest in all cases (n=7). Missing data within returned questionnaires were uncommon and mainly concerned items on sexual function in the CR38 questionnaire of female patients. One patient in the LAR group did not answer questions regarding the defecation scale; otherwise, all functional and symptom scales were complete. For questions regarding sexuality, there were 28 questions with missing data in the ISR group, 83 questions with missing data in the APR group, and 54 questions with partially missing data in the LAR group. Data collection for the Wexner score was complete for all surveyed patients. There were no missing data in the C30 questionnaire.

Even though matching could not achieve completely homogeneous patient samples, the three groups were comparable in regard to tumor staging and median follow-up.

Table 1 Patients characteristics

	ISR (n=33)	LAR (n=41)	APR (n=50)
Sex (male/female)	26/7 (79/21 %)	25/16 (61/39 %)	38/12(76/24 %)
Age (mean±SD, range)	63.1±9.5 (46–80)	68.0±10.8 (46–80)	69.2±11.5 (40–88)
T0	4 (12 %)	2 (5 %)	2 (4 %)
T1	7 (21 %)	5 (12 %)	3 (6 %)
T2	10 (30 %)	12 (29 %)	18 (36 %)
T3	10 (30 %)	20 (49 %)	24 (48 %)
T4	0 (0 %)	1 (2 %)	2 (4 %)
Unknown	2 (6 %)	1 (2 %)	1 (2 %)
pN–	26 (79 %)	28 (68 %)	38 (76 %)
pN+	7 (21 %)	13 (32 %)	12 (24 %)
M0	33 (100 %)	39 (95 %)	49 (98 %)
M1	0 (0 %)	2 (5 %)	1(2 %)
Local recurrence	4 (12 %)	0 (0 %)	2 (4 %)
Post-op morbidity (patients)	16 (48 %)	12 (29 %)	34 (68 %)
Impaired wound healing	3 (9 %)	5 (12 %)	32 (64 %)
Bowel obstruction (early)	5 (15 %)	2 (5 %)	7 (14 %)
Other surgical complications	5 (15 %)	3 (7 %)	6 (12 %)
Other nonsurgical complications	6 (18 %)	1 (2 %)	5 (10 %)
Length of post-op hospital stay (median in days (range))	14 (6–36)	12 (6–22)	16 (6–37)
Neoadjuvant chemoradiation	19 (58 %)	17 (41 %)	28 (56 %)
Adjuvant chemoradiation	1 (3 %)	10 (24.4 %)	8 (16 %)
Adjuvant chemotherapy	6 (18 %)	16 (39 %)	14 (28 %)
Median follow-up at time of survey (months)	55.6	59.0	59.5
BMI	25.4	25.8	26.1

There were differences in age and sex ratio: patients with ISR were younger than patients after APR.

Results of the generic QoL questionnaire QLQ-C30

No significant differences were found between patients undergoing ISR, LAR, and APR in global QoL, emotional, social, and cognitive functioning.

Patients undergoing LAR had statistically significant higher scores in physical functioning than patients undergoing APR (p=0.0262); APR patients had lower scores than ISR patients (p, 0.0280). Role functioning and symptom scales dyspnea, pain, fatigue, insomnia, appetite loss, nausea, and financial difficulties showed no differences between the three groups. The symptom scale constipation showed significantly higher scores in LAR than in APR patients (p=0.0106). The symptom scale diarrhea showed significantly higher scores for patients after LAR (p=0.0053) and ISR (p<0.0001) compared to patients after APR.

Comparison of QoL C30 scores between patient groups and with common reference populations are shown in Table 2 (and Fig. 1)

Results of the disease-specific QoL module CR 38

No significant differences were shown for the symptom scales of body image, micturition problems, chemotherapy side effects, stoma-related problems, and weight loss.

However, patients after APR had significantly lower scores in the future perspective scale than patients after LAR (p=0.0096). In sexual functioning, ISR patients had higher scores than APR patients (p=0.0025), and in sexual enjoyment, ISR patients had higher scores than LAR patients (p=0.0477). In the scale of symptoms in the area of the gastrointestinal tract, APR patients had significantly lower scores than ISR patients (p=0.0161). LAR (p=0.0601) and ISR (p=0.0131) patients had lower scores in the scale male sexual problems than APR patients. The scale female sexual problems showed no significant differences between groups; however, missing data were frequent in this scale. In the scale defecation problems, LAR patients had lower scores than ISR patients (p=0.0198).

Comparison of QoL-C38 scores between patient groups are shown in Table 3 (and Fig. 2)

Table 2 EORTC QLQ-C30 quality of life scale mean scores in study groups and scores of two reference populations from the EORTC scoring manual ([18, 19])

Quality of life—scale	Mean reference scores healthy German population—all sexes/ages [12]	Mean reference scores C30-EORTC colorectal cancer population—all stages [13]	Mean scores—ISR patients (n=33)	Mean scores—LAR patients (n=41)	Mean scores—APR patients (n=50)	p value, Kruskal–Wallis test (U tests)
QL	70.8	60.0	58.1	65.9	59.2	p=0.3374
PF	90.1	79.2	82.2	80.2	69.9	p=0.028 (ISR-APR); p=0.026 (LAR-APR)
RF	88.0	70.4	63.6	66.3	56.0	p=0.2445
CF	91.2	85.2	80.3	79.3	87.0	p=0.1639
EF	78.7	68.9	70.7	73.4	71.8	p=0.8210
SF	91.0	76.0	59.6	66.7	62.0	p=0.4619
DY	8.1	17.4	18.2	17.1	26.7	p=0.1186
PA	15.4	24.0	22.7	17.5	25.3	p=0.8028
FA	17.1	34.7	25.9	30.9	35.3	p=0.1968
AP	5.4	19.1	7.1	8.9	6.0	p=0.8854
NV	2.8	7.3	4.6	4.9	2.3	p=0.3446
CO	3.6	15.8	20.2	25.2	12.0	p=0.0106 (LAR-APR)
DI	2.8	16.6	45.5	34.1	16.7	p=0.0053 (LAR-APR); p<0.0001 (ISR-APR)
FI	6.0	13.6	22.2	18.7	21.3	p=0.6437
IN	16.4	30.5	24.2	28.5	29.3	p=0.5441

Score range 0–100. Mean scores from both reference populations (healthy German and colorectal cancer population) are shown as an orientation for overall baseline QoL but were not used for statistical analysis. In functional scales, higher scores indicate better QoL; in symptom scales, lower scores indicate better QoL

PF physical functioning, *RF* role functioning, *CF* cognitive functioning, *EF* emotional functioning, *SF* social functioning (functional scales), *DY* dyspnea, *PA* pain, *FA* fatigue, *SL* sleeplessness, *AP* appetite loss, *NV* nausea and vomiting, *CO* constipation, *DI* diarrhea, *FI* financial difficulties, *IN* insomnia (symptom scales), *QL* global health and quality of life

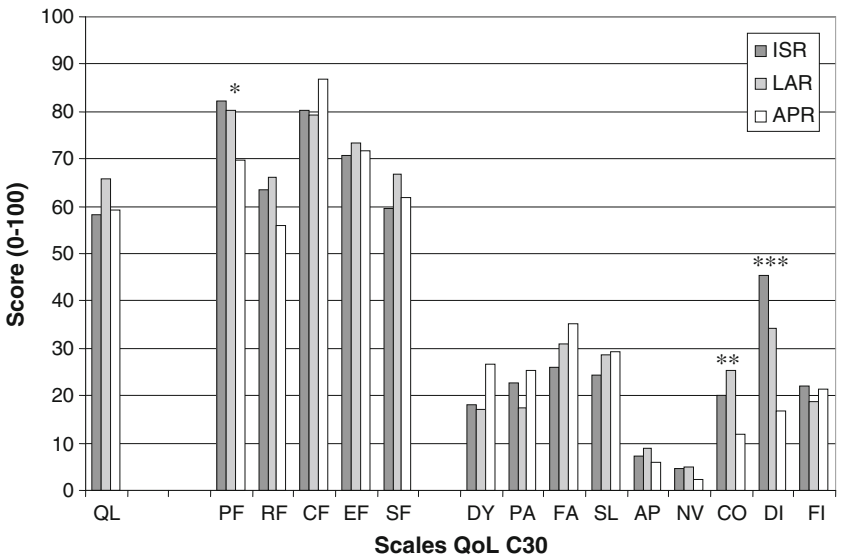

Fig. 1 Mean quality of life scores for QLQ-C30 in study groups. Global health and quality of Life (*QL*); functional scales: physical functioning (*PF*), role functioning (*RF*), cognitive functioning (*CF*), emotional functioning (*EF*), social functioning (*SF*); symptom scales: dyspnea (*DY*), pain (*PA*), fatigue (*FA*), sleeplessness (*SL*), appetite loss (*AP*), Nausea and vomiting (*NV*), constipation (*CO*), diarrhea (*DI*), financial difficulties (*FI*). In functional scales, higher scores indicate better QoL; in symptom scales, lower scores indicate better QoL. PF: *p, 0.02 (APR versus LAR/ISR); CO: **p, 0.01 (APR versus LAR); DI: ***p, 0.005 (APR versus LAR), ***p, <0.0001 (APR versus ISR)

Table 3 CR38 (disease-specific colorectal cancer module) mean quality of life scores of patient groups

Scale	Mean score—ISR patients (n=33)	Mean score—LAR patients (n=41)	Mean score—APR patients (n=50)	p value Kruskal–Wallis test (U tests)
Micturition problems	30.0	28.2	34.3	p=0.3710
GIT symptoms	37.8	32.5	23.6	p=0.0161 (ISR-APR)
Weight loss	11.1	5.7	8.7	p=0.4068
CTX side effects	16.5	13.8	18.2	p=0.5853
BI (body image)	72.7	75.3	62.4	p=0.1398
FU (future perspective)	52.5	65.0	44.7	p=0.0096 (LAR-APR)
Sex—active functioning	44.4	31.7	21.7	p=0.0025 (ISR-APR)
Sex—enjoyment	75.9	53.7	56.4	p=0.0477 (ISR-LAR)
Male—sex problems	53.6	55.6	80.9	p=0.0131 (ISR-APR)
Female—sex problems	33.3	42.6	44.4	p=0.8400
Defecation problems	44.7	34.2	n.a.	p=0.0198 (ISR-LAR)
Stoma-related problems	n.a.	n.a.	38.5	

Score range 0–100. In functional scales, higher scores indicate better QoL; in symptom/problems scales, lower scores indicate better QoL

n.a. not applicable

Results for the Wexner incontinence score

Evaluation of the Wexner incontinence summary score revealed that patients after ISR were less continent than patients after LAR (difference of 3.4 points on average, p=0.0038) (Table 4 and Fig. 3). Differences in continence function were highest for the item "pad use" which was almost twice as frequent among ISR patients compared to LAR patients.

Discussion

It is a commonly held opinion—based on previous observational studies—that quality of life after APR is poorer than after ISR and LAR because the patients have a permanent stoma [4, 14]. Therefore, avoiding a permanent colostomy after rectal resection for cancer is considered an important goal.

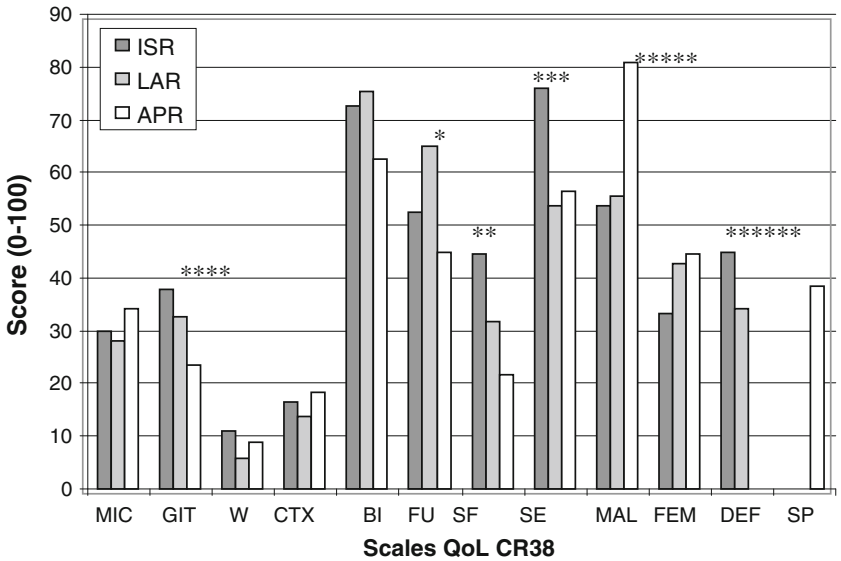

Fig. 2 Mean quality of life scores for QLQ-CR38 in study groups. Micturition problems (*MIC*), GIT symptoms (*GIT*), weight loss (*W*), CTX side effects (*CTX*), BI (body image) (*BI*), FU (future perspective) (*FU*), sex—active functioning (*SF*), sex—enjoyment (*SE*), male—sex problems (*MAL*), female—sex problems (*FEM*), defecation problems (*DEF*), stoma-related problems (*SP*). In functional scales, higher scores indicate better QoL; in symptom/problems scales, lower scores indicate better QoL. FU: *p, 0.009 (APR versus LAR); SF: **p, 0.002 (ISR versus APR); SE: ***p, 0.05 (ISR versus LAR); GIT: ****p, 0.01 (APR versus ISR); MAL: *****p, 0.01 (LAR/ISR versus APR), DEF: ******p, 0.01 (LAR versus ISR)

Table 4 Comparison of mean Wexner scores of ISR and LAR patients

Wexner score items ("questions")	Mean score—ISR patients	Mean score—LAR patients
1 (incontinence for solid stool)	2.2	2.0
2 (incontinence for liquid stool)	2.4	1.9
3 (incontinence for gas)	2.8	2.2
4 (use of pads)	3.2	1.7
5 (social life limitations)	2.3	1.7
Summary score (0–20)*	12.90	9.50

Score: 0 (at no time), 1 (infrequent), 2 (sometimes), 3 (frequent), 4 (always). Sum score 0–20: 0, no incontinence; 20, worst incontinence

*p, 0.0038

But there is concern that extending the limits of deep anterior resection may result in a higher rate of local recurrence due to the reduction of safety margins. Although this has not been substantiated by the recently published data [15, 16], larger studies will have to confirm that the 1 cm rule indeed no longer holds true.

Previous studies have shown that LAR and especially ISR often lead to severe functional problems both in short and long term and may result in a poor defecatory function [17]. Patients with very low anastomoses are especially prone to develop a condition termed "low anterior resection syndrome" [18, 19], which incorporates a number of unpleasant symptoms such as frequent defecation, urgency, and stool incontinence [7], and severely impairs QoL. These commonly occurring problems after deep sphincter-preserving surgery are probably the reason why recent studies have shown that QoL after ISR and LAR, contrary to former beliefs, is not better than QoL after APR [14, 20–22]. This is in accordance with the results of our study which show an equivalent global health status for all three groups. There were no significant differences in most of the QoL items. However, diarrhea and constipation were significantly worse in ISR and LAR compared to APR patients. Patients with ISR showed significantly more symptoms in the gastrointestinal tract and more defecation problems, which is consistent with current literature and well explicable as the operation impairs anorectal function the most [23, 24]. A synopsis of studies and corresponding Qol scores examining QoL in APR, LAR, or ISR patients is given in Table 5.

Interestingly in our study, patients after sphincter-preserving surgery not only had more problems with diarrhea but also experienced more constipation than APR patients. This is in accord with results from another study also reporting on constipation problems after LAR with a mean score of 20 for this symptom [25]. Constipation after sphincter-preserving surgery may possibly be explained on the basis of an evacuation disorder due to loss of the sensitive region at the anorectal junction with consecutive loss of coordination in the defecatory process. Constipation after deep anterior resection has also been described in cases with large J-pouches but this is unlikely in our series as, as a rule, only small pouches were constructed (≤4–5 cm) [26]. Finally, anastomotic stenosis and impaired compliance of the neorectum, especially after adjuvant chemoradiation, may also play a role in the occurrence of constipation.

Fecal incontinence was more common in patients after ISR compared to LAR. This is well explicable as patients undergoing ISR generally have direct impairment of anal sphincter function as the cranial part of the internal sphincter is removed. Moreover, most of or the entire transition zone are also removed resulting in an impairment of sensibility

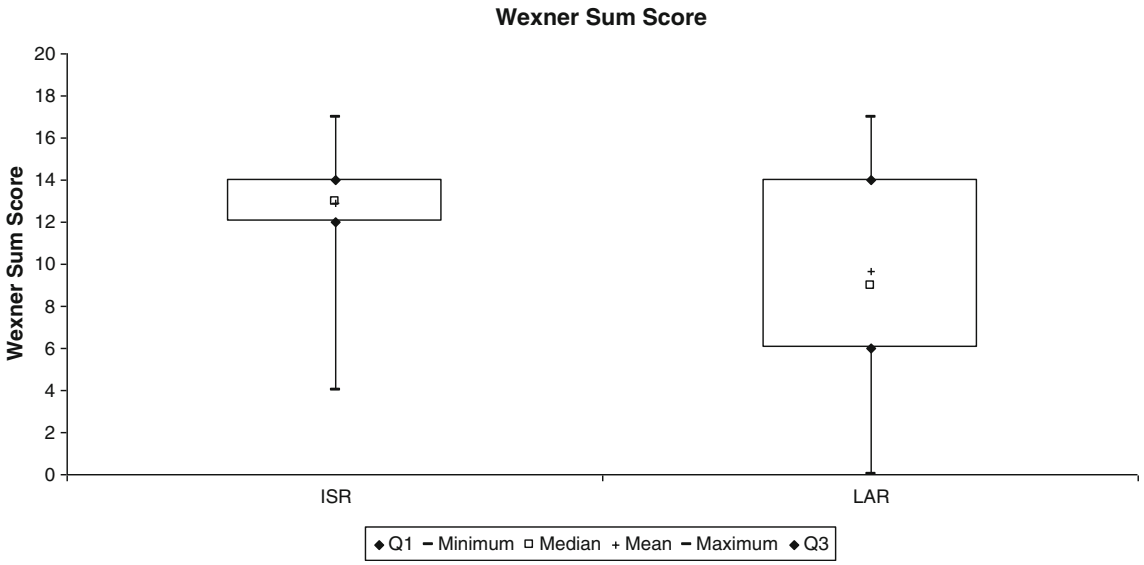

Fig. 3 Comparison of mean Wexner scores for items (questions) 1–5 and mean Wexner summary score of ISR versus LAR patients. Sum score 0–20: 0, no incontinence; 20, worst incontinence

Table 5 Overview of studies comparing QoL between patients after APR, LAR/AR, ISR

Reference	Population (*n*)	Instruments	Groups	Results C30				Results CR38					Resumé of study results Global QoL
				Scores QL	PF	CO	DI	GIT	FU	DEF	MALE	Sex-AF	
Allal et al. [14]	52 (29 APR, 23 LAR)	EORTC-C30/ CR38	APR	78	87	0	9	12	80			27	Better QoL for APR patients
			LAR	67	70	22	16	15	66	17		18	
			p=	0.38	0.2	0.09	0.66	0.53	0.35			0.71	
Camilleri-Brennan et al. [20]	106 (53 APR, 53 AR)	EORTC-C30/ CR38 SF36	APR	69.5	70.6	6.9	15.7	16.1	69.2		57.3	13.1	Equal QoL
			AR	70.4	79.3	19.5	11.3	20.3	64.7	20.3	45.2	15.5	
			p=	0.77	0.09	0.001	0.26	0.19	0.31		0.58	0.65	
Engel et al. [4]	299 (69 LAR, 176 AR, 54 APR)	EORTC-C30/ CR38	APR	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	Better QoL for AR patients
			LAR										
			AR										
			p=										
Vironen et al. [21]	82 (54 AR, 28 APR)	SF-36		n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	Equal QoL
Tsunoda et al. [25]	47 (22 LAR, 25 AR)	EORTC-C30/ CR38	LAR	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	n.a	Better QoL for AR patients
			AR										
			p=										
Kasparek et al. [24]	168 (85 LAR, 83 APR)	EORTC-C30/ CR38	APR	73	87	8	13	12	71	26	68	76	Equal QoL
			LAR	78	94	16	20	15	70	22	52	27	
				0.086	0.003	0.018	0.148	0.049	0.747	0.611	0.019	<0.0001	
Our study (Konanz et al.)	124 (50 APR, 41 LAR, 33 ISR)	EORTC C30/ CR38, Wexner	APR	59.2	69.9	12.0	16.7	23.6	44.7		80.9	21.7	Equal global QoL
			LAR	65.9	80.2	25.2	34.1	32.5	65.0	34.2	55.6	31.7	
			ISR	58.1	82.2	20.2	45.5	37.8	52.5	44.7	53.6	44.4	
			p=	0.3374	0.028 (ISR-APR)	0.0106 (LAR-APR)	0.0053 (LAR-APR)	0.0161 (ISR-APR)	0.0096 (LAR-APR)	0.0198 (ISR-LAR)	0.0131 (ISR-APR)	0.0025 (ISR-APR)	
					0.026 (LAR-APR)		<0.0001 (ISR-APR)						

APR abdominoperineal resection, *AR* anterior resection, *LAR* low anterior resection, *ISR* intersphincteric resection, *QoL* quality of life, *EORTC QLQ-C30 and EORTC QLQ-CR38* questionnaires developed by the QOL Study Group of the European Organization for Research and Treatment of Cancer, *SF-36* short-form health survey, *QL* global quality of life scale, *PF* physical functioning, *CO* constipation, *DI* diarrhea, *GIT* gastrointestinal symptoms, *FU* future perspective, *Male* male—sex problems, *Sex-AF* sex—active functioning, *n.a.* not applicable

and hence also to more incontinence. Finally, radiation therapy may have to involve the anal sphincter more in very low tumors in need for intersphincteric resection [27].

Application of radiation therapy by itself, however, cannot be held responsible for the higher rate of incontinence in ISR compared to LAR patients in our study as a comparable percentage of patients (65.4 versus 61 %, not significant) had chemoradiation in the LAR group (Table 1). Moreover, only 3 % of patients underwent adjuvant chemoradiation after ISR versus 24.4 % after LAR and especially adjuvant radiation has been shown to have a deleterious effect on postoperative function. More patients received neoadjuvant chemoradiation in the ISR compared to the LAR group (58 versus 41 %), the strategy here being facilitation of sphincter preservation by potential down staging. This results in an inherent bias in this group. As the primary aim of this study was the comparison of these three groups with regard to QoL we felt that stratification according to chemoradiation was not necessary. Moreover, this would have further reduced the sample sizes further reducing the statistical power of the analysis. Lastly, as patients were surveyed roughly 5 years after surgery, we feel that the above shown differences in the rate of chemoradiation are probably not relevant although this can obviously not be excluded with certainty.

Patients having undergone LAR and ISR showed better physical functioning in our study than patients having undergone APR. However, this difference may, at least partially, be explained by the significantly higher age of patients in the APR compared to the ISR group. Kasparek et al. also found higher physical functioning scores in patients after ISR. However, the data of that study have to be interpreted with caution as the study population had even higher physical functioning scores than the colorectal EORTC reference population [24]. The cognitive function here was also significantly better in the ISR group, again supporting the perception of relevant age bias in the above study.

An important issue after rectal cancer surgery is sexual function [28]. Generally, response rates for questions concerning sexual functioning are poorly reported. Palmer's recent matched-pair quality of life study did not report sexual functioning scales of the CR 38 questionnaire at all because of frequently missing data [29]. Our study had a nearly complete response rate to the questions on sexual functioning in male patients. Only 2 of 89 male patients did not answer the questions. Men had a markedly worse sexual function if they had undergone APR compared to LAR or ISR. Although highly statistically significant, these results may be biased by the younger age of LAR and especially of ISR patients when assuming that younger patients are generally sexually more active. Nonetheless, several other studies have also found significantly more sexual dysfunction after APR than after LAR and ISR [4, 30]. This may primarily be explained by the extent of dissection in abdominoperineal resection compared to low anterior and intersphincteric resection. As the dissection in the lower pelvis is more extensive in APR compared to the other two procedures, the nerves important for sexual function such as the pudendal nerve are more at risk [31].

Micturition problems were comparable in all patient groups and micturition scores of our patient population were comparable to those reported in the literature [29], [25, 30, 34].

The worse results for the item future perspective in patients after APR compared to LAR is in contrast to the results from an earlier study [14]. But then, the difference in our study may again be biased by the significantly higher age of patients in the APR group and merely reflect the overall less optimistic view of the future of older people. In the above-cited study, there was no age bias and patients after APR actually showed a better future perspective than patients after sphincter-preserving surgery. The authors suggested that the more radical surgery in APR may give patients the impression that tumor excision was more complete and therefore a relapse less likely, resulting in patients looking into the future more optimistic. However, the patient sample in this study was small and there was no matching; therefore, a relevant selection bias can again not be ruled out.

The Wexner score revealed a significantly poorer continence function for ISR compared to LAR patients. According to a study correlating GIQLI, SF-36, and Wexner incontinence score, scores above 9 are associated with a significant impairment of global QoL because of the risk of social isolation as patients are more confined to their toilets at home [32, 33]. Our analysis showed a statistical trend towards a worse global QoL in ISR compared to LAR patients (58 versus 66), possibly reflecting the significantly higher Wexner summary score (12.9) in ISR compared to LAR patients (9.5). Why the latter significant difference in the Wexner score did not result in a significantly different global quality of life may simply be a matter of small sample size. But it may also be due to a so-called response-shift phenomenon: despite markedly impaired anal continence and limited social life, patients may shift their expectations in regard to global QoL because of gratefulness for living without a permanent stoma [34, 35]. However, in order to detect and quantify such possible influences on patient values and preferences, preoperative incontinence scores would have to be measured and evaluation of such self concepts and expectations would have to be done.

The response rate in our study was high, 95 % of patients returned the questionnaire, which was better than reported in other studies [14, 36]. But this could not prevent the major drawback of this study, which is the limited sample size. Matching was a problem, as several potential confounding factors had to be considered which in turn reduced the number of eligible patients. This is a well-known problem in matched-pair analyses, but obviously the issue addressed

in our study cannot be adequately studied in other study types such as randomized studies.

Furthermore, drawing matched samples from already operated patients does not allow longitudinal intra- and intergroup QoL and functional comparisons. Therefore, the validity of our post-op results is limited in the sense that poor post-op functional outcome may have already been present prior to the operation and may therefore not have been the result of the surgery itself. However, according to our general practice as a specialized colorectal unit, patients with poor preoperative function are generally not selected for an intersphincteric procedure.

Comparisons between the significantly older APR patient group with the two other sphincter-preserving populations have to been interpreted with caution. However, comparable global quality of life scores in all three groups can be interpreted as a clinically relevant and valid result as bias in the APR group would have been expected to distort QoL scores to a lower level because of higher age. So, if anything, APR may actually in reality result in a better QoL than ISR and LAR. Therefore, in conclusion, patients undergoing surgery for low rectal cancer can be counseled that even if their sphincter has to be sacrificed it is unlikely that their global QoL is worse than if the sphincter had been preserved.

Conclusion

In conclusion, the present study showed no difference in global quality of life after sphincter-preserving surgery compared to abdominoperineal resection. Continence was markedly poorer after ISR compared to LAR and there were significantly fewer problems with diarrhea and constipation after APR than after sphincter preservation. Male sexual functioning was significantly worse after APR than after sphincter-preserving injury, but this may have been biased by the higher age in the APR group. These results are important for patient counseling before performing sphincter-saving resection in deep rectal cancer.

Patients may not always profit from sphincter preservation "at any price" and should be aware that global quality of life is not worse after APR than after sphincter-sparing surgery. Decision making should be individualized depending on preoperative anal function and personal preferences also potentially taking into consideration sexual activity.

References

1. Weitz J et al (2005) Colorectal cancer. Lancet 365(9454):153–65
2. National Comprehensive Cancer Network (2012) NCCN Guidelines—rectal cancer version 2.2012. NCCN Clinical Practice Guidelines in Oncology, 09.12.2012
3. Wilson TR, Alexander DJ (2008) Clinical and non-clinical factors influencing postoperative health-related quality of life in patients with colorectal cancer. Br J Surg 95(11):1408–15
4. Engel J et al (2003) Quality of life in rectal cancer patients: a four-year prospective study. Ann Surg 238(2):203–13
5. Hohenberger W et al (2006) The influence of abdomino-peranal (intersphincteric) resection of lower third rectal carcinoma on the rates of sphincter preservation and locoregional recurrence. Colorectal Dis 8(1):23–33
6. Ho VP et al (2011) Sexual function after treatment for rectal cancer: a review. Dis Colon Rectum 54(1):113–25
7. Hassan I et al (2006) Long-term functional and quality of life outcomes after coloanal anastomosis for distal rectal cancer. Dis Colon Rectum 49(9):1266–74
8. Hassan I, Cima RR (2007) Quality of life after rectal resection and multimodality therapy. J Surg Oncol 96(8):684–92
9. MacFarlane JK, Ryall RD, Heald RJ (1993) Mesorectal excision for rectal cancer. Lancet 341(8843):457–60
10. Fayers PM, Aaronson NK, on behalf of the EORTC Quality of Life Group et al (2001) The EORTC QLQ-C30 Scoring Manual. European Organization for Research and Treatment of Cancer, Brussels
11. Jorge JM, Wexner SD (1993) Etiology and management of fecal incontinence. Dis Colon Rectum 36(1):77–97
12. Schwarz R, Hinz A (2001) Reference data for the quality of life questionnaire EORTC QLQ-C30 in the general German population. Eur J Cancer 37(11):1345–51
13. Hayashi T, Murakami M, Era S (2009) Preliminary study of modification of serum albumin through paracellular pathway of rat submandibular gland. J Med Invest 56(Suppl):393–4
14. Allal AS et al (2000) Sphincter-sparing surgery after preoperative radiotherapy for low rectal cancers: feasibility, oncologic results and quality of life outcomes. Br J Cancer 82(6):1131–7
15. Kiran RP, Lian L, Lavery IC (2011) Does a subcentimeter distal resection margin adversely influence oncologic outcomes in patients with rectal cancer undergoing restorative proctectomy? Dis Colon Rectum 54(2):157–63
16. Bujko K, et al (2011) Is the 1-cm Rule of Distal Bowel Resection Margin in Rectal Cancer Based on Clinical Evidence? A Systematic Review. Ann Surg Oncol
17. Bretagnol F et al (2004) Long-term functional results after sphincter-saving resection for rectal cancer. Gastroenterol Clin Biol 28(2):155–9
18. Ortiz H, Armendariz P (1996) Anterior resection: do the patients perceive any clinical benefit? Int J Colorectal Dis 11(4):191–5
19. Kakodkar R, Gupta S, Nundy S (2006) Low anterior resection with total mesorectal excision for rectal cancer: functional assessment and factors affecting outcome. Colorectal Dis 8(8):650–6
20. Camilleri-Brennan J, Steele RJ (2002) Objective assessment of morbidity and quality of life after surgery for low rectal cancer. Colorectal Dis 4(1):61–66
21. Vironen JH et al (2006) Impact of functional results on quality of life after rectal cancer surgery. Dis Colon Rectum 49(5):568–78
22. Pachler J, Wille-Jorgensen P (2005) Quality of life after rectal resection for cancer, with or without permanent colostomy. Cochrane Database Syst Rev 2:CD004323
23. Cornish JA et al (2007) A meta-analysis of quality of life for abdominoperineal excision of rectum versus anterior resection for rectal cancer. Ann Surg Oncol 14(7):2056–68
24. Kasparek MS et al (2011) Quality of life after coloanal anastomosis and abdominoperineal resection for distal rectal cancers: sphincter preservation vs quality of life. Colorectal Dis 13(8):872–7
25. Tsunoda A et al (2008) Quality of life after low anterior resection and temporary loop ileostomy. Dis Colon Rectum 51(2):218–22
26. Hida J, Okuno K (2010) Pouch operation for rectal cancer. Surg Today 40(4):307–14

27. Kuo LJ, et al (2011) Oncological and Functional Outcomes of Intersphincteric Resection for Low Rectal Cancer. J Surg Res
28. Schmidt C et al (2010) Sexual impairment and its effects on quality of life in patients with rectal cancer. Dtsch Arztebl Int 107(8):123–30
29. Palmer G et al (2008) Quality of life after potentially curative treatment for locally advanced rectal cancer. Ann Surg Oncol 15(11):3109–17
30. Havenga K et al (1996) Male and female sexual and urinary function after total mesorectal excision with autonomic nerve preservation for carcinoma of the rectum. J Am Coll Surg 182(6):495–502
31. Moszkowicz D et al (2011) Where does pelvic nerve injury occur during rectal surgery for cancer? Colorectal Dis 13(12):1326–34
32. Ogata Y et al (2009) Elevated preoperative serum carcinoembrionic antigen level may be an effective indicator for needing adjuvant chemotherapy after potentially curative resection of stage II colon cancer. J Surg Oncol 99(1):65–70
33. Barisic G et al (2011) Function after intersphincteric resection for low rectal cancer and its influence on quality of life. Colorectal Dis 13(6):638–43
34. Ito N et al (2010) Response shift in quality-of-life assessment in patients undergoing curative surgery with permanent colostomy: a preliminary study. Gastroenterol Nurs 33(6):408–12
35. Schwartz CE et al (2006) The clinical significance of adaptation to changing health: a meta-analysis of response shift. Qual Life Res 15(9):1533–50
36. Rauch P et al (2004) Quality of life among disease-free survivors of rectal cancer. J Clin Oncol 22(2):354–60