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ARTICLE

Health-related quality-of-life after radical cystectomy among Norwegian men and women compared to the general population

Cathrine O. Normann[a], Randi Opheim[b], Bettina K. Andreassen[c], Tomm Bernklev[d,e] and Erik S. Haug[a]

[a]Department of Urology, Vestfold Hospital Trust, Oslo, Norway; [b]Faculty of Health and Society, University of Oslo, Oslo, Norway; [c]Department of Research, Cancer Registry of Norway, Oslo, Norway; [d]Department of Research and Innovation, Vestfold Hospital Trust, Oslo, Norway; [e]Institute of Clinical Medicine, University of Oslo, Oslo, Norway

ABSTRACT

Objective: The aim of this study was to assess health-related quality-of-life (HRQoL) in men and women operated on with radical cystectomy, compared to the general Norwegian population.

Materials and methods: All patients with bladder cancer who had undergone radical cystectomy (RC) between 2011–2017 and either received ileal conduit (IC) or orthotopic neobladder (ONB) as urinary diversion were included in a cross-sectional study. HRQoL and sociodemographic data was collected and measured with a questionnaire consisting of the generic EORTC QLQ-C30.v3 and the cancer specific EORTC QLQ-BLM30 and compared to a general population sample.

Results: Of the 220 invited patients, 173 patients (78.6%) returned the questionnaires. The global quality-of-life (QoL) score was comparable with the general population. Women had significantly higher fatigue score, worse future perspective and symptoms like bloating, compared to male patients. Men had significantly lower social functioning, more constipation, diarrhoea and sleep disturbance compared to the general male population. There was no significant difference in HRQoL domains between female patients and the general female population. A follow-up (FU) period longer than 37 months since surgery was associated with significantly improved physical- and role-functioning, less fatigue and fewer problems with the urostoma, compared to a shorter FU time.

Conclusion: This study found a high global QoL score after radical cystectomy, comparable with the general Norwegian population. Symptoms seem to improve over time. Difference in HRQoL outcomes between men and woman in the study population was comparable with the difference found in the general population.

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Health-related quality-of-life; radical cystectomy; bladder cancer; patient reported outcome measurement

Introduction

The gold standard for treatment of muscle invasive bladder cancer with curative intent is radical cystectomy (RC) and urinary tract reconstruction. Although ileal conduit (IC) traditionally has been the dominating diversion, continent cutaneous diversions and orthotopic neobladder (ONB) have been popular alternatives. However, all procedures are associated with possible long-term implications for the patients' health-related quality-of-life (HRQoL) [1]. To establish knowledge on how treatments may affect the patient's daily lives, there has been an increased focus on patient reported outcome measurements (PROM) in recent years [2]. With the use of PROM, HRQoL research can clarify problems that are as or more important for the patient, than signs of symptoms of disease or treatments. HRQoL is often considered to be a multi-dimensional concept composed of; physical functioning, disease-specific or treatment-specific symptoms, mental and social function [3].

Recent literature reviews claim a favourable effect of ONB compared to IC on the HRQoL [4,5], but reasonable comparison is questioned by a review article by Crozier et al. [6] due to adverse patient selection for IC.

Studies on HRQoL after RC have traditionally been hampered by poor design, HRQoL measured at a single point, athe bsence of preoperative HRQoL assessments and the use of non-validated questionnaires as possible problems [1,7]. Poor quality and lack of standardization of patient-reported outcome measure (PROM) questionnaires is still a problem according to a recent review article by Mason et al. [8].

Månsson et al. [9] have performed several Swedish studies on HRQoL after RC, although published more than 10 years ago, and the only Norwegian study, performed by Frich et al. [10], was published in 2009. The latter study included relatively few patients and used a QoL questionnaire translated from Swedish to Norwegian which was not validated. Thus, at present, there are no good quality studies investigating generic- and disease-specific HRQoL in Norwegian bladder cancer (BC) patients operated on with RC. In addition, there seems to be a lack of contemporary Nordic studies using population-based HRQoL data as a control group.

The primary aim of the present study was to compare generic and disease-specific HRQoL in a current population-based cohort of Norwegian BC patients undergoing RC with an aged matched Norwegian general population. Secondary

CONTACT Cathrine O. Normann caolau@siv.no Department of Urology, Vestfold Hospital Trust, Postboks 2168, 3103 Tonsberg, Oslo, Norway

aims were to assess the impact of gender, time since surgery and demographic and clinical variables on the patients HRQoL score.

Materials and methods

Study design and study population

We conducted a single centre, cross-sectional study between January and May 2017. Bladder cancer patients receiving RC between January 2011 and May 2017 at Vestfold Hospital Trust and still alive were eligible for inclusion. Patients with metastases, receiving palliative treatment for disseminated disease and/or suffering from cognitive failure were excluded. All patients had received either ileal conduit (IC) or orthotropic neo-bladder (ONB) as urinary diversion. Out of 281 patients operated on with RC in the time period, we identified 220 eligible patients (56 were dead and five metastatic at survey) after review of the urological quality registry at our hospital.

Collection of data variables

All eligible patients received a letter of explanation including an informed consent form and two HRQoL-questionnaires in addition to questions regarding sociodemographic variables (civil status, age, gender and education), by postal mail. Clinical data were collected from the hospital urological registry and from the hospital electronic medical record (DIPS); age at surgery, nerve sparing intent, postoperative complications, type of urinary diversion, neoadjuvant chemotherapy and length of hospital stay. Assuming that complications treated with medication only (Clavien Dindo < 3) have few long-term implications for HRQoL, we focused on Clavien score $\geq$ 3a. The dataset did not subdivide the Clavian Dindo score of 3 and 4. Generic HRQoL data from the Norwegian background population was collected from the study of Hjermstad et al. [11] and was gender- and age-matched with our study cohort.

HRQoL questionnaires

The EORTC QLQ-C30.v3 is a generic questionnaire consisting of five functional scales (cognitive, emotional, physical, role and social), nine symptom scales (fatigue, nausea, pain, appetite loss, constipation, diarrhoea, dyspnoea, financial impact and sleep disturbance), one global QoL score and one global health score. EORTC QLQ-C30.v3 has been developed and validated internationally by 'the EORTC study group on HRQoL' [12]. The questionnaire has previously been translated and validated on Norwegian cancer patients and found to be a reliable and valid instrument [13].

The disease-specific questionnaire, EORTC QLQ-BLM30, was developed specifically for patients with muscle invasive bladder cancer (MIBC). The questionnaire consists of six symptom scales (urinary, urostoma, single catheter use, flatus/bloating, body image and sexual functioning) [14]. Validation studies are currently ongoing. We translated and back translated the questionnaire from English to Norwegian following the EORTC research group recommendations [15].

Statistics

Data were explored using descriptive statistics (e.g. medians, frequencies, confidence interval (CI) and range). When data had a skewed distribution, non-parametric statistics were used. Chi-square test was used for pairwise comparisons of categorical variables, non-parametric Mann-Whitney U and Kruskal-Wallis tests were used to compare means of continuous variables for two or more groups whenever indicated. We used the definition by Snyder et al. [16] implying that a score > 70 is associated with a high HRQoL and < 70 is associated with a low HRQoL. Consequently, a high score at the functional scales and a low score at the symptom scales are associated with a high HRQoL [17]. The global QoL score was calculated following the EORTC instructions for question 29 (global Qol) and 30 (global health) in the generic EORTC QLQ-C30.v3 questionnaire. The variables were summarized to form functional and symptom scales, as described in the EORTC scoring manual, with a range from 0–100 [18]. When $>$ 50% of the items from a multi-item scale were answered, the missing items was assumed to have the average value of the existing answers from that respondent and were included in the scale [18]. To assess the impact of time after surgery on aspects of HRQoL, the respondents were divided by time since surgery; Group 1: 0–12 months, group 2: 12–37 months, and group 3: $>$ 37 months follow-up time. Due to the small number of responders on questions regarding sexual functioning of men (23%) and woman (16%), the variable set was not included in the analyses.

The HRQoL mean scores from the general Norwegian population [11] were adjusted to match the age distribution in the study population, by calculating the expected mean score as described by Schou et al. [19] (Appendix 1). One-sample *t*-test was used to compare the mean functional and symptom scores from the study population, with the expected mean score from the general Norwegian population. All statistical analyses were performed in IBM SPSS Statistics version 23 and *p*-values < 0.05 were considered statistically significant.

Ethical considerations

According to the Norwegian legislation when the study was performed, the study was registered as a local quality study and submitted to the Norwegian centre for research data (NSD), which was the hospital's local data protection officer for research. The NSD approved the study, with ref.nr; 51277/3/HJP, and all data were deidentified before analyses were performed.

Table 1. Baseline characteristics of RC patients.

	All	Male	Female
Gender, *n* (%)	173	141 (81.5)	32 (18.5)
Level of education, *n* (%)			
Primary school and below	60 (35)	45 (33)	15 (49)
Middle school	62 (37)	52 (37)	10 (32)
University (14–16 years)	22 (13)	20 (14)	2 (6)
University and above (17+ years)	26 (15)	22 (16)	4 (13)
Missing	3	2	1
Civil status, *n* (%)			
Living with a partner	135 (78)	116 (82)	19 (59)
In a relationship, but not living together	4 (2)	4 (3)	–
Not in a relationship/single	18 (11)	11 (8)	7 (22)
Widow/widower	16 (9)	10 (7)	6 (19)
Clinical variables			
Age at surgery (years)			
Median	70.4	70.0	70.7
Range	38–89	38–89	54–86
Neoadjuvant chemotherapy, *n* (%)			
Total	47 (27)	37 (26)	10 (31)
Urinary diversion, *n* (%)			
Ileal Conduit (IC)	135 (78)	104 (74)	31 (97)
Orthotop neobladder (ONB)	38 (22)	37 (26)	1 (3)
Nerve-sparing procedure, *n* (%)			
Total	39 (22)	38 (27)	1 (3)
Length of hospital stay, *n* (%)			
0–7 days	100 (59)	82 (59)	18 (56)
8+ days	71 (41)	57 (41)	14 (44)
Missing	2	2	
Postoperative complications, *n* (%)			
Total	74 (43)	64 (45)	10 (31)
Clavien 1	21 (28)	18 (28)	3 (30)
Clavien 2	30 (41)	24 (37)	6 (60)
Clavien 3	20 (27)	19 (30)	1 (10)
Clavien 4	3 (4)	3 (5)	–
Follow-up			
Age at follow-up (years)			
Median	72	72	71
Range	43–90	43–90	55–87
Time since surgery (*n*, (%))			
<12 months	55 (32)	40 (29)	15 (47)
12–37 months	61 (36)	48 (35)	13 (41)
>37 months	54 (32)	50 (36)	4 (12)
Missing	3	3	
Follow-up (months)			
Median	21.8	23.5	15.6
Range	(0–71)	(1–71)	(0–70)

Clavien score 1: Any deviation from the normal postoperative course, without need for pharmacological treatment or surgical, endoscopic or radiological intervention. Clavien score 2: Requiring pharmacological treatment with drugs, blood transfusion and/or total parenteral nutrition. Clavien score 3: Requiring surgical, endoscopic or radiological intervention. Clavian dindo score 3a: Intervention not under general anaesthesia. Clavian dindo score 3b: Intervention under general anaesthesia. Clavien score 4: Life-threatening complication. Clavian dindo score 4a: Single organ dysfuntion (including dialysis). Clavian dindo score 4b: Multiorgan dysfunction (http://www.assessurgery.com/clavien-dindo-classification/).

Results

Patient characteristics

Of the 220 patients invited, 173 (79%) returned the questionnaire, 141 (82%) men and 32 (18%) women. Median age for both genders at the time of the study was 71 years (range = 43–90). Of the 32 females, one received ONB and 31 IC. Corresponding numbers for males were 104 IC (74%) and 37 ONB (26%). The median follow-up time for all patients were 21.8 months (range = 0–71 months). Twenty-three (13%) patients had postoperative complications with a Clavian score above 3a. Further baseline characteristics are summarized in Table 1.

Table 2. EORTC QLQ-C30.v3. Generic questionnaire – comparison between males and females, in the study population.

	Men ($n = 141$)		Women ($n = 32$)		
Item	Mean	95% CI	Mean	95% CI	*p*-value
Functional scales*					
Cognitive	87.2	84–90	82.7	75–90	0.23
Emotional	88.0	85–90	80.2	72–89	0.08
Physical	83.5	80–87	78.4	72–85	0.15
Role	79.2	74–83	73.1	63–83	0.22
Social	71.5	66–75	73.1	64–85	0.76
Global health/QoL	75.4	71–79	73.6	68–82	0.62
Symptom scales**					
Fatigue	25.9	22–29	39.4	31–48	<0.01[a]
Nausea/vomiting	2.0	0.9–3.2	5.3	1.7–9.0	0.02[a]
Pain	13.4	10–18	23.1	13–35	0.07
Single items**					
Appetite loss	6.1	3.6–8.8	11.8	4.4–19	0.13
Constipation	21.0	16–26	25.8	12–39	0.48
Diarrhoea	16.7	13–21	19.3	7.6–31	0.65
Dyspnoea	23.8	19–28	29.0	18–40	0.35
Financial impact	9.4	5.7–13	6.4	0.2–13	0.37
Sleep disturbance	25.0	20–30	33.3	21–46	0.17

p-Value is calculated between men and women. [a]*p*-value < 0.05.
*Higher score indicates better function (score range = 0–100).
**Higher score indicates more symptoms (score range = 0–100).

Table 3. EORTC QLQ-BLM30. Cancer specific questionnaire – comparison between male and females, in the bladder cancer population.

	Men		Women		
Item (*n*: men, women)	Mean	95% CI	Mean	95% CI	*p*-value
Symptom scales**					
Urinary (35, 2)	27.7	21–34	4.7	−56–65	0.13
Urostomy (96, 29)	16.1	13–19	15.3	8.8–22	0.81
Single catheter use (8)	4.1	−5.7–14	–	–	–
Future perspective (115, 21)	26.1	22–31	46.0	32–60	0.01[a]
Bloating (118, 21)	14.1	10–18	32.5	17–48	0.01[a]
Body image (117, 21)	28.1	23–33	28.5	15–42	0.94
Sexual function	–	–	–	–	–

p-value is calculated between men and women. [a]*p*-value < 0.05.
**Higher score indicates more symptoms (score range = 0–100).
–, No available data.

Generic HRQoL scores

The generic EORTC QLQ-C30.v3 questionnaire showed that women reported statistically significantly more fatigue, worse emotional function and a tendency towards more nausea/vomiting and pain, compared to men. However, these differences were also present in the Norwegian background population. There was no significant difference in the global QoL score between men and women (Table 2).

Compared to the background male population, men had significantly worse social functioning and better cognitive function. Furthermore, male patients had statistically significantly less problems with pain, but more problems with constipation, diarrhoea and sleep disturbance compared to the general male population. There were no statistically significant differences in global QoL or in the functional and

Table 4. EORTC QLQ-C30.v3. Comparison between RC patients and the Norwegian background population.

	General Norwegian men			General Norwegian women		
Item mean	Population ($n = 583$)	RC patients ($n = 141$)	p-value	Population ($n = 605$)	RC patients ($n = 32$)	p-value
Functional scales*						
Cognitive	79.9	87.2	<0.01[a]	81.0	82.7	0.62
Emotional	86.5	88.0	0.26	83.1	80.2	0.51
Physical	82.3	83.5	0.45	73.1	78.4	0.12
Role	76.0	79.2	0.18	71.7	73.1	0.77
Social	81.1	71.5	<0.01[a]	81.4	73.1	0.12
Global health/QoL	72.9	75.4	0.19	69.1	73.6	0.21
Symptom scales**						
Fatigue	26.9	25.9	0.59	35.3	39.4	0.33
Nausea/vomiting	3.0	2.0	0.09	6.6	5.3	0.50
Pain	21.9	13.4	<0.01[a]	29.1	23.1	0.26
Single items**						
Appetite loss	6.8	6.1	0.65	11.4	11.8	0.91
Constipation	14.4	21.0	0.01[a]	20.2	25.8	0.41
Diarrhoea	9.6	16.7	<0.01[a]	9.7	19.3	0.10
Dyspnoea	22.0	23.8	0.43	21.9	29.0	0.21
Financial impact	7.3	9.4	0.26	11.5	6.4	0.13
Sleep disturbance	17.7	25.0	0.01[a]	33.2	33.3	0.98

p-Value is calculated between men and women. [a]p-value <0.05.
*Higher score indicates better function (score range = 0–100).
**Higher score indicates more symptoms (score range = 0–100).

Table 5. EORTC QLQ-C30 v3. Comparison between subgroups after time since surgery in RC patients.

	Time since surgery (months)			
Item mean (SD)	<12 ($n = 55$)	12–37 ($n = 61$)	>37 ($n = 54$)	$p =$ <12 vs > 37
Functional scales*				
Cognitive	83.6 (20.4)	87.1 (14.0)	87.7 (15.7)	0.15
Emotional	84.3 (21.2)	87.5 (16.3)	88.3 (16.4)	0.18
Physical	79.1 (20.3)	84.1 (17.4)	85.0 (19.5)	0.04[a]
Role	73.1 (29.7)	79.4 (26.6)	83.6 (25.8)	0.01[a]
Social	69.6 (27.7)	72.6 (25.0)	73.2 (27.2)	0.35
Global health/QoL	75.4 (19.0)	75.5 (21.7)	75.3 (24.9)	0.95
Symptom scales**				
Fatigue	31.5 (24.0)	27.5 (23.0)	25.0 (19.3)	0.05[a]
Nausea/vomiting	2.1 (7.2)	2.1 (5.6)	3.8 (9.6)	0.09
Pain	13.2 (22.0)	14.4 (23.8)	18.6 (25.9)	0.08
Single items**				
Appetite loss	8.4 (19.4)	6.0 (12.9)	6.4 (16.2)	0.43
Constipation	21.8 (28.1)	21.8 (30.9)	20.7 (30.1)	0.77
Diarrhoea	16.3 (26.3)	18.5 (26.8)	15.7 (24.1)	0.85
Dyspnoea	20.0 (25.3)	26.7 (29.7)	26.2 (26.6)	0.07
Financial impact	10.3 (23.8)	9.8 (22.2)	6.2 (19.6)	0.21
Sleep disturbance	28.4 (27.5)	26.6 (29.9)	22.4 (26.9)	0.11

Mean functional and symptom scales, and single items stratified by time since operation (months). SD, Standard deviation of the functional and symptom scales. From the study population. The analyses include both genders.
p-values estimated between the groups of time since surgery. [a]p-value <0.05.
*Higher score indicates better function (score range = 0–100).
**Higher score indicates more symptoms (score range = 0–100).

symptom scores between female patients and the general female population (Table 4).

The clinical or sociodemographic variables included in the analysis did not have any statistically significant impact on the global QoL score (Data not shown).

Disease-specific HRQoL scores

Data from the disease-specific EORTC QLQ-BLM30 questionnaire showed that women, compared to men, reported statistically significantly more symptoms of bloating and worse future perspectives regarding their health, disease and possible treatments (Table 3).

HRQoL and follow-up time after surgery

Table 5 shows the different HRQoL scores stratified by time since surgery. Patients with longer FU (> 37 months) reported statistically significantly better physical and role functioning and reduced fatigue compared to patients followed-up on the first year after operation (< 12 months).

The disease-specific symptom scales showed that a longer FU time was associated with statistically significant better

Table 6. EORTC QLQ-BLM30. Comparison between subgroups after time since surgery, in RC patients.

	Time since surgery (months)			
Item mean (SD)	< 12	13–37	> 37	p = < 12 vs > 37
Symptom scales**				
Urinary	21.7 (18.4)	24.1 (19.3)	32.0 (21.0)	0.19
Single catheter use	0.0	0.0	11.1 (19.2)	–
Urostomy	20.0 (14.4)	14.2 (18.4)	12.1 (13.0)	<0.01[a]
Future perspective	37.1 (29.8)	31.9 (25.4)	17.4 (22.7)	<0.01[a]
Bloating	19.2 (25.4)	12.1 (20.5)	18.1 (23.7)	0.76
Body image	32.5 (26.2)	26.0 (27.5)	26.1 (26.6)	0.10
Sexual function	–	–	–	–

Mean score on scales and items by time since operation (in months). The analyses include both genders.
p-value is calculated between time since surgery. [a]p-value < 0.05.
**Higher score indicates more symptoms (score range = 0–100).
–, Not possible to compare means/no available data.

future perspectives, compared to patients with a shorter FU time. There was also significantly less symptom burden related to the urostoma over time (Table 6).

Discussion

In this cross-sectional study, we explored health-related quality-of-life (HRQoL) in a population of Norwegian bladder cancer (BC) patients after radical cystectomy (RC). The patients reported a high global QoL score (> 70), which was also found by Frich et al. [10] in an earlier study of Norwegian BC patients after RC. This may be caused by culturally high acceptance for disease-related changes in life among Norwegian patients. Although the global QoL score in our study was comparable with the global score in the general Norwegian population, the male patients reported worse social and role functioning. In a German study by Singer et al. [20], they found a significantly lower global QoL score compared to the general population. However, Singer et al.'s study was designed as a cross-sectional study in a rehabilitation clinic for bladder cancer survivors. One might assume that RC patients attending a rehabilitation clinic have several complications and worse adaptation to life after RC, compared to those who do not attend rehabilitation. A study from Denmark by Jensen et al. [21] investigating the impact of a multidisciplinary rehabilitation programme for RC patients, was unable to find any impact from the programme on the Global Qol score. However, pre- and postoperative physical rehabilitation significantly improved HRQoL aspects such as bowel management and dyspnea.

In our study, male patients reported more bowel symptoms, especially constipation and diarrhoea, compared to the general male population. We observed the same tendency for women, however not with statistical significance, which is probably due to the low numbers. Analysis of the HRQoL domains in relation to time since surgery showed that bowel symptoms were generally high and did not change noteworthy over time. This might indicate that RC affects bowel functioning permanently, which is in line with Kramer et al. [22], who found that one-fourth of the patients experienced change in bowel symptoms after RC, most commonly as diarrhoea (75%) and flatulence/bloating (82%). Given these high figures, it should be further evaluated whether pre- and postoperative physical rehabilitation or other interventions can improve bowel outcomes [21].

Addressing associations between patient characteristics and the global QoL score revealed no statistically significant impact regarding age at operation, which is in line with other studies [23]. Still, it is important to consider the need older patients might have for social support and their ability for self-care regarding the urinary diversion to maintain good HRQoL [24].

In the present study, women reported a significantly higher fatigue score, lower future perspective and more bloating, as well as a tendency towards lower scores in all HRQoL domains when compared to men. This gender difference is also present in the general population and found in several other studies [11,25,26] and may accordingly be caused by other factors than the RC. This is further supported by another observation in our study, where female patients did not significantly differ in any of the functional or symptom scores compared to the general female population. This is also in line with Rouanne et al. [27] investigating HRQoL in women with ONB as urinary diversion.

Male patients reported worse social functioning and better cognitive functioning, compared to the general male population, which may seem like a contradiction. One would assume that patients receiving cancer treatment experience a severe impact on their ability to remember and concentrate in a negative way, not the opposite. One possible explanation for this contradiction may be that those responding in our study represent a selected group regarding cognitive function.

Time since RC seemed to be associated with a higher score in several HRQoL domains. Patients with a longer FU time reported significantly better physical and role functioning, as well as lower fatigue score and better future perspective compared to patients with a shorter FU time after surgery. This observation is in line with previous studies, which indicates that the patient's situation after RC improves over time [10]. This finding might be related to the decreasing risk of recurrence of disease. One might assume that patients find comfort in that the risk of metastatic-disease diminishes over time, which in turn leads to increased motivation and well-being.

We also found that the urostoma symptom score improved with longer follow-up time after surgery. Our

findings might indicate that adaption over time combined with increasing experience is associated with better patient self-stomal care. Tal et al. [28] support the idea of an early patient education, to improve self stomal-care after surgery. This will increase the chance of independence, improve HRQoL and enhance necessary psychological adjustment to life after RC. A previous study found that patients without urostomal complications had improved HRQoL, compared to those with some complications [29].

We could not observe any statistically significant associations between the sociodemographic or clinical variables and the global QoL score. This is in line with the results of Kretchmer et al. [30], however we were unable to reproduce that the nerve-sparing procedure positively influenced the global QoL score.

This study has some limitations. The low number of patients operated on with ONB limits the opportunity to conduct analyses comparing different urinary diversions. Furthermore, the relatively small number of women included in this study makes it difficult to rule out the possibility of type two errors when comparing the results between genders. Even though our material is age-matched with Hjermstad et al. [11], we cannot rule out the presence of unknown selection which is not adjusted for. Another limitation in this study is the lack of baseline data, which should be included in further prospective studies on consequences of RC and urinary diversion.

However, the patients included in this study were operated on at the same hospital with the same procedure, had equal access to healthcare and were subject to the same postoperative follow-up regime. This, in combination with the use of a validated instrument and a high response rate, must be considered as strengths.

Conclusion

Global HRQoL scores among Norwegian men and women after RC were comparable to the Norwegian background population, although men experienced lower social functioning and more bowel symptoms. Female gender was associated with higher fatigue and lower emotional functioning score, but with a similar global QoL score compared to men and in line with corresponding figures from the general population sample. Functional status and symptom burden seem to improve over time in both genders.

Disclosure statement

No potential conflict of interest was reported by the author(s).

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Appendix 1

Reference values for the EORTC QLQ C30 global health-related quality-of-life, functional and symptom scales from the general male and female population were obtained from the study of health related HRQoL in the general population conducted by Hjermstad et al. [11].

Reference mean score values for the global health QoL score, broken down by age in the general population:

Age group (years)	General male	General female
40–49	79.0	72.7
50–59	75.9	74.1
60–69	75.2	70.2
>70	71.4	67.6
Total (*n*)	583	605

Age distribution of the study participants, number of subjects in each category who completed the global health QoL scales and QLQ C30 questionnaire:

Age group (years)	Male participants	Female participants
40–49	2	0
50–59	15	5
60–69	35	7
>70	89	20
Total (*n*)	141	32

An example of calculation of expected mean score:

From the reference values, the mean global health QoL score for the males > 70 years is 71.4 [11]. For the 141 males in the study population with the same age distribution as the study participants, we would expect a total sum score of: $2 \times 79.0 + 15 \times 75.9 + 35 \times 75.2 + 89 \times 71.4 = 10{,}283.1$. And the expected mean sum score for males is: $10{,}283.1/141 = 72.9$.