Archives of Gynecology and Obstetrics (2019) 299:191–201
https://doi.org/10.1007/s00404-018-4922-2

GYNECOLOGIC ONCOLOGY

Sexual activity and quality of life in patients after treatment for breast and ovarian cancer

Sebastian Mayer[1] · Severine Iborra[6] · Donata Grimm[3] · Lisa Steinsiek[3] · Sven Mahner[4] · Michaela Bossart[1] · Linn Woelber[3] · Pit Jacob Voss[2] · Gerald Gitsch[1] · Annette Hasenburg[5]

Received: 5 October 2017 / Accepted: 27 September 2018 / Published online: 1 November 2018
© Springer-Verlag GmbH Germany, part of Springer Nature 2018

Abstract

Objective Sexual activity (SA) and functioning (SF) are important factors influencing quality of life (QoL). Anticancer treatment can cause or promote sexual dysfunctions. In this study we analyzed the SA, SF and QoL in patients after completion of treatment for breast cancer (BC) and ovarian cancer (OC).

Methods In this retrospective multicenter study 396 BC patients and 93 OC patients aged between 18 and 70 years were surveyed at least 24 months after cancer diagnosis and compared to 60 healthy women. Data were collected through validated questionnaires (Sexual Activity Questionnaire, Female Sexual Function Index-d, EORTC Quality of Life Questionnaire-C30).

Results 45.9% of BC patients and 56.5% of OC patients reported SA. SF and well-being of sexually active BC patients were not influenced by the type and radicality of surgery or the administration of chemotherapy. Patients who received antihormonal therapy at the time of evaluation showed a lower frequency of SA ($p=0.007$), less satisfaction ($p=0.003$) and more discomfort during SA ($p=<0.001$) compared to healthy controls but no differences in experiencing orgasms, health status, QoL and global health status. In contrast, BC patients without antihormonal therapy showed only a higher discomfort score ($p=0.028$) than healthy controls and estimated their health status and QoL significantly better than patients who received antihormonal therapy ($p=0006$). In general, SA was associated with a better health status ($p=0.007$), a better QoL ($p=0.004$) and a better global health status ($p=0.004$) in BC patients. Sexually active OC patients showed no significant differences in SF, QoL and health status compared to healthy controls.

Conclusions Compared to healthy controls BC patients showed limitations in SF with a lower SA rate and more discomfort. Antihormonal therapy was an important factor influencing SF and well-being. Breast and OC survivors reported good physical and psychical health without differences in QoL and health status compared to controls. This might be explained by a change of perspective on life difficulties and altered priorities through a life threatening disease.

Keywords Quality of life · Sexual activity · Sexual function · Breast cancer · Ovarian cancer

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s00404-018-4922-2) contains supplementary material, which is available to authorized users.

✉ Annette Hasenburg
annette.Hasenburg@unimedizin-mainz.de

[1] Department of Obstetrics and Gynecology, University Medical Center Freiburg, Freiburg, Germany

[2] Department of Oral and Maxillofacial Surgery, University Medical Center Freiburg, Freiburg, Germany

[3] Department of Gynecology and Gynecologic Oncology, University Medical Center Hamburg-Eppendorf, Hamburg, Germany

[4] Department of Obstetrics and Gynecology, University Hospital, LMU Munich, Munich, Germany

[5] Department of Gynecology and Obstetrics, University Medical Center Mainz, Mainz, Germany

[6] Department of Obstetrics and Gynecology, University Medical Center Aachen, Aachen, Germany

Background

Quality of life (QoL) and well-being are influenced by different physical, social, spiritual and mental factors [1]. In this context sexual activity (SA) and sexual functioning (SF) play an important role. Immediately after diagnosis of cancer, most patients focus on anticancer treatment and its challenges—sexuality becomes less important [2]. In this situation the primary objective of treatment is to cure the disease or—if healing is not possible—to prolong survival and secondary to maintain the best possible QoL. Since survival rates and life expectancy after treatment for cancer are rising due to more effective therapies and the implementation of screening programs, QoL concerns and the underlying factors come more into focus [1, 3]. To ensure the best possible well-being of cancer patients, negative influences on factors affecting QoL should be identified and improved as soon as possible.This is especially important for sexual dysfunction, which often occurs soon after therapy and may turn into a chronic problem without early and adequate intervention. Anticancer treatment for breast and gynecological cancer consists of surgery and, depending on tumor stage and risk factors, adjuvant and/or neoadjuvant chemotherapy, antihormonal therapy, radiation and/or targeted therapies. These therapies can—besides physical, psychological and social side effects—cause or promote sexual dysfunctions, such as decreased sexual desire or interest, arousal disorder, vaginal dryness and difficulty or inability to achieve an orgasm [4–6]. Reasons for sexual dysfunctions after cancer treatment may be the loss of ovarian function and consecutive hormonal deficits due to chemotherapy, antihormonal therapy or salpingo-oophorectomy, which lead to postmenopausal symptoms or body-image changes and changes in self-perception [4, 6–8]. Several authors reported decreased sexual health, including reduced sexual interest, increased discomfort and increased vaginal dryness in breast cancer (BC) patients [6, 9–11]. Studies exploring the impact of different surgical and systemic therapies on sexual disorders in BC patients showed heterogeneous results. While some studies found significant differences in SF and QoL between BC patients who received breast conserving surgery or mastectomy others could not find any differences between both groups [8, 12–14].

In ovarian cancer (OC) patients there is only little information about the impact of surgical and adjuvant therapy on sexuality. Kim et al. recently reported no differences in SA or SF besides a poorer social functioning and more financial difficulties in OC patients compared to healthy women, whereas Li et al. reported significantly worse sexual function in those patients [15, 16]. The significance of radical pelvic and paraaortal lymph node dissection with possible damage to the surrounding sympathetic and parasympathetic nerves with regard to sexual arousal disorders is not yet well evaluated. A current study from the "AGO-Ovar" (working group gynecological oncology) is supposed to solve this question: the LION-PAW study, a substudy of the LION Study (Lymphadenectomy In Ovarian Neoplasm) and (PAW = Pleasure Ability of Women), has the aim to clarify to which extent a radical lymphadenectomy affects sexual function (ClinicalTrials.gov Identifier: NCT00712218).

There are still deficits in communication between patients and doctors about sexual problems after anticancer treatment, even though patients and physicians consider sexual health as important [17]. According to Stabile et al. [17] 70% of their cohort of OC and BC patients were concerned about sexual function and preferred the topic to be raised by the medical team with written educational material followed by expert discussion.It is important to provide sufficient information about QoL and sexuality after anticancer treatment to physicians working with cancer patients as well as to the patients themselves in order to sensitize them for these topics.

The present study investigated SF and well-being of BC and OC patients in comparison to healthy controls. Furthermore, the impact of different treatment modalities on SF and well-being of BC and OC patients was evaluated. We hypothesized that SA and QoL are influenced by anticancer treatment resulting in impaired SF and QoL in BC and OC patients compared to healthy controls. Furthermore, due to more radical surgery and chemotherapy in OC patients we estimated that SF and QoL would be worse in OC patients compared to BC patients.

Methods

In this multicenter-study 396 patients with primary breast cancer and 93 patients with primary ovarian cancer between 18 and 70 years of age who had received therapy (surgery and/or chemotherapy and/or radiation) between 2001 and 2008 at the University Medical Center Freiburg and the University Medical Center Hamburg were retrospectively identified and surveyed 24 months or later after cancer diagnosis. Patients with pre-existing depression and untreated thyroid dysfunction as well as local recurrence, distant metastasis or secondary malignancy were excluded. The study was approved by the local ethics committee of the Albert Ludwig University Freiburg in December 2009 (397/2009).

Patients eligible for the study were identified from existing medical records and contacted via mail. They received a cover letter with information about aims and scopes of the study as well as a confirmation of strict confidence and anonymity. Patients were also informed that participation

was voluntary and withdrawal was possible at any time without giving reasons. Together with the questionnaire patients received a non-participation-form. Patients who did not want to take part in the study were able to state their reasons for non-participation or comment about the study with this form. The control group (CG) consisted of 60 healthy females who attended the outpatient clinic of the center for dental medicine of the University Medical Center Freiburg for routine check-up or ambulant dental treatment and were selected in order to provide a CG with average health status and without severe illnesses. The questionnaires were handed out to consecutive patients during routine consultation. Inclusion criteria were age between 18 and 70 years, no history of cancer or depression and no surgery during the past 4 weeks. Inclusion and exclusion details are shown in Table 1.

QoL, SA and SF were assessed by a questionnaire which was composed of three components: the complete Sexual Activity Questionnaire (SAQ), items 11–13 ("orgasm") of the Female Function Index (FSFI) and two questions regarding general health and QoL of the EORTC Quality of Life Questionnaire (QLQ-C30). Questionnaires are attached as Appendix 1–3.

The SAQ is a self-assessment questionnaire which was designed to evaluate the SF in women concerning SA, pleasure and discomfort and has been validated for women with long-term tamoxifen intake and women at high risk of developing breast cancer (BC) as well women with no such risk [18]. The FSFI is a brief multidimensional self-report instrument and was designed and validated for assessment of female SF and quality of life in clinical trials and epidemiologic studies [19].

QLQ-C30 is a validated multidimensional self-administrable questionnaire which was developed to evaluate the health-related QoL in cancer patients [20]. Furthermore socio-demographic data (marital status, educational achievements, history of smoking and alcohol) as well as clinical and histopathological data (age, height, weight, menstrual cycle, family history of cancer, medication, tumor type and stage) and anticancer treatment (surgery, chemotherapy, radiation, antihormonal therapy) were collected with a self-designed questionnaire and from clinical records. Data were collected into MS Access databases. Statistical analysis was performed with SAS 9.1/9.2 (SAS Institute, Inc., Cary. NC, 2004) and SPSS 15.0 (SPSS Institute Inc., Chicago, IL, 2006). A two-sided p value < 0.05 was considered significant.

For univariate analysis, Wilcoxon Two-Sample tests and Kruskal–Wallis tests were used. Multivariate analyses were performed using analysis-of-(co-)variance (ANCOVA) models for the SAQ, FSFI, EORTC items (scores) as dependent variables. The comparison of BC patients, OC patients and controls were adjusted for age (years) at returning the questionnaire. Additionally, SA was considered as a covariate in the analysis of QoL items.

The impact of therapy-related issues (surgery, chemotherapy, antihormonal therapy) on SAQ, FSFI, QoL items was investigated separately in diagnostic groups with ANCOVA models. Besides age and SA (for QoL items) the interval between diagnosis and returning the questionnaire was incorporated as a covariate. Group differences are presented in terms of parameter estimates from ANCOVA models with accompanying two-sided 95% confidence intervals. Further, p-values testing the relevance of a factor on the dependent variables are reported from ANCOVA models (F test).

Results

Participation

361 BC patients returned the questionnaire or the non-participation form. 183 (50.0%) participated in the study. 178 (49.3%) patients who responded did not want to take part in the study and sent back the non-participation form. 93 ovarian cancer patients returned the questionnaire or the non-participation form. 62 patients (66.0%) returned valid questionnaires; 31 (33.0%) OC patients who responded did

Table 1 Inclusion and exclusion criteria for the cancer and the control group

Inclusion criteria cancer group	Exclusion criteria cancer group
Female 18–70 years of age Treatment (surgery and or/chemotherapy and/or radiation) for Cancer of the breast or ovary Treatment period between 2001 and 2008 at the recruiting university hospitals Initial diagnose more than 24 month back	Male Pre-existing depression Untreated thyroid dysfunction Local recurrence Distant metastasis Secondary malignancy
Inclusion criteria control group	**Exclusion criteria control group**
Healthy female 18–70 years of age	History of cancer or depression Surgery during the preceding 4 weeks

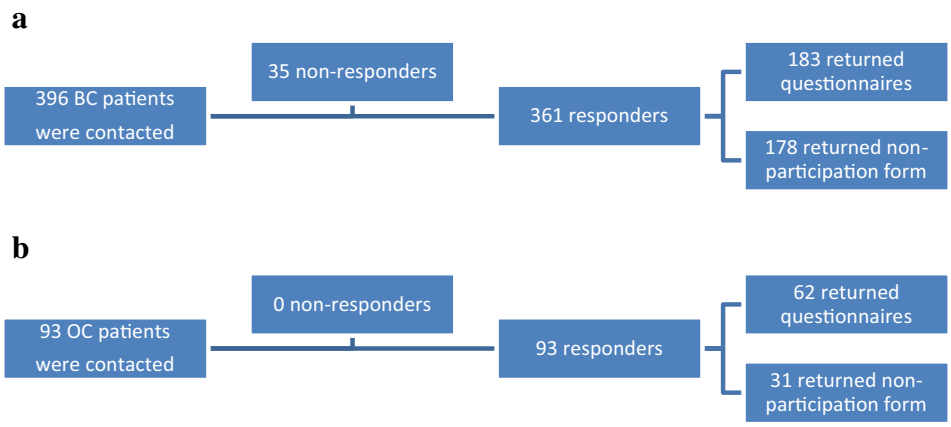

Fig. 1 **a** Response rate of BC patients. **b** Response rate of OC patients

not want to take part in the study and sent back the non-participation form. The response rates are displayed in Fig. 1. Main reasons for non-participation in both cancer groups were "questions are too intimate" (43.1%) and "other reasons" (53.3%) (e.g., "no partner", "relationship conflicts" or "sexual problem of the partner"). Further reasons for non-participation were "do not want to be reminded of the disease" (13.3%) and "not interested in the study" (12.2%).

Demographic, clinical and treatment data

Women in the CG were younger than BC and OC patients (median age CG: 46 years, BC: 56 years, OC: 53 years; $p < 0.001$). Comparing only women with SA, age was approximating between the groups but still showed a significant difference (CG: 45 years; BC: 51 years; OC: 47 years, $p < 0.001$). Women in the CG were more often premenopausal than cancer patients (CG: 80.7%, BC: 11.6%, OC: 12.1%, $p < 0.001$). Considering only women with SA the percentage of premenopausal women was still higher in the CG than in BC and OC patients (CG: 88.9%, BC: 19.2%, OC 17.7%, $p < 0.001$). In the CG 88.3% of the women lived in a relationship compared to 79.2% in BC and 80.6% in OC patients. In sexually active women this percentage was even higher (CG: 97.9%, BC: 94.05%, OC: 91.4%).Median time since diagnosis was 40.0 months in BC patients and 53.0 months in OC patients.

For demographic and clinical details as well as treatment data see Tables 2 and 3.

Sexual activity and function

SA was higher in healthy women than in cancer patients ($p < 0.001$). In the CG 76.7% of the women were sexually active, whereas 45.9% of BC patients and 56.5% of OC patients reported SA (Table 2). In the CG the main reason for sexual inactivity was the lack of a partner (41.7%). Main reasons for BC patients not being sexually active were "I am not interested in sex" (42.4%), "I have a physical problem which makes sexual relations difficult or uncomfortable" (34.3%), "I do not have a partner at the moment" (30.3%) and "other reasons" (33.3%). In OC patients main reasons for sexual inactivity were "no interest in sex" (58.3%), "I do not have a partner at the moment" (40.7%), "other reasons" (25.9%) and "My partner has a physical problem which makes sexual relations difficult or uncomfortable" (22.2%). Only 5 of 27 OC patients without SA (18.5%) stated that they had "a physical problem which makes sexual relations difficult or uncomfortable" (Table 4).

Breast cancer patients ($n = 183$)

Univariate analysis showed a lower frequency of SA ("habit": $p = 0.014$), less satisfaction ("pleasure": $p = 0.009$) and more discomfort during SA ("discomfort": $p = < 0.001$) in BC patients compared to healthy controls. No difference was seen between both groups regarding the item "orgasm" ($p = 0.266$). BC patients estimated their health status and their QoL as good as healthy controls ("health status": $p = 0.632$; "QoL": $p = 0.407$), which was also shown by the global health status ($p = 0.551$) (Table 5). The type and radicality of operation regarding breast (breast-preserving surgery vs. mastectomy) and axilla (sentinel-node biopsy vs. axillary dissection) did not influence SF and QoL of BC patients. Comparing patients with or without breast reconstruction after mastectomy there were no differences seen regarding SF and QoL either. Chemotherapy did not influence SF and QoL in BC patients. Patients who had received chemotherapy showed no significant differences in SF compared to patients without chemotherapy. However, patients who received antihormonal therapy at the time of the study showed a lower frequency of SA ("habit": $p = 0.007$), less satisfaction ("pleasure": $p = 0.003$) and more discomfort during SA ("discomfort": $p = < 0.001$) compared to healthy controls, but no differences in experiencing orgasms ("orgasm" $p = 0.168$), health status ($p = 0.268$), QoL ($p = 0.223$) and

Table 2 Demographic and clinical data BC patients, OC patients and CG

	Breast cancer (BC) All: $n=183$ SA: $n=84$		Ovarian cancer (OC) All: $n=62$ SA: $n=35$		Control group (CG) All: $n=60$ SA: $n=48$	
Age (years)	Median	Range	Median	Range	Median	Range
All	56	29–70	53.0	26–69	46	21–64
SA	51	29–70	47.0	26–65	45	21–64
BMI (kg/m^2)	Median	Range	Median	Range	Median	Range
All	25.98	17.80–47.90	23.95	17.80–40.70	22.50	17.40–36.20
SA	24.30	17.80–42.70	24.0	17.90–40.70	22.40	17.40–36.20
Menopausal status	*n*	%	*n*	%	*n*	%
Pre						
All	20	11.0	7	11.3	46	80.7
SA	15	19.2	6	17.7	40	88.9
Post						
All	153	83.6	51	82.3	11	19.3
SA	63	80.8	28	82.3	5	11.1
Unknown						
All	10	5.4	4	6.4	3	0.5
SA	6	7.1	1	2.8	3	0.6
Relationship	*n*	%	*n*	%	*n*	%
Living alone						
All	38	20.8	12	19.4	7	11.7
SA	5	6.0	3	8.6	1	2.1
Married						
All	126	68.9	39	62.9	39	65.0
SA	64	76.2	23	65.7	34	70.8
Solid partner ship						
All	19	10.4	11	17.7	14	23.3
SA	15	17.9	9	25.7	13	27.1

SA sexually active patients

global health status ($p=0.217$). In contrast, BC patients without antihormonal therapy showed only a higher discomfort score ($p=0.028$) than healthy controls. Other differences concerning SF, health status and QoL were not observed. Patients without antihormonal therapy estimated their health status and QoL better than patients who received antihormonal therapy. This was illustrated by a better health status ($p=0.006$) and global health status ($p=0.011$) as well as a trend towards a better QoL ($p=0.107$) in this group. In general, SA was associated with a better health status ($p=0.007$), a better QoL ($p=0.004$) and a better global health status ($p=0.004$) in BC patients. A multivariate analysis with adjustment for age supported the findings of the univariate analysis. Less pleasure ($p=0.038$), more discomfort ($p=0.004$) and a trend towards lower frequency of SA ($p=0.063$) were observed in BC patients compared to healthy controls. Except for a lower frequency of SA and a trend towards lower pleasure in patients with axillary dissection, multivariate analysis with adjustment for age and time since diagnosis showed no influence of the type and radicality of operation, chemotherapy and antihormonal therapy on SF in BC patients. Antihormonal therapy was associated with lower health status ($p=0.016$), a trend for a lower QoL ($p=0.061$) and a lower global health status ($p=0.013$) in BC patients in this analysis (Table 6).

Ovarian cancer patients ($n=62$)

Univariate and multivariate analysis revealed no differences in SF (habit, pleasure, discomfort and orgasm), health status, QoL and global health status for OC patients compared to BC patients and healthy controls. Administration of chemotherapy did not alter these findings. There were no differences seen for SF, general health, QoL and global health status—neither comparing OC patients with chemotherapy to patients without chemotherapy nor comparing patients with chemotherapy to healthy controls. SA did not influence health status and QoL in OC patients.

Table 3 Treatment details of BC ($n=183$) and OC ($n=62$) patients

Breast cancer	*n*	(%)
Tumor stage		
Tis	8	4.30
T1a	8	17.74
T1b	33	44.09
T1c	82	2.15
T1mic	4	23.12
T2	43	2.69
T3	5	1.61
T4	3	4.30
Surgery breast ($n=182$)		
Breast conserving surgery	129	70.9
Mastectomy	53	29.1
Surgery axilla ($n=182$)		
Sentinel-node biopsy	121	66.5
Axillary dissection	61	33.5
Chemotherapy ($n=182$)		
Chemotherapy	138	75.8
No chemotherapy	44	24.2
Antihormonal therapy ($n=183$)		
Antihormonal therapy	149	81.4
No antihormonal therapy	34	18.6
Ovarian cancer	***n***	**(%)**
FIGO stage		
IA	15	24.19
IB	1	1.61
IC	9	14.52
IIA	3	4.84
IIB	2	1.61
IIIA	2	3.23
IIIB	2	3.23
IIIC	23	37.10
IV	1	1.61
Unkown	4	6.45
Chemotherapy ($n=62$)		
Chemotherapy	42	67.7
No chemotherapy	18	29.0
Unkown	2	3.3

Discussion

In the present study BC patients showed less satisfaction and more discomfort and a trend towards a lower frequency of SA compared to healthy controls. These results support the findings of previously published studies [5, 9, 21]. The ability to reach and experience an orgasm was not impaired in these patients. BC patients showed no difference in QoL and general health status compared to healthy controls. The impact of anticancer treatment on SA and SF and Quality of life in BC patients has been discussed controversially in literature. While some authors described changes in SF in BC patients dependent of the type of surgery (mastectomy with or without reconstruction, autologous versus implant) or chemotherapy others found no impairment of SF in patients with regard to these treatment modalities [13, 14, 22–24]. Type and radicality of surgery did not influence SF and well-being of BC patients in this study. Significant differences between patients with breast-preserving surgery and patients with

Table 4 Reasons for sexual inactivity (FSAQ)

	Control group ($n=12$) (%)	Breast cancer ($n=99$) (%)	Ovarian cancer ($n=27$) (%)
"I do not have a partner at the moment"	41.7	30.3	40.7
"I am too tired"	0.0	17.2	14.8
"My partner is too tired"	8.3	2.0	7.4
"I am not interest in sex"	16.7	42.4	58.3
"My partner is not interest in sex"	16.7	14.1	14.8
"I have a physical problem which makes sexual relations difficult or uncomfortable"	8.3	34.3	18.5
"My partner has a physical problem which makes sexual relations difficult or uncomfortable"	16.7	18.2	22.2
"Other reasons"	16.7	33.3	25.9

Patients had the option for multiple answers. Therefore percentage values can sum up to more than 100%

Table 5 Sexual function (SF), quality of life (QoL)and health status in breast cancer (BC) patients (n_1) and healthy controls (CG) (n_2) (univariate analysis)

Item (range)	$n_1 = n_2 =$	Mean	Std-dev	95%-confidence-interval	Median	p value
Habit (0–3)	80	0.63	0.603	0.49–0.76	100	**0.014**
	48	0.90	0.627	0.71–1.08	100	
Pleasure (0–18)	80	9.74	4.176	8.81–10.67	900	**0.009**
	46	11.67	3.584	10.61–12.74	1150	
Discomfort (0–6)	82	3.57	1.982	3.14–4.01	400	**< 0.001**
	48	4.85	1.688	4.36–5.34	600	
Orgasm (0–6)	82	4.59	1.26	4.31–4.86	480	0.266
	48	4.80	1.28	4.43–5.17	520	
Health status (1–7)	130	5.05	1.209	4.84–5.26	500	0.632
	51	5.16	1.332	4.78–5.53	500	
Quality of life (1–7)	127	5.03	1.215	4.82–5.24	500	0.407
	50	5.20	1.178	4.86–5.53	500	
Global health status	132	67.74	18.997	64.47–71.01	6667	0.551
	51	69.77	18.850	64.47–75.07	6667	

mastectomy (with or without breast reconstruction) were not observed, confirming the results of Cortés-Flores [14]. Chemotherapy had no impact on SF in BC patients as well. Interestingly, patients with chemotherapy also showed no differences in QoL and global health status compared to BC patients without chemotherapy and healthy controls. Panjari et al. [24] reported similar results in their study. In contrast other authors just recently described a negative influence of chemotherapy on SF in BC patients [3, 25]. Special attention has been drawn to the influence of antihormonal therapy on SF in BC patients. Some authors reported no changes in SA and SF linked to antihormonal therapy with tamoxifen, whereas other studies described increased sexual dysfunctions like dyspareunia, discomfort and hot flashes [5, 26, 27]. Sexual interest, arousal and orgasm were not impaired by tamoxifen therapy [26]. Aromatase inhibitors seemed to be more often connected with sexual dysfunction, vaginal dryness, pruritus, dyspareunia and decreased sexual desire (libido) [28, 29].

Our findings support the hypothesis that antihormonal therapy seems to be an important factor influencing SF and QoL in BC patients. If this effect will also be seen in larger studies, patients should be especially informed about this side-effect of antihormonal therapy and possible treatment strategies.

The relevance of SA for QoL in BC patients was emphasized by the finding that sexually active BC patients reported a significant better health status and QoL in our study.

In the present study BC patients showed a lower SA rate (45.9%) than healthy controls (76.7%). While in healthy controls mainly the lack of a partner (41.7%) was the source for sexual inactivity, BC patients reported decreased or no interest in sex (42.4%) and physical problems (34.3%) as main reasons for sexual inactivity. These findings are consistent with previously published studies [25]. The higher rate of BC patients without sexual interest compared to healthy controls might, besides social factors like higher age and a higher rate of patients living without a partner (20.8% vs.

Table 6 Multivariate analysis (a) (adjusted for age) of sexual function (SF) in breast cancer (BC) and ovarian cancer (OC) patients and healthy controls (CG), (b) (adjusted for age and time since diagnosis) of SF in BC and OC patients

(a)	Parameter estimates	95% CI	*p* value	*F* test *p* value
Habit				
BC vs. CG	−0.24	−0.49 to 0.01	**0.063**	0.110
OC vs. CG	−0.02	−0.31 to 0.26	0.876	
BC vs. OC	−0.21	−0.48 to 0.05	0.108	
Pleasure				
BC vs. CG	−1.71	−3.33 to −0.10	**0.038**	0.114
OC vs. CG	−1.15	−3.00 to 0.70	0.220	
BC vs. OC	−0.56	−2.24 to 1.11	0.507	
Discomfort				
BC vs. CG	−1.08	−1.80 to −0.35	**0.004**	**0.015**
OC vs. CG	−0.60	−1.44 to 0.24	0.157	
BC vs. OC	−0.47	−1.24 to 0.29	0.225	
Orgasm				
BC vs. CG	−0.35	−0.86 to 0.15	0.167	0.335
OC vs. CG	−0.09	−0.66 to 0.49	0.769	
BC vs. OC	−0.27	−0.80 to 0.26	0.314	
Health status				
BC vs. CG	0.06	−0.38 to 0.50	0.773	0.228
OC vs. CG	0.42	−0.10 to 0.94	0.117	
BC vs. OC	−0.35	−0.81 to 0.11	0.133	
QoL				
BC vs. CG	−0.07	−0.51 to 0.37	0.755	0.774
OC vs. CG	0.10	−0.42 to 0.61	0.714	
BC vs. OC	−0.17	−0.63 to 0.29	0.477	
Global health status				
BC vs. CG	0.02	−6.70 to 6.75	0.994	0.423
OC vs. CG	4.42	−3.54 to 12.38	0.275	
BC vs. OC	−4.40	−11.39 to 2.60	0.217	

(b)	Parameter estimates	95% CI	*F* test *p* value
Breast cancer (BC)			
Habit			
Operation (breast)			0.991
Operation (axilla)	−0.35	−0.65 to −0.05	**0.024**
Chemotherapy	−0.15	−0.27 to 0.56	0.486
Antihormonal therapy	−0.17	−0.51 to 0.18	0.337
Pleasure			
Operation (breast)			0.972
Operation (axilla)	−1.97	−4.11 to 0.18	**0.071**
Chemotherapy	1.26	−1.66 to 4.18	0.393
Antihormonal therapy	−1.61	−4.14 to 0.92	0.208
Discomfort			
Operation (breast)			0.755
Operation (axilla)	-0.46	−1.48 to 0.55	0.365
Chemotherapy	-0.20	−1.59 to 1.19	0.772
Antihormonal therapy	0.26	−0.88 to 1.40	0.653
Orgasm			
Operation (breast)			0.353
Operation (axilla)	−0.35	−0.98 to 0.28	0.268

Table 6 (continued)

(b)	Parameter estimates	95% CI	*F* test *p* value
Chemotherapy	−0.20	−1.06 to 0.67	0.655
Antihormonal therapy	−0.21	−0.96 to 0.54	0.580
Health status			
Operation (breast)			0.892
Operation (axilla)	0.15	−0.30 to 0.60	0.515
Chemotherapy	0.29	−0.26 to 0.83	0.298
Antihormonal therapy	−0.63	−1.13 to −0.12	**0.016**
QoL			
Operation (breast)			0.289
Operation (axilla)	−0.17	−0.63 to 0.29	0.470
Chemotherapy	−0.08	−0.64 to 0.49	0.792
Antihormonal therapy	−0.52	−1.06 to 0.03	**0.061**
Global Health status			
Operation (breast)			0.454
Operation (axilla)	−0.09	−7.01 to 6.82	0.979
Chemotherapy	2.95	−5.46 to 11.37	0.489
Antihormonal therapy	−10.11	−18.03 to −2.18	**0.013**
Ovarian cancer (OC)			
Habit			
Chemotherapy	−0.28	−0.75 to 0.181	0.222
Pleasure			
Chemotherapy	−2.24	−5.76 to 1.27	0.202
Discomfort			
Chemotherapy	−0.12	−1.55 to 1–32	0.871
Orgasm			
Chemotherapy	−0.44	−1.53 to 0.66	0.419
Health status			
Chemotherapy	0.12	−0.81 to 1.04	0.799
QoL			
Chemotherapy	−0.14	−1.16 to 0.88	0.775
Global health status			
Chemotherapy	0.15	−14.61 to 14.90	0.984

11.7%), be due to a lack of hormones (androgens, estrogen, progesterone) caused by decreased or missing ovarian function (chemotherapy, postmenopausal status, oophorectomy) and/or the administration of antihormonal therapy. Main reasons for sexual inactivity of OC patients were, as in BC patients, decreased sexual desire and the lack of a partner. In contrast to the BC patients of our study and to the report of Carmack-Taylor et al. [30] physical problems only played a minor role as reason for sexual inactivity in OC patients (18.5% vs. 34.3%).

SA in OC patients (56.5%) was lower than in healthy controls (76.7%), but still higher than in BC patients (45.9%). The observed SA rate in the present study was slightly higher than reported before (56.5% vs 50.0%) [30].

Sexual problems including vaginal dryness, discomfort during intercourse, problems with orgasm and decreased desire have been associated with therapy (including pelvic surgery) for OC and other gynecologic malignancies [12]. In our study population no significant differences in SF were observed for OC patients compared to healthy controls as well as to BC patients. Interestingly, OC patients even did not show differences in QoL and health status compared to healthy controls. Administration of chemotherapy did not change these findings. In contrast to BC patients SA was not linked to QoL and health status. Neither problems in SF nor decreased QoL and health status were seen in OC patients, who had survived their disease for at least 2 years. These observations are corresponding to the findings of Zhou et al. [31] in 2016 who reported good health and QoL in OC survivors. As reasons for the surprisingly good physical and psychical health of OC survivors a change of perspective on life difficulties and altered priorities as well as gratefulness

after surviving a life threatening illness must be discussed. These conclusions, as well as the finding that overall QoL is highly more correlated with psychological well-being than with physical, social or spiritual well-being may also be suitable to explain the observation in BC patients that problems in SF were not associated with decreased health status and QoL [32].

Women who have survived a life threatening disease like OC or BC are not only grateful for belonging to the survivor group ("the lucky ones") but also alter their life perspective and change their priorities resulting in giving physical restrictions (e.g., SF, scars) less importance for overall well-being.

The high refusal rate to answer the questionnaires could be a potential source of bias leading to underestimation of the reported issues due to possible positive selection of the responders. Other sources of bias could be the lack of an age-matched CG and different periods of time between diagnosis and this one-time study evaluation.

Communication about SF and especially sexual problems seems to be still difficult for patients even in an anonymous setting. In our study this was shown by the high percentage (462 of 803 = 57.6%) of either non-responding or non-participating patients. This observation was illustrated by the reasons for non-participation which patients stated in the non-participation form. Besides "other reasons" the most frequently given reason for non-participation was "questions are too intimate" (43.1%). Compared to healthy controls BC patients showed limitations in SF with a lower SA rate and more discomfort, but no differences in experiencing orgasm. Antihormonal therapy was an important factor influencing SF and well-being during the first years after therapy. In general, SA was associated with a better health status, a better QoL and a better global health status. Sexually active OC patients reported no significant differences in SF compared to healthy controls.

Conclusions and clinical relevance

This study showed that communication about SF and especially sexual problems seems to be still difficult for patients even in an anonymous setting. In clinical routine this should be considered in patient consultations after cancer. BC patients showed limitations in SF with a lower SA rate and more discomfort compared to healthy controls. Since antihormonal therapy was an important factor influencing SF and well-being in the present study, this should be taken into account counseling BC patients with impaired SF or well-being.

Interestingly, BC and OC survivors reported good physical and psychical health without differences in QoL and health status compared to controls. This might be explained by a change of perspective on life difficulties and altered priorities after surviving a life threatening disease.

Author contributions SM protocol/project development, data collection, data analysis, manuscript writing/editing. SI data collection, data analysis. DG data collection, manuscript editing. LS data collection. SM Protocol/project development, data collection. MB data collection, manuscript writing/editing. LW Protocol/project development, data collection, manuscript editing. PJV data collection. GG data collection. AH Protocol/project development, data collection, manuscript writing/editing

Compliance with ethical standards

Conflict of interest The authors declare no potential conlicts of interest.

References

1. Chopra I, Kamal KM (2012) A systematic review of quality of life instruments in long-term breast cancer survivors. Health Qual Life Outcomes 10:14
2. Hasenburg A, Schröck R, Schmalfeldt B, Ortmann A (2008) Nachsorge und rehabilitation nach therapie eines ovarialkarzinoms. Onkologe 14:1172–1178
3. Thors CL, Broeckel JA, Jacobsen PB (2001) Sexual functioning in breast cancer survivors. Cancer Control 8(5):442–448
4. Audette C, Waterman J (2010) The sexual health of women after gynecologic malignancy. J Midwifery Womens Health 55(4):357–362
5. Ganz PA, Rowland JH, Desmond K, Meyerowitz BE, Wyatt GE (1998) Life after breast cancer: understanding women's health-related quality of life and sexual functioning. J Clin Oncol 16(2):501–514
6. Ganz PA, Greendale GA, Petersen L, Kahn B, Bower JE (2003) Breast cancer in younger women: reproductive and late health effects of treatment. J Clin Oncol 21(22):4184–4193
7. Al-Ghazal SK, Fallowfield L, Blamey RW (2000) Comparison of psychological aspects and patient satisfaction following breast conserving surgery, simple mastectomy and breast reconstruction. Eur J Cancer 36(15):1938–1943
8. Ohsumi S, Shimozuma K, Kuroi K, Ono M, Imai H (2007) Quality of life of breast cancer patients and types of surgery for breast cancer—current status and unresolved issues. Breast Cancer 14(1):66–73
9. Fobair P, Stewart SL, Chang S, D'Onofrio C, Banks PJ, Bloom JR (2006) Body image and sexual problems in young women with breast cancer. Psychooncology 15(7):579–594
10. Cavalheiro JA, da Bittelbrunn A, Menke CH, Biazús JV, Xavier NL, Cericatto R (2012) Sexual function and chemotherapy in postmenopausal women with breast cancer. BMC Womens Health 12:28
11. Schover LR, Yetman RJ, Tuason LJ, Meisler E, Esselstyn CB, Hermann RE (1995) Partial mastectomy and breast reconstruction. A comparison of their effects on psychosocial adjustment, body image, and sexuality. Cancer 75(1):54–64
12. Aerts L, Christiaens MR, Enzlin P, Neven P, Amant F (2014) Sexual functioning in women after mastectomy versus breast conserving therapy for early-stage breast cancer: a prospective controlled study. Breast 23(5):629–636
13. Pusic AL, Matros E, Fine N, Buchel E, Gordillo GM, Hamill JB (2017) Patient-reported outcomes 1 year after immediate breast

reconstruction: results of the mastectomy reconstruction outcomes consortium study. J Clin Oncol 35(22):2499–2506
14. Cortés-Flores AO, Vargas-Meza A, Morgan-Villela G, Jiménez-Tornero J, del Valle CJZ-F, Solano-Genesta M (2017) Sexuality among women treated for breast cancer: a survey of three surgical procedures. Aesthetic Plast Surg 41(6):1275–1279
15. Kim SI, Lee Y, Lim MC, Joo J, Park K, Lee DO (2015) Quality of life and sexuality comparison between sexually active ovarian cancer survivors and healthy women. J Gynecol Oncol 26(2):148–154
16. Li C-C, Rew L, Chen L (2014) Factors affecting sexual function: a comparison between women with gynecological or rectal cancer and healthy controls. Nurs Health Sci 17(1):105–111
17. Stabile C, Goldfarb S, Baser RE, Goldfrank DJ, Abu-Rustum NR, Barakat RR (2017) Sexual health needs and educational intervention preferences for women with cancer. Breast Cancer Res Treat 165(1):77–84
18. Thirlaway K, Fallowfield L, Cuzick J (1995) The sexual activity questionnaire: a measure of women's sexual functioning. Qual Life Res 5(1):81–90
19. Rosen R, Brown C, Heiman J, Leiblum S, Meston C, Shabsigh R (2000) The female sexual function index (FSFI): a multidimensional self-report instrument for the assessment of female sexual function. J Sex Marital Ther 26(2):191–208
20. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ (1993) The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. J Natl Cancer Inst 85(5):365–376
21. Oberguggenberger A, Martini C, Huber N, Fallowfield L, Hubalek M, Daniaux M (2017) Self-reported sexual health: breast cancer survivors compared to women from the general population—an observational study. BMC Cancer 17(1):599
22. Candy B, Jones L, Vickerstaff V, Tookman A, King M (2016) Interventions for sexual dysfunction following treatments for cancer in women. In: The Cochrane Library [Internet]. John Wiley & Sons, Ltd. Verfügbar unter. http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD005540.pub3/full. zitiert 20. März 2018
23. Broeckel JA, Thors CL, Jacobsen PB, Small M, Cox CE (2002) Sexual functioning in long-term breast cancer survivors treated with adjuvant chemotherapy. Breast Cancer Res Treat 75(3):241–248
24. Panjari M, Bell RJ, Davis SR (2011) Sexual function after breast cancer. J Sex Med 8(1):294–302
25. Avis NE, Johnson A, Canzona MR, Levine BJ (2018) Sexual functioning among early post-treatment breast cancer survivors. Support Care Cancer 26(8):2605–2613
26. Mortimer JE, Boucher L, Baty J, Knapp DL, Ryan E, Rowland JH (1999) Effect of tamoxifen on sexual functioning in patients with breast cancer. J Clin Oncol 17(5):1488
27. Day R, Ganz PA, Costantino JP, Cronin WM, Wickerham DL, Fisher B (2016) Health-related quality of life and tamoxifen in breast cancer prevention: a report from the National Surgical Adjuvant Breast and Bowel Project P-1 study. J Clin Oncol [Internet]. Verfügbar unter. http://ascopubs.org/doi/abs/10.1200/JCO.1999.17.9.2659?url_ver=Z39.88-2003&rfr_id=ori:rid:crossref.org&rfr_dat=cr_pub%3dpubmed. zitiert 29 März 2018
28. Bradford A (2013) Sexual outcomes of aromatase inhibitor therapy in women with breast cancer: time for intervention. Menopause 20(2):128–129
29. Baumgart J, Nilsson K, Evers AS, Kallak TK, Poromaa IS (2013) Sexual dysfunction in women on adjuvant endocrine therapy after breast cancer. Menopause 20(2):162–168
30. Taylor CLC, Basen-Engquist K, Shinn EH, Bodurka DC (2004) Predictors of sexual functioning in ovarian cancer patients. J Clin 22(5):881–889
31. Zhou Y, Irwin ML, Ferrucci LM, McCorkle R, Ercolano EA, Li F (2016) Health-related quality of life in ovarian cancer survivors: Results from the American Cancer Society's Study of Cancer Survivors—I. Gynecol Oncol 141(3):543–549
32. Ersek M, Ferrell BR, Dow KH, Melancon CH (1997) Quality of life in women with ovarian cancer. West J Nurs Res 19(3):334–350