

Areas to Improve Quality of Life After Ovarian Tumor Surgery and Adjuvant Treatment

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Abstract. *Background/Aim:* To evaluate quality of life (QoL) in women treated for ovarian tumors one year after laparotomy. *Patients and Methods:* The validated quality of life questionnaires (EORTC QLQ-C30 and QLQ-OV28) were sent to women who had undergone laparotomy due to ovarian tumors 12 months after surgery. The answers were analyzed and grouped according to the ovarian tumor histology (benign, borderline and cancer). *Results:* A total of 621 patients (87.5% out of 710) agreed to participate in the study. Ovarian cancer patients experienced statistically worse QoL one year after laparotomy in several analyzed parameters, including financial difficulties, compared to patients treated for benign and borderline tumors. *Conclusion:* Women with ovarian cancer still need further cancer rehabilitation and support one year after diagnosis to improve their QoL. The novel finding was that ovarian cancer patients suffered from financial difficulties even in a free of charge health care system.

Ovarian cancer is the sixth most common cancer in women and the seventh cause of death from cancer worldwide. Ovarian cancer is the leading cause of death from all gynecological cancers in developed countries and just a third of patients presented with early stage disease, defined as disease localized inside the pelvis (FIGO stages I and II). The estimated number of new ovarian cancer cases in Europe in 2012 was 65,538 with 42,704 deaths (1). In Sweden, where this study was performed, approximately 700 new ovarian cancers and borderline tumors occur every year (2, 3). For all women with ovarian cancer, the five-year

survival rate is around 50% (4). Patients with early stage disease have a significantly higher five-year survival rate (2). Today the more advanced methods of treatment and improved postoperative rehabilitation have increased the number of cancer survivors living with the disease. Women who have had surgery and a cancer diagnosis also face many challenges, such as fatigue, depression, changed sexual function, as well as loss of fertility, and changed self-image. In the last few years, a growing interest has developed in post-treatment rehabilitation. Women may present with adnexal tubo-/ovarian lesions before surgery. Hence, patients with tubo-/ovarian lesions with a suspicion of ovarian malignancy have a laparotomy performed a perioperative frozen pathological section is examined meanwhile surgery is ongoing, which gives the diagnosis of benign, borderline or ovarian cancer tumor. The surgery thereafter continues and may include a total hysterectomy, bilateral or unilateral salpingo-oophorectomy, omental biopsy, peritoneal biopsies and lymphadenectomy according to clinical situation. The subsequent postoperative pathological microscopic examination will give a definitive diagnosis and all women with ovarian cancer stage II-IV are then offered adjuvant chemotherapy according to national guidelines (2). Women with ovarian cancer stage I, borderline or benign disease do not receive any adjuvant chemotherapy and are only subject to clinical follow-up according to national guidelines (2).

In order to evaluate quality of life (QoL), or as it is also called, patient-reported outcome measurement (PROM), in ovarian cancer patients the European Organization for Research and Treatment of cancer (EORTC) QLQ-C30 and QLQ-OV28 questionnaires are recommended to be used (5). These questionnaires (QLQs) are used for assessing the health-related QoL of cancer patients participating in clinical trials. The core questionnaire QLQ-C30 is the result of more than a decade of collaborative research and it has been used in a wide range of clinical cancer trials and non-trial studies (6, 7). The questionnaires are both validated and standardized measures for the assessment of overall health-related QoL for cancer patients (QLQ-C30) and specifically for ovarian cancer patients (QLQ-OV28) (3, 6, 8, 9).

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Key Words: Ovarian cancer, quality of life (QoL), patient-reported outcome measurement (PROM), assessment, symptom.

QoL is often measured during randomized trials but there are no publications comparing QoL/PROM in women who have had a laparotomy due to benign or borderline ovarian tumors with laparotomy due to ovarian cancer (10). All women in this study were subjected to a laparotomy with subsequent postoperative recuperation and rehabilitation, but how does this differ depending on the subsequent diagnosis? Does the diagnosis *i.e.* ovarian cancer, borderline or benign disease impact QoL 12 months postoperatively or is it the laparotomy itself? The aim of this study was to evaluate QoL one year after diagnosis in women treated for ovarian cancer with laparotomy and compare the QoL scores of patients who had undergone laparotomy for benign or borderline tumors.

Patients and Methods

Study layout. The Swedish National Registry for Gynecological Surgery (GynOp) collects preoperative, intraoperative, and postoperative information on women undergoing gynecological surgery. Women are included in the registry before surgery by the surgical planner (generally a nurse) whenever a gynecological operation is planned.

Once consented to participate, data are collected preoperatively and during follow-up using questionnaires. At baseline, a preoperative questionnaire is sent to all women for collection of demographic data to be completed either on-line or on paper. The operating physician will postoperatively fill an online form answering questions regarding the surgery. Both participants and physicians will complete further follow-up questionnaires at certain intervals. The responses to all questionnaires from both patients and physicians are automatically transferred to the registry as well as data from *Befolkningsregistret (National Swedish Population registry)* (11). All participating women can opt out at any time without any effect on their treatment. All surgeons are also requested to fill in forms at admission, at dismissal and at the time of pathological diagnosis. When filling in the forms postoperatively, the surgeons need to answer whether or not a major complication has occurred. The definitions of major complications are: injury to the bowel, urinary tract, nerves, or vessels that caused reoperation or hospitalization for more than seven days or persistent physical handicap or death; bleeding of more than 3000 ml or bleeding that led to reoperation; infection that led to readmission; deep vein thrombosis or pulmonary embolism; and any other major complication, such as aspiration, allergic shock, myocardial infarct, or cerebral complication.

Subjects. Patients planned for laparotomy at nine hospitals in Sweden scheduled for ovarian tumor surgery between 4 January 2016 and 1 February 2018 and who were included in the GynOp registry were invited to participate in this study 12 months after surgery. Of a total of 710 patients, 621 (87.5%) agreed to participate and filled out the questionnaire. In the ovarian cancer group the participation rate was 93.5% (345/369). The participants were divided into groups according to histological type of ovarian tumor: benign 166 (26.7%), borderline 110 (17.7%) and ovarian cancer 345 (55.6%). The questionnaires EORTC QLQ-C30 (version 3.0) and the EORTC QLQ-OV28 were sent electronically or in paper form. One electronic reminder was sent followed by a paper reminder

within two months from the first electronic invitation. All participants were older than 18 years of age and signed the informed consent agreement electronically or on paper.

QLQ-C30 measures. The validated QLQ-C30 questionnaire is composed of both multi-item scales and single-item measures. These include five functional scales covering the areas of physical, role, emotional, cognitive and social functioning; three symptom scales including symptoms of fatigue, nausea/vomiting and pain; a global health status/QoL scale, and six single items regarding dyspnea, sleep disturbances, appetite loss, constipation, diarrhea and financial impact (3, 8). Each of the multi-item scales includes a different set of items, between one and five items, and no item occurs in more than one scale. Single item scales has one question and functional scales have at least two. Collected answers were then further divided into combined item scales and each answer was assigned to the appropriate item (12). The estimated average of the items that contribute to each item scale is the raw score. Raw scores are then linearly transformed into a 0-100 scale according to the EORTC scoring manual (13). A lower scale score represents a lower response level (13). In functional scales, higher scores indicate better functioning, while higher scores in symptom scales indicate worse symptoms.

QLQ-OV28 measures. The same scoring method was used for the validated QLQ-OV28 questionnaire as in the QLQ-C30 (1, 13, 14). The average of the items that contribute to each scale is the raw score. Raw scores are linearly transformed to a 0-100 scale in which the higher scores indicated worse symptoms (9). The QLQ-OV28 consists of 28 items assessing peripheral neuropathy, chemotherapy side effects, hormonal, gastro-intestinal and body image symptoms, sexuality and symptoms attitude to disease (9). The sexuality was similar to the functional scale in that a higher score indicated better functioning. When analyzing the data, we analyzed the question about vaginal dryness separately. In the original QLQ-OV 28 questionnaire, the scale had a higher score with worse vaginal dryness, when included in the sexual activity and comfort scale. We removed this question about vaginal dryness from our calculations about sexuality since it is more likely to be influenced by age and menopause than by having had a laparotomy.

Ethical consideration. Ethical approval was obtained from the Regional Ethical Review Board of Umeå (DNR2015-236-31). Informed consent was obtained from all individual participants included in the study.

Statistical analyses. The Student's *t*-test and ANOVA with Bonferroni's post hoc test were used in analyzing the normally distributed variables. Categorical variables were reported by the number of observations and the frequency of each modality and were then compared with the Pearson's chi-square or Fisher's exact test. All comparisons were two-sided, and a 5% significance level was used. Statistical analyses were performed using SPSS TM 26.0 2019 (IBM Corp, Armonk, NY, USA).

Results

All included 621 women have had a laparotomy performed. All patients diagnosed with ovarian cancer stages II-IV received adjuvant chemotherapy. At the time of the study, the standard

Table I. Patients' characteristics according to tumor histology.

	Benign n=166			Borderline n=110			Ovarian cancer n=345		
	Mean	SD	p-Value*	Mean	SD	p-Value**	Mean	SD	p-Value***
Age (year)	51	15.1	<0.001	60	12.6	0.010	64	11.5	<0.001
Body mass index (BMI)	27.24	5.2	n.s.	27.23	5.8	0.107	25.97	4.9	0.045
Operating time (min)	91.89	41.4	n.s.	124.89	48.3	<0.001	211.64	113.1	<0.001
Perioperative bleeding (ml)	165.83	281.5	0.008	184.59	183.4	<0.001	458.94	572.3	<0.001
Days to normal ADL (days)	8.32	8.9	n.s.	9.81	10.0	0.038	13.20	13.8	<0.001
ASA score	n=	%		n=	%		n=	%	
ASA I	93	56.4		47	43.1		115	33.5	
ASA II	66	40		55	50.5		192	56	
ASA III	2	3		7	6.4		31	9	
ASA IV	0	0		0	0		2	0.6	
Missing ASA score	1	0.6		0	0		3	0.9	
Current smoker (yes)	14/150	9.4	n.s.	10/102	9.8	n.s.	28/314	8.7	n.s.
Co-morbidity									
Hypertension	36/110	24	n.s.	36/61	35.3	n.s.	100/207	31.8	n.s.
Lung disease	18/129	12	n.s.	18/79	17.6	n.s.	55/249	17.5	n.s.
Diabetes mellitus	6/139	4	n.s.	7/87	7	n.s.	23/279	7.3	n.s.
Endometriosis	18/86	12.0	0.01	4/51	3.9	n.s.	17/134	5.4	<0.001
FIGO Stage (Borderline and Cancer)									
Missing				22	20		30	8.7	
I				77	70		68	19.7	
II				6	5.4		24	6.9	
III				5	4.5		164	47.5	
IV				0	0		59	17.1	
Perioperative complications (Major complications)	3/163	1.8	n.s.	5/105	4.5	n.s.	22/323	6.4	0.025
Postoperative complications (Patient reported)	27/126	17.6	n.s.	16/83	16.2	n.s.	61/258	19.1	n.s.
Postoperative complications (Doctor reported)	10/145	6.5	n.s.	10/89	10.1	n.s.	36/284	11.3	n.s.

n.s.: Non-significant; ADL: activity of daily living; ASA: The American Society of Anesthesiologists physical status classification system; FIGO: The International Federation of Gynecology and Obstetrics. *p: post-hoc test Bonferroni (Benign vs. Borderline) both in ANOVA and chi2 tests; **p: post-hoc Bonferroni (Borderline vs. Malignant) both in ANOVA and chi2 tests; ***p: Bonferroni (Benign vs. Malignant) both in ANOVA and chi2 tests.

adjuvant chemotherapy in Sweden was carboplatin (AUC 5), paclitaxel 175 mg/sqm +/- bevacizumab, given every 3 weeks for 6 cycles (2) adding up to a total treatment time of 18 weeks. At the time of inclusion in the study, all patients with ovarian cancer had completed their adjuvant chemotherapy. Women with ovarian cancer stage I, borderline and benign disease did not receive any adjuvant chemotherapy (2).

Women in the benign and borderline groups were younger, had shorter time to normal activity of daily living and had less estimated blood loss than the ovarian cancer group (Table I). Women with benign tumors had higher BMI and shorter surgical time than women with ovarian cancer (Table I). The surgical time was also shorter for the borderline group compared to the ovarian cancer group (Table I). Women with cancer had a higher ASA-score (the American

Society of Anesthesiologists score) (15). The number of current smokers was similar in all groups. Fewer women in the borderline and ovarian cancer group had known endometriosis compared to the benign group.

The perioperative major complication rate evaluated by the individual surgeons was lower in the benign group than in the ovarian cancer group, but no significant difference in the postoperative complication rates reported by patients or surgeons was observed between the groups (Table I).

The combined item global health was significantly lower for patients treated for ovarian cancer compared with the patients who had undergone surgery for benign or borderline ovarian tumors (Figure 1). The combined items for physical, role, emotional, cognitive, and social functioning showed all lower item scores in ovarian cancer patients compared with

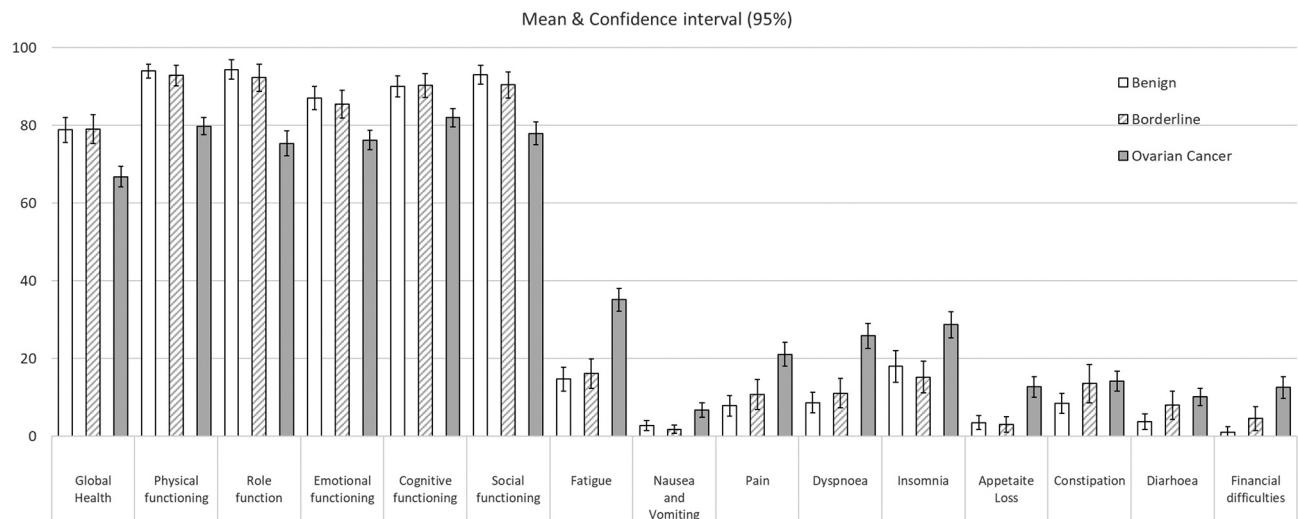


Figure 1. *Health related quality of life (QoL) of ovarian tumor patients according to the QLQ-C30 questionnaire. The scores (Y-axis) are transformed to a scale from 0 to 100 according to the QLQ-C30. In the functional scales, higher scores indicate better functioning and higher scores in symptom scales indicated worse symptoms.*

benign and borderline patients (Table II). The combined symptoms fatigue, nausea and vomiting, pain, dyspnea, insomnia, and appetite loss were significantly worse in the ovarian cancer group compared with the benign and borderline groups. Obstipation and diarrhea symptoms did not differ between ovarian cancer and borderline but between ovarian cancer and benign tumors. Patients with ovarian cancer scored significantly higher in the item financial difficulties than both borderline and ovarian cancer groups (Figure 1).

Patients treated for ovarian cancer scored significantly higher in the item groups gastro-intestinal symptoms, peripheral neuropathy, chemotherapy side effects, and discomfort and worries about the disease, but not in hormonal discomfort compared with patients who had undergone surgery for benign or borderline tumors (Figure 2). There was no difference in body image discomfort between ovarian cancer and borderline groups, but women with ovarian cancer had higher scores compared to women in the benign group (Table III). The ovarian cancer patient group scored significantly lower in the item sexual activity and comfort compared with the other two groups.

In the single question about vaginal dryness 12.6% (78/621) answered that they had no symptoms, and 60.7% (377/621) of the participants did not answer the question.

Discussion

This PROM study showed that ovarian cancer patients had worse QoL one year after diagnosis compared to patients

treated for benign and borderline tumors in almost all analyzed parameters. The global health score and the separate functions scores all showed worse outcomes in the ovarian cancer patients. Physical, role, emotional, cognitive, and social functioning results were also significantly worse in cancer patients. The outcomes may have been influenced by the adjuvant chemotherapy and older age in the ovarian cancer group, and not only by laparotomy, but psychological effects can still be observed one year after surgery (3). A negative effect on QoL has previously been shown in similar cohorts of ovarian cancer patients one month after laparotomy (mean age 54.3 years; n=116 ovarian cancer patients) (16), further on during follow-up (mean age 62.8 years; n=100 ovarian cancer patients) (3) and may be present for a long time (17). Worse QoL has been associated both with negative impact on survival (18) but also with no association with survival (19).

Fatigue, pain, dyspnea, insomnia and appetite loss were symptoms which scored higher in ovarian cancer patients compared with the other groups. Patients with benign and borderline tumors had fewer of these symptoms. Fatigue is a common side-effect associated with chemotherapy. The health care team should pay attention to fatigue as a symptom and must always check for other treatable medical conditions such as anemia, liver or kidney dysfunction. Physical training is the intervention that has been scientifically approved and best accepted as treatment for fatigue. Activities in daily life such as power walks, bicycling or any other kind of activity increasing heart activity should be encouraged (20). There are no drugs that

Table II. EORTC QLQ-C30 subscale scores at each assessment.

		95% Confidence interval for Mean			
	Group	Mean	Standard error	Lower bound	Upper bound
Global Health	Benign	78.9	1.6	75.7	82.0
	Borderline	79.1	1.9	75.4	82.8
	Ovarian cancer	66.8	1.3	64.2	69.4
Physical functioning	Benign	94.0	0.9	92.2	95.8
	Borderline	92.9	1.4	90.2	95.5
	Ovarian cancer	79.8	1.1	77.6	82.0
Role function	Benign	94.4	1.3	91.8	97.0
	Borderline	92.3	1.8	88.8	95.8
	Ovarian cancer	75.4	1.6	72.2	78.7
Emotional functioning	Benign	87.1	1.5	84.1	90.0
	Borderline	85.5	1.8	81.9	89.0
	Ovarian cancer	76.3	1.3	73.8	78.8
Cognitive functioning	Benign	90.0	1.4	87.3	92.8
	Borderline	90.3	1.6	87.2	93.4
	Ovarian cancer	82.0	1.2	79.6	84.4
Social functioning	Benign	93.1	1.2	90.7	95.5
	Borderline	90.4	1.7	87.1	93.8
	Ovarian cancer	77.9	1.5	75.0	80.9
Fatigue	Benign	14.8	1.6	11.7	17.8
	Borderline	16.2	1.9	12.4	19.9
	Ovarian cancer	35.2	1.5	32.3	38.1
Nausea and vomiting	Benign	2.8	0.6	1.6	4.0
	Borderline	1.9	0.6	0.8	2.9
	Ovarian cancer	6.8	0.9	5.0	8.6
Pain	Benign	7.9	1.3	5.3	10.5
	Borderline	10.8	1.9	7.0	14.6
	Ovarian cancer	21.1	1.6	18.0	24.2
Dyspnoea	Benign	8.7	1.4	6.0	11.4
	Borderline	11.1	1.9	7.3	14.9
	Ovarian cancer	25.9	1.6	22.6	29.1
Insomnia	Benign	18.0	2.1	13.9	22.1
	Borderline	15.3	2.0	11.2	19.3
	Ovarian cancer	28.7	1.7	25.4	32.0
Appetite loss	Benign	3.5	0.9	1.7	5.3
	Borderline	3.1	1.0	1.0	5.1
	Ovarian cancer	12.8	1.3	10.1	15.4
Constipation	Benign	8.5	1.3	6.0	11.1
	Borderline	13.6	2.5	8.7	18.5
	Ovarian cancer	14.1	1.3	11.6	16.7
Diarrhoea	Benign	3.8	1.0	1.7	5.8
	Borderline	8.0	1.9	4.3	11.7
	Ovarian cancer	10.2	1.1	8.0	12.3
Financial difficulties	Benign	1.1	0.7	0.3	2.4
	Borderline	4.6	1.5	1.6	7.7
	Ovarian cancer	12.6	1.4	9.8	15.4

can be recommended for treating fatigue (21). As only participants with stage II-IV ovarian cancer received adjuvant chemotherapy it is not strange that fatigue was observed more often in this group as this is a common side-effect of chemotherapy (22).

We also observed that financial problems were worse and significantly more common for ovarian cancer patients.

Financial difficulties may put further burden on cancer patients and their families (23, 24). In Sweden, with a free of charge health care system, it was surprising that patients with ovarian cancer faced financial difficulties one year after diagnosis to a higher degree than patients having had a laparotomy for borderline and benign reasons. For some cancer patients these financial problems may be related to

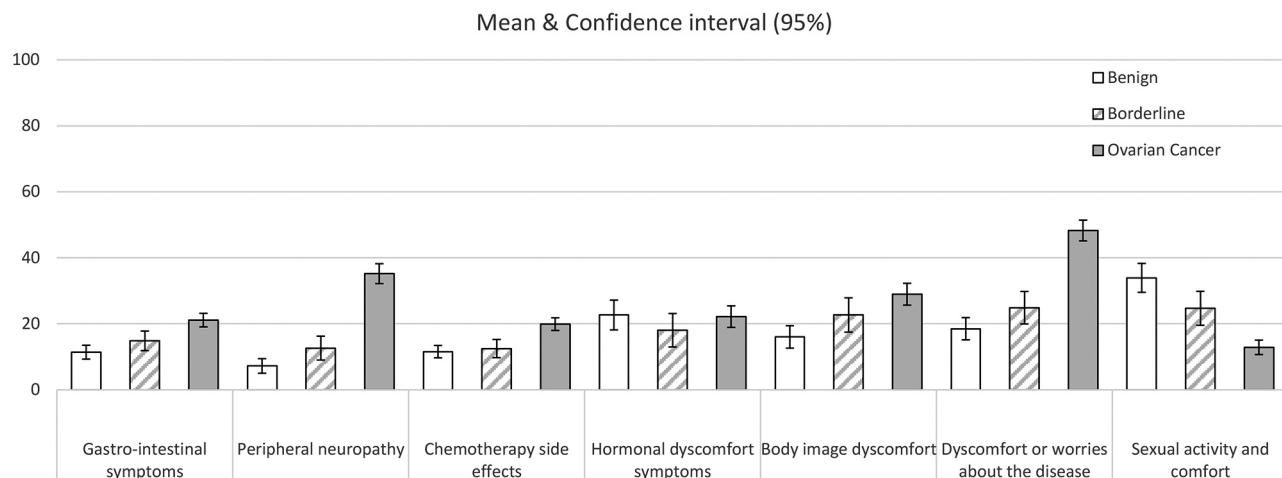


Figure 2. Health related quality of life (QoL) of ovarian tumor patients according to the QLQ-OV28 questionnaire. The scores (Y-axis) are transformed to a scale from 0 to 100 according to the QLQ-OV28 manual where higher scores indicated worse symptoms. High score in sexual activity and comfort indicated better functioning.

the fact that they have had to retire earlier with a lower pension, but it could also be due to the fact that advanced stage ovarian cancer patients were not able to return to work until finished the chemotherapy resulting in a longer sick-leave than the other groups who were on sick-leave only for the postoperative recuperation. Bhugwandass *et al.*, found when comparing women with early stages of ovarian cancer, that the women who received adjuvant chemotherapy also had significantly more financial distress compared to women that only had surgery (25).

Pain was the more common symptom in the ovarian cancer patients and may increase fatigue. The rehabilitation team may involve the specialized pain unit with expertise in multimodal pain rehabilitation if standard treatment is not enough. The healthcare teams should offer non-pharmacological pain-relieving treatments including assistance from the physiotherapist (26-30). Constipation and diarrhea were similar in patients with ovarian cancer and borderline tumors, who may have had more extensive surgery than the benign group. Defecation problems are common as a result of decreased physical activity, altered diet, abdominal pain, or drug side effects. Obstipation should be noted and if needed, bulk laxatives should be initiated, and if this is not enough, gastro-intestinal experts should be consulted (31). Treatment with drugs (loperamide, octreotide, antibiotics) is often effective (31).

Our results show that chemotherapy-related side effects were higher in ovarian cancer patients compared to patients with borderline or benign ovarian tumors, but the difference was not as large as for other questions. The questions

regarding chemotherapy are as follows *e.g.*: “Have you lost any hair?”, “Were you upset by this loss of hair?”, or “Did you have problems with hearing?” which are symptoms that may occur in women not having had chemotherapy. Interestingly, also women who had not received adjuvant chemotherapy answered in their questionnaires that they were suffering from symptoms such as peripheral neuropathy but since the questions for peripheral neuropathy include the following questions: “Have you had tingling hands or feet?”, “Have you had numbness in your fingers and toes?”, and “Have you felt weak in your arms or legs?” these symptoms may occur in women without having had chemotherapy but for other reasons. Peripheral neuropathy is a common chemotherapy related side-effect especially associated with taxanes but may also be due to other causes, *e.g.* diabetes mellitus, vitamin B12 deficiency or excessive long-term use of alcohol (32). We do not know how many patients had these symptoms before treatment, and this needs to be investigated in future studies.

There was no observed difference in hormonal/menopausal symptoms between the groups as seen in Figure 2 and the variable hormonal discomfort symptoms. However, even if there was no difference in hormonal/menopausal symptoms we observed that the ovarian cancer patients had less sexual activity and felt less sexual comfort than women in the benign or borderline groups. This may have been due to the age of the patients, as the mean age of the patients in the benign group was significantly lower than in the other groups, 51 years *vs.* 60 years and 64 years respectively. In Sweden the median age of the menopause is 52 years, so a larger number

Table III. EORTC QLQ-OV28 subscale scores at each assessment.

		95% Confidence interval for Mean			
	Group	Mean	Standard error	Lower bound	Upper bound
Gastro-intestinal symptoms	Benign	11.6	1.1	9.5	13.8
	Borderline	14.7	1.5	11.7	17.7
	Ovarian cancer	21.7	1.1	19.5	23.8
Peripheral neuropathy	Benign	7.4	1.2	5.2	9.7
	Borderline	11.7	1.7	8.3	15.2
	Ovarian cancer	35.9	1.6	32.7	39.0
Chemotherapy side effects	Benign	11.7	1.0	9.8	13.7
	Borderline	12.4	1.0	9.6	15.2
	Ovarian cancer	20.2	1.0	18.2	22.2
Hormonal discomfort symptoms	Benign	22.7	2.3	18.1	27.3
	Borderline	17.6	2.6	12.4	22.8
	Ovarian cancer	22.6	1.7	19.1	26.0
Body image discomfort	Benign	16.5	1.8	13.0	19.9
	Borderline	22.7	2.7	17.4	28.0
	Ovarian cancer	29.9	1.8	26.5	33.4
Discomfort or worries about the disease	Benign	18.8	1.7	15.3	22.2
	Borderline	25.1	2.5	20.0	30.1
	Ovarian cancer	49.0	1.6	45.8	52.2
Sexual activity and comfort	Benign	31.3	1.9	27.6	34.9
	Borderline	23.2	2.3	18.5	27.8
	Ovarian cancer	13.5	1.1	11.2	15.7

of cancer and borderline patients would have already been postmenopausal and hence less influenced by the effect of drop in hormonal levels after laparotomy including bilateral salpingo-oophorectomy. Research has shown that younger women, women in a relationship and women who have received chemotherapy are more likely to suffer from sexual dysfunction (33). Research has also shown that it is possible to improve the situation for women with *e.g.* behavioral intervention (34). A previous systematic review, showed that survivors of gynecological cancers were likely to have sexual problems but that previous research has mostly been focused on the physical aspects of sexual functioning, not as much on the psychological and social aspects of sexuality in gynecological cancer survivors (35). Dyspareunia was a common physical symptom prevalent according to the above mentioned review (35) but in this study when analyzing the data, we removed the question about vaginal dryness from our calculations about sexuality since less than half of the participating women had answered the question. Increased vaginal dryness in gynecological cancer survivors could be due to older age, more years since menopause but also that fewer women may use local oestrogen treatment due to a malignant diagnosis (36, 37). Patients with ovarian cancer diagnosis were less satisfied with their body image compared with patients with benign tumors. Body image perception may itself affect sexuality. All cancer diagnoses and cancer

treatment can affect sexual health, and the healthcare team must address the topic of sexual health with the cancer patient and her partner in order to show the patient that it is a not neglected subject. Logue *et al*. described that psychosocial morbidity is a relevant topic that needs to be explored more and future studies need consensus in their questionnaires, definitions, thresholds, and primary outcome measures (37).

To the best of our knowledge, there has been no previous comparison of patients' QoL after laparotomy for ovarian cancer, borderline and benign ovarian tumors one year postoperatively. The validated questionnaires EORTC QLQ-C30 and the EORTC QLQ-OV28 or other validated questionnaires may be used in the future to determine how to improve patients' QoL after surgery for ovarian tumors (3). In retrospect, we should have considered administering the questionnaire also before surgery in order to compare each patient individually. The ovarian cancer patients were older than both the benign and borderline patients, which may have influenced a portion of the outcomes when comparing the groups, but not the general symptoms and manifestations of ovarian cancer disease which patients face after their disease treatment.

The study population consisted of a large, unselected cohort of ovarian tumor patients having had surgery at their regional hospitals. QoL were evaluated with validated, well-known methods, and the outcomes were compared for women treated

by laparotomy for ovarian cancer, borderline or benign lesions in the ovaries. The percentage of non-participants was low in the three groups, especially in the cancer group reducing the risk for survival bias and selection bias.

Several studies have shown that active symptom monitoring performed in cancer patients have a positive impact on quality of life and survival (38-40). The present study demonstrated diminished QoL in patients with ovarian malignancies. The validated questionnaires EORTC QLQ-C30 and the EORTC QLQ-OV28 should be implemented and used in the regular follow-up scheme to determine how to improve patients' QoL after laparotomy for ovarian tumors. How often the questionnaires should be offered to the patients (every six or 12 months) needs to be discussed and may depend on the health care resources available. By offering the questionnaires and discussing the most important symptoms or side effects the patients will get more involved in their own rehabilitation.

Our study showed that ovarian cancer patients had worse QoL one year after laparotomy, in most analyzed parameters, compared to patients treated for benign and borderline tumors. Worse QoL could be related to oncological diagnosis and complex treatment. Several of the symptoms may be reduced by treatment from a good cancer rehabilitation team working in consultation with the patient (2, 41) hence, this should be offered to all patients after treatment for ovarian cancer.

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Conflicts of Interest

The Authors are solely responsible for the content and writing of the paper. The Authors report no conflicts of interest regarding this study.

Authors' Contributions

Arturas Dobilas: Study conception and design; data acquisition, analysis and interpretation; drafting and revising the manuscript. Louise Moberg: Study conception and design; data interpretation; critically revising the manuscript. Christer Borgfeldt: Study conception and design; data acquisition, analysis and interpretation; critically revising the manuscript. All Authors have approved the final version of this article.

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