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Self-reported symptoms of faecal incontinence among long-term gynaecological cancer survivors and population-based controls

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ABSTRACT

Aim of the study: To make a comprehensive, detailed inventory of gastrointestinal symptoms reported by gynaecological cancer survivors and control women from the general population.

Method: We identified a cohort of 789 eligible women in the Stockholm and Gothenburg areas, treated with pelvic radiotherapy during the period 1991–2003, alone or as combined treatment, for gynaecological cancer. As controls, we randomly recruited 478 women, frequency matched by age and residence from the Swedish Population Registry. We collected data in 2006 by means of a study-specific, validated, postal questionnaire including 351 questions covering symptoms from the pelvic region. We asked about demographics, psychological and quality-of-life issues as well as social functioning.

Results: Participation was 78% for cancer survivors and 72% for controls. Mean follow-up was 7.2 years. In this large, population-based study, the greatest age-adjusted absolute risk difference between cancer survivors and control women was observed for the symptom defaecation urgency with faecal leakage and the highest age-adjusted relative risk for emptying of all stools into clothing without forewarning.

Conclusions: Cancer survivors having undergone pelvic radiotherapy alone or as part of combined treatment between the period 1991–2003 for a gynaecological malignancy had a higher occurrence of long-lasting gastrointestinal symptoms as compared to population controls.

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1. Introduction

In Sweden approximately 30,000 women are gynaecological cancer survivors[1] and many of them have received pelvic radiotherapy as part of cancer treatment. Gastrointestinal symptoms following pelvic radiotherapy are common and well documented,[2–6] but self-reported descriptions of gastrointestinal symptoms among long-term gynaecological cancer survivors are rare in the literature.

Prospective studies of gastrointestinal morbidity have used various instruments for recording and monitoring acute and late treatment-related effects after pelvic radiotherapy.[7–11] Although these scoring systems are applicable in comparing treatment arms in clinical trials, they lack self-reported descriptions of gastrointestinal symptoms and therefore, detailed distinctions between symptoms. Few studies report long-term morbidity exceeding 3–5 years after completed therapy.

Advances in gynaecological cancer treatment have resulted in improved survival and the number of cancer survivors has increased accordingly.[1] Long-term cancer survivors will therefore constitute a growing proportion of the general population seeking health-care outside oncology centres. In-depth knowledge of existing long-lasting symptoms and their influences on social functioning and quality-of-life is increasingly important for health-care providers.

Personal identity numbers and population-based registers in Sweden allow us to follow cancer survivors long after therapy and without selection-induced problems. We have performed a large population-based study on long-lasting symptoms after pelvic radiotherapy, given alone or as part of combined treatment, among gynaecological cancer survivors encompassing physical symptoms, demographics, psycho-sexual issues and social functioning. We here report an inventory of self-reported detailed descriptions of gastrointestinal symptoms and relate the reported occurrence to women from the general population.

2. Patients and methods

2.1. Study population

We identified a cohort of 1800 women treated between 1991 and 2003 with external pelvic radiotherapy for a gynaecological malignancy at Radiumhemmet, Karolinska University Hospital in Stockholm, and at Jubileumskliniken, Sahlgren ska University Hospital in Gothenburg of whom 1303 were alive in 2004. When excluding patients who did not meet the eligibility criteria, i.e. born 1927 or later, could read and understand Swedish and without recurrence of their malignancy, 789 patients remained and were included in the study (Fig. 1).

As controls we randomly recruited 486 women from the Swedish Population Registry, matched by age and place of residence. An error in the matching procedure led to a younger control population, which was adjusted for in the analyses. Exclusion criteria were previous radiotherapy to the pelvic region and inability to understand Swedish (Fig. 1). Women with prior abdominal surgery or malignancy other than a gynaecological cancer were allowed to participate. The regional ethics committees approved the study.

2.2. Questionnaire development

During an 18-month qualitative phase, which included 26 interviews, we constructed a study-specific questionnaire. The questionnaire was tested in a pilot study and was followed by the data collection, January–October 2006. The method used is well founded and has been described in several previous publications.[12–16]

2.3. Interviews

The gynaecological cancer survivors, who had undergone radiotherapy to the pelvic region 2–10 years earlier, were asked to participate in an interview at a routine follow-up. The interviews had no time limitation and were performed by the first author in a semi-structured way, focusing on the woman's current symptoms, quality-of-life and social functioning. A secretary prepared word-by-word transcripts from the interview recordings.

After interviewing 26 gynaecological cancer patients, no new information was identified. The reported symptoms were transformed into questions and sorted as follows: physical symptoms from the gastrointestinal area, bladder, genitals, pelvic bones and legs, as well as psychological symptoms, quality-of-life and social functioning. Additional questions from previous studies within the research unit were added to a first draft of the study-specific questionnaire.

2.4. Instruments

In each part of the study-specific questionnaire we asked about the incidence, prevalence, intensity and duration of the symptoms when appropriate. For example: '*Have you emptied all stools into your clothes without forewarning during the past six months?*' with the following possible answers: '*No*', '*Yes, occasionally*', '*Yes, at least once every month*', '*Yes, at least once a week*', '*Yes, at least three times a week*', '*Yes, at least once a day*'.

2.5. Validation

The study-specific questionnaire was validated within the study-population with 20 women, using face-to-face validity. Based on their comments the questions were revised and a new draft was completed. The final questionnaire consisted of 351 questions divided as follows: the first part covered demographic data, information about the disease and its treatment. The second part included questions on psychological issues such as self-assessed anxiety and depression, quality-of-life, physical health and social functioning including relations to family and friends. In parts 3–8 we asked for information concerning the physical symptoms and the participant's sexuality.

In a pilot study including 20 other individuals from the study population, we tested the questions, the participation rate for completing the questionnaire, the response rate on

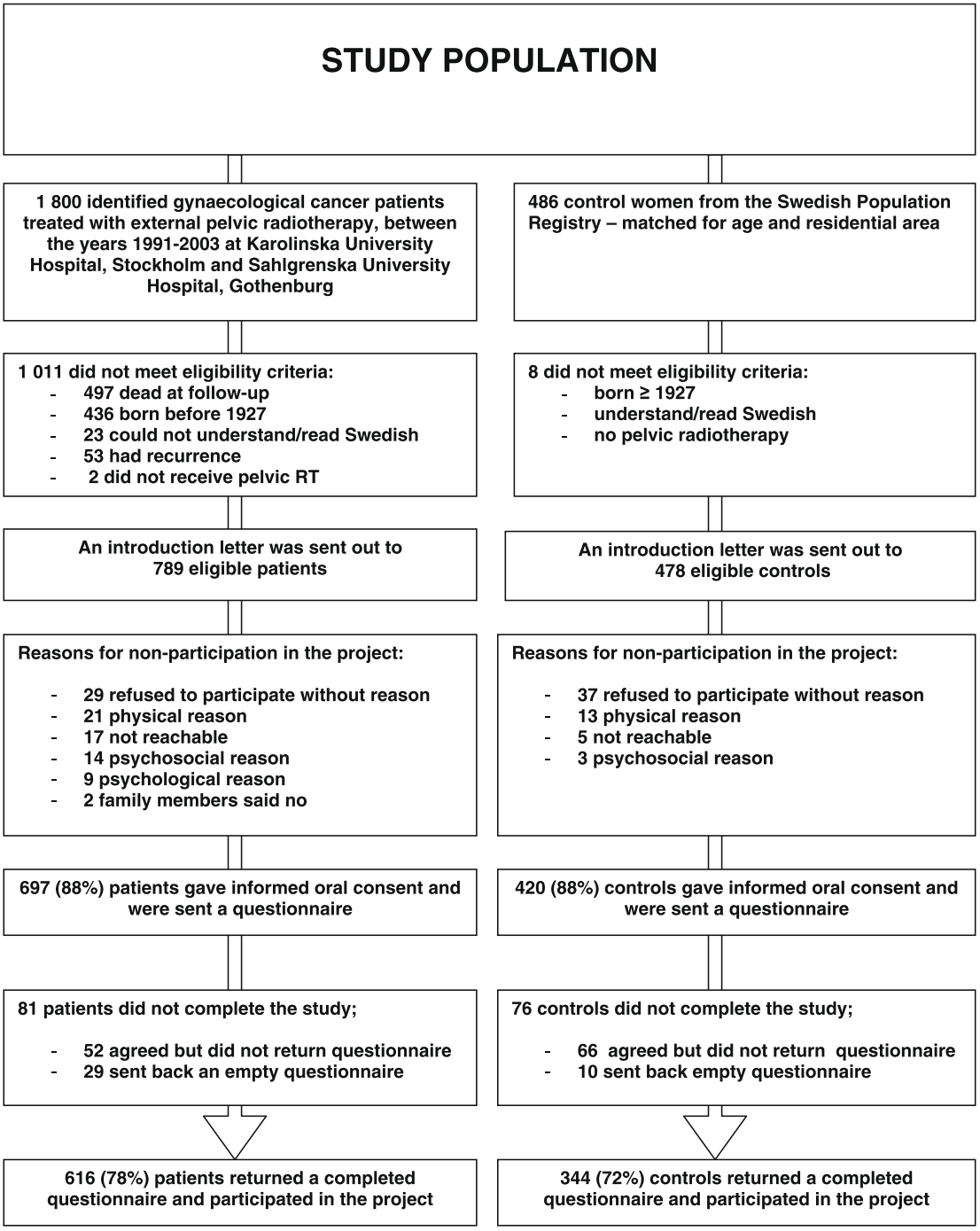

Fig. 1 – Flow chart study population, cancer survivors and control women.

each question and logistics. The overall participation rate in the pilot study was 80% and resulted in only minor improvements of the questionnaire.

2.6. *Data collection*

Between January and October 2006, we sent an introductory letter to 789 patients and 478 controls explaining the objectives of the study emphasising that their participation in the study was voluntary. One week later an interviewer phoned each informant. Those giving informed oral consent to participate received a postal questionnaire along with a letter again explaining our objectives for conducting the study with information on data collection from medical records. Three weeks after the initial contact a thank-you-card was sent to show appreciation for the subject's participation and to serve as a reminder. A week later the interviewer phoned those who had not returned their questionnaires. Each returned questionnaire contained a number for identification to maintain anonymity. Information collected from the medical records included cancer diagnosis, treatment-techniques and cancer recurrence.

Table 1 – Demographics and clinical characteristics of cancer survivors and control women.

Characteristics among participants	Cancer survivors $n = 616$ (%)	Control women $n = 344$ (%)
Age		
28–38	14 (11)	23 (7)
39–49	51 (8)	79 (23)
50–60	120 (19)	87 (25)
61–71	252 (41)	87 (25)
72–79	179 (29)	66 (19)
Not stated	0 (0)	2 (1)
Mean age (range)	64.4 (28–79)	58.0 (36–79)
Marital status		
Married or living with a partner	344 (56)	220 (64)
Has a partner but lives alone	37 (6)	22 (6)
Widow	84 (14)	37 (11)
Single	148 (24)	65 (19)
Not stated	3 (<1)	0 (0)
Level of education		
Elementary school	196 (32)	69 (20)
Secondary school	236 (38)	146 (42)
Collage/university	183 (30)	127 (37)
Not stated	1 (<1)	2 (1)
Employment status		
Student	5 (1)	2 (1)
Unemployed	12 (2)	6 (2)
Employed	202 (33)	188 (55)
Housewife, other	11 (2)	5 (1)
On sick leave	11 (2)	10 (2)
Disability pension	53 (9)	15 (4)
Retired	319 (52)	117 (34)
Not stated	3 (<1)	1 (<1)
Smoking		
Current smoker	142 (23)	88 (26)
Former smoker	182 (30)	108 (31)
Never smoked	277 (45)	146 (42)
Not stated	15 (2)	2 (1)
Exercise		
Never	76 (12)	20 (6)
Occasionally – at least once a week	78 (13)	59 (17)
At least once a week	445 (74)	262 (77)
Not stated	17 (3)	3 (1)
Body Mass Index[a]		
<18.5 (underweight)	16 (3)	4 (1)
18.5–25.0 (normal weight)	261 (42)	163 (47)
25.0–30.0 (overweight)	201 (33)	116 (34)
>30.0 (obese)	95 (15)	43 (13)
Not stated	43 (7)	18 (5)
Parity		
Nulli (never given birth)	154 (25)	45 (13)
1–3 para	410 (67)	280 (81)
>3 para	51 (8)	19 (6)
Not stated	1 (<1)	0 (0)
Delivery		
Fast < 5 h	250 (54)	147 (49)
Slow > 24 h	141 (31)	88 (29)
Vacuum	41 (9)	43 (14)
Forceps	12 (3)	7 (2)
Episiotomy	132 (29)	117 (39)
Caesarean	28 (6)	40 (13)
Breech birth	18 (4)	20 (7)
Vagina/perineum injury	111 (18)	101 (29)
Anal sphincter injury	18 (3)	18 (5)

Table 1 – (continued)

Characteristics among participants	Cancer survivors $n = 616$ (%)	Control women $n = 344$ (%)
Previous		
Abdominal surgery	251 (41)	108 (31)
Gynaecological surgery	555 (90)	76 (22)
Surgery or ring for pelvic organ prolapse	12 (2)	13 (4)
Oestrogen	224 (36)	50 (15)
Intercurrent diseases		
Neurological disease[b]	15 (2)	3 (1)
Cardiovascular disease[c]	249 (40)	96 (28)
Diabetes mellitus	58 (9)	17 (5)
Lung disease	40 (6)	12 (3)
Lactose intolerance	33 (5)	13 (4)
Gluten intolerance	8 (1)	3 (1)
Osteoporosis	58 (9)	25 (7)
Treatment for Crohn's disease, Ulcerous colitis, Irritable Bowel Syndrome (IBS)	69 (11)	32 (9)
Diagnosis		
Endometrial cancer	366 (59)	Not applicable
Cervical cancer	143 (23)	
Ovarian cancer	45 (7)	
Uterine sarcoma	30 (5)	
Vaginal cancer	14 (2)	
Cancer of the fallopian tube	12 (2)	
Vulvar cancer	6 (1)	
Treatment		
Surgery and radiotherapy, total	555 (90)	Not applicable
Surgery and radiotherapy alone	45 (7)	
+ Brachytherapy	347 (56)	
+ Chemotherapy	59 (10)	
+ Brachy- and chemotherapy	104 (17)	
Radiotherapy alone, total	61 (10)	
Radiotherapy alone	2 (<1)	
+ Brachytherapy	27 (4)	
+ Chemotherapy	9 (1)	
+ Brachy- and chemotherapy	23 (4)	
Months since radiotherapy mean (SD)	86.1 (40.4)	

Percentage may not total 100 because of rounding.
[a] Current BMI at the time the questionnaire was completed.
[b] Parkinson's disease, multiple sclerosis, epilepsy.
[c] Hypertension, heart failure, angina pectoris, myocardial infarction.

2.7. *Statistical analysis*

For initial analysis questions related to frequency of symptoms were dichotomised into having the symptom occasionally or more often and not having the symptom, during the past 6 months. For symptoms with a high prevalence among control women, i.e. exceeding 45%, we changed the cut-off level to at least once a week in the final analysis while keeping the previous cut-off level of occasionally during the past 6 months for less prevalent symptoms (Table 2).

All calculations were performed using the SAS statistical software package (version 9). We computed the proportions of the outcome (symptom) among cancer survivors and control women. As outcome measures we utilised the relative risk and the absolute risk difference, defined as the ratio and difference, respectively, between these proportions. Age-adjusted outcome measures were created by fitting the relevant grouping variable as well as the age variable in bivariate regression models. This was done using the SAS GENMOD procedure with binomial error distribution, with log link for relative risks and identity link for absolute risk differences. Age was included as a continuous variable. To avoid confusion, we give 95% confidence intervals for relative risks only. In Tables 2 and 3, individuals who failed to respond to a certain question were excluded from the analysis of that outcome (Table 2).

3. Results

3.1. *Study population and characteristics*

In January 2006, 789 of 1800 eligible gynaecological cancer patients were alive and included in the study. Six hundred and sixteen (78%) cancer survivors returned a completed

Table 2 – Gastrointestinal symptoms among cancer survivors and control women during the past 6 months.

	Cancer survivors, No./total (%)	Controls, No./total (%)	Survivors versus controls Age-adjusted relative risk (95% CI) [p-value]		Survivors versus controls Age-adjusted absolute risk difference
Defaecation urgency at least once a week	175/602 (29)	19/341 (6)	5.9 (3.7–9.4)	[$p < 0.001$]	+24
Protracted abdominal pain lasting at least 1 year[a]	69/601 (11)	15/339 (4)	3.1 (1.8–5.4)	[$p < 0.001$]	+8
Loose stools at least once a week	234/602 (39)	48/344 (14)	3.1 (2.3–4.1)	[$p < 0.001$]	+28
Incomplete bowel emptying at least once a week	79/609 (13)	22/340 (6)	2.5 (1.6–4.0)	[$p < 0.001$]	+7
Abdominal bloating at least once a week	147/605 (24)	60/342 (18)	1.8 (1.4–2.4)	[$p < 0.001$]	+10
Abdominal pain occasionally	307/604 (51)	137/340 (40)	1.4 (1.2–1.6)	[$p < 0.001$]	+15
With vomiting	57/307 (19)	13/137 (9)	1.7 (0.9–3.0)	[$p = 0.076$]	+8
With stool	194/305 (64)	77/137 (56)	1.1 (1.0–1.4)	[$p = 0.115$]	+9
With bloating	223/305 (73)	102/135 (76)	1.0 (0.9–1.1)	[$p = 0.597$]	+3
Anal pain at least once a week	19/608 (3)	7/343 (2)	1.7 (0.7–4.1)	[$p = 0.247$]	+1
Anal itch at least once a week	34/609 (6)	22/343 (6)	1.0 (0.6–1.8)	[$p = 0.921$]	−1
No to moderate ability to strain at stool[b]	187/604 (31)	108/338 (32)	1.0 (0.8–1.2)	[$p = 0.890$]	−1
Hard stools at least once a week	40/608 (7)	32/343 (9)	0.7 (0.5–1.2)	[$p = 0.179$]	−3
Emptying of all stools into clothing without forewarning occasionally	70/606 (12)	3/344 (1)	11.9 (3.8–37.8)	[$p < 0.001$]	+10
Leakage of loose stools while awake occasionally	199/608 (33)	18/344 (5)	6.1 (3.8–9.7)	[$p < 0.001$]	+27
Leakage of loose stools while asleep occasionally	72/611 (12)	8/343 (2)	5.3 (2.6–11.1)	[$p < 0.001$]	+9
Anal leakage of mucus while asleep occasionally	32/607 (5)	4/344 (1)	4.4 (1.5–12.6)	[$p = 0.005$]	+4
Faecal leakage without forewarning despite previous defaecation occasionally	188/605 (31)	23/344 (7)	4.2 (2.8–6.4)	[$p < 0.001$]	+23
Leakage of solid stools while awake occasionally	46/607 (8)	5/344 (1)	4.2 (1.7–10.6)	[$p = 0.002$]	+5
Defaecation urgency with faecal leakage occasionally	298/603 (49)	42/343 (12)	4.1 (3.0–5.5)	[$p < 0.001$]	+37
Foul smelling flatulence at least once a week	116/602 (19)	22/343 (6)	3.6 (2.3–5.6)	[$p < 0.001$]	+13
Anal leakage of mucus while awake occasionally	87/603 (14)	14/343 (4)	3.5 (2.0–6.1)	[$p < 0.001$]	+10
Self-perception of faecal odour occasionally	108/606 (18)	18/340 (5)	3.3 (2.0–5.4)	[$p < 0.001$]	+12
Loud unpreventable flatulence at least once a week	107/607 (18)	25/344 (7)	3.0 (1.9–4.5)	[$p < 0.001$]	+11
Unpreventable flatulence at least once a week	127/606 (21)	33/343 (10)	2.4 (1.7–3.5)	[$p < 0.001$]	+12
Unwanted defaecation while urinating occasionally	238/603 (39)	57/342 (17)	2.4 (1.9–3.2)	[$p < 0.001$]	+23
Mucus in stools occasionally	156/607 (26)	45/343 (13)	2.2 (1.6–3.0)	[$p < 0.001$]	+13
Anal leakage of blood while awake occasionally	42/608 (7)	12/343 (3)	2.0 (1.0–3.8)	[$p = 0.038$]	+3
Rectal bleeding occasionally	103/604 (17)	42/341 (12)	1.6 (1.1–2.2)	[$p = 0.007$]	+7
Anal leakage of blood while asleep occasionally	9/608 (1)	2/343 (1)	2.5 (0.5–11.8)	[$p = 0.256$]	+1
Leakage of solid stools while asleep occasionally	15/611 (2)	0/344 (0)	NA		+4
Abdominal surgery for fistula[a]	11/605 (2)	NA	NA		NA

[a] Possible answers: 'yes' or 'no'.

[b] Possible answers; 'not applicable', 'no ability', 'little ability', 'moderate ability' and 'large ability'.

Table 3 – Radiotherapy without and with surgery – gastrointestinal symptoms among cancer survivors during the past 6 months.

	Radiotherapy without surgery No./total (%)	Radiotherapy and surgery No./total (%)	Age-adjusted Absolute risk difference
Defaecation urgency at least once a week	17/59 (29)	158/543 (29)	−3
Protracted abdominal pain lasting at least 1 year[a]	10/59 (17)	59/542 (11)	+5
Loose stools at least once a week	28/60 (47)	206/542 (38)	+6
Incomplete bowel emptying at least once a week	2/58 (3)	77/551 (14)	−11
Abdominal bloating at least once a week	17/59 (29)	130/546 (24)	−2
Abdominal pain occasionally	35/58 (60)	272/546 (50)	+6
with vomiting	11/35 (31)	46/272 (17)	+16
with stool	26/35 (74)	168/270 (62)	+12
with bloating	29/35 (83)	194/270 (72)	+6
Anal pain at least once a week	3/59 (5)	16/549 (3)	+1
Anal itch at least once a week	3/60 (5)	31/549 (6)	−3
No to moderate ability to strain at stool[b]	11/59 (19)	176/545 (32)	−13
Hard stools at least once a week	2/60 (3)	38/548 (7)	−3
Emptying of all stools into clothing without forewarning occasionally	15/59 (25)	55/547 (10)	+18
Leakage of loose stools while awake occasionally	27/61 (44)	172/547 (31)	+13
Leakage of loose stools while asleep occasionally	14/61 (23)	58/550 (11)	+12
Anal leakage of mucus while asleep occasionally	7/60 (12)	25/547 (5)	+8
Faecal leakage without forewarning despite previous defaecation occasionally	20/59 (34)	168/546 (31)	+6
Leakage of solid stools while awake occasionally	8/61 (13)	38/546 (7)	+8
Defaecation urgency with faecal leakage occasionally	35/60 (58)	263/543 (48)	+9
Foul smelly flatulence at least once a week	13/60 (22)	103/542 (19)	−1
Anal leakage of mucus while awake occasionally	10/60 (17)	77/543 (14)	+1
Self-perception of faecal odour occasionally	12/61 (20)	96/545 (18)	+2
Loud unpreventable flatulence at least once a week	14/60 (23)	93/547 (17)	+1
Unpreventable flatulence at least once a week	16/60 (27)	111/546 (20)	+4
Unwanted defaecation while urinating occasionally	25/60 (42)	213/543 (39)	−0
Mucus in stools occasionally	12/60 (20)	144/547 (26)	−9
Anal leakage of blood while awake occasionally	4/61 (7)	38/547 (7)	−0
Rectal bleeding occasionally	10/57 (18)	93/547 (17)	−1
Anal leakage of blood while asleep occasionally	1/60 (2)	8/548 (1)	+1
Leakage of solid stools while asleep occasionally	3/61 (5)	12/550 (2)	+4
Abdominal surgery for fistula[a]	3/60 (5)	8/545 (1)	+4

a Possible answers: 'yes' or 'no'.

b Possible answers; 'not applicable', 'no ability', 'little ability', 'moderate ability' and 'large ability'.

questionnaire and participated in the study (Fig. 1). Among 478 eligible control women, 344 (72%) returned the questionnaire (Fig. 2).

Clinical characteristics among cancer survivors and controls are presented in Table 1. The mean age was higher among survivors (64.4 years) compared to that among control women (58.0 years). No differences were observed concerning smoking habits or high Body Mass Index between the two groups. Twice as many survivors compared to control women neither exercised nor had given birth. Control women reported more injury to the vagina and/or perineum than cancer survivors, no difference was seen concerning anal sphincter injury. Cardiovascular diseases were more common among cancer survivors but no differences were found for diabetes mellitus, intercurrent bowel diseases or neurological diseases.

The most common gynaecological cancer was endometrial cancer (59%) followed by cervical- and ovarian cancer. Surgery was performed in 555 of 616 cancer survivors (90%) and included all endometrial, ovarian, vulvar cancers, cancer of the fallopian tube and uterine sarcoma. Among these women, surgery consisted of total hysterectomy and bilateral salpingoophorectomy, with or without omentectomy. Pelvic and/or paraaortic lymphadenectomy was not performed.

Among cervical- and vaginal cancer patients ($n = 157$), 62% had surgery followed by adjuvant radiotherapy. In 29% of these women additional brachy- and chemotherapy were given. Surgery for cervical cancer consisted of radical hysterectomy and pelvic lymphadenectomy. In the group treated without surgery, 9 of 61 women received external pelvic radiotherapy and chemotherapy, 27 women received external pelvic radiotherapy and brachytherapy and 23 women received external radiotherapy, brachytherapy and chemotherapy. Seventeen of 61 (28%) women received concomitant chemotherapy. Concomitant radio-chemotherapy with weekly cisplatin was given to a total of 32 women, all cervical cancer patients.

All cancer survivors received external beam radiotherapy using a linear accelerator delivering an energy varying between 6 and 50 megavoltage (MV) photons. In general,

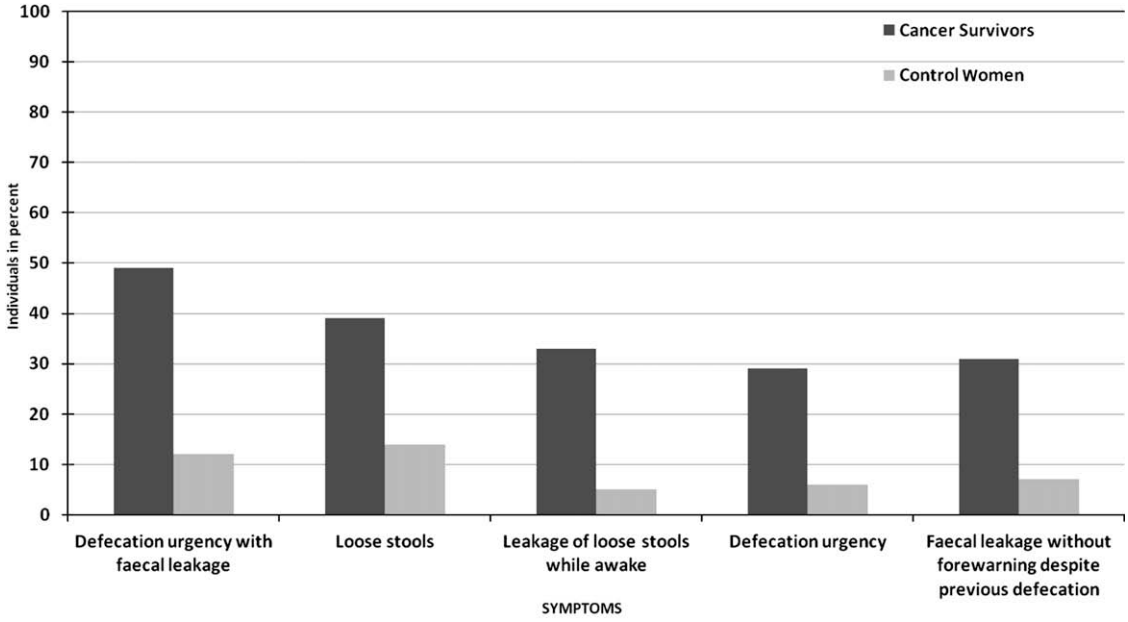

Fig. 2 – Long-term symptoms with the greatest age-adjusted risk difference between gynaecological cancer survivors and control women.

radiotherapy as an addition to surgery entailed target doses between 40 and 50 Gy (1.6–2.0 Gy per fraction, 5 d a week). The mean dose given to the women who did not have surgery was 54 Gy (SD 7.8) ranging from 39.6 to 70 Gy. Ten patients received a dose below 38 Gy due to severe acute side-effects. Before 1996, a two-field technique comprised the therapy and from 1996 a four-field box technique became the standard therapy. In total, 501 (81%) survivors had brachytherapy and 195 (32%) received chemotherapy in addition to other therapies (Table 1). The mean time between end of radiotherapy and study participation was 86.1 months. Among control women 22% had undergone previous surgery (hysterectomy in 47% and oophorectomy in 30%) for gynaecological benign disease.

3.2. *Symptoms associated with cancer therapy*

The survivors described 32 gastrointestinal symptoms, 18 of which concerned symptoms of anal incontinence. In 26 of 32 gastrointestinal symptoms we found a statistically significant increased age-adjusted relative risk for the cancer survivors, when compared to control women (at the 95% confidence level) (Table 2).

The greatest age-adjusted absolute difference between cancer survivors and control women was observed for the symptom defaecation urgency with faecal leakage occurring occasionally during the past 6 months, with a prevalence of 49% among cancer survivors and 12% among controls, followed by the symptoms loose stools and leakage of loose stools while awake (Fig. 2).

The highest relative risks (RRs) among gastrointestinal symptoms were for the following; emptying of all stools into clothing without forewarning, RR 11.9 (95% CI: 3.8–37.8), leakage of loose stools while awake, RR 6.1 (95% CI: 3.8–9.7) and defaecation urgency, RR 5.9 (95% CI: 3.7–9.4) (Table 2). Among these symptoms the prevalence was highest for the symptom defaecation urgency, occurring at least once a week during the past 6 months (29%) compared to control women (6%).

3.3. *Symptoms and treatment options*

In Table 3, the symptoms are described in relation to the treatment given. The greatest age-adjusted absolute risk differences between the two treatment groups 'Radiotherapy without surgery' and 'Surgery and radiotherapy' were observed for the symptoms emptying of all stools into clothing without forewarning, with a prevalence of 25% among women treated with radiotherapy alone compared to 10% among women treated with surgery and radiotherapy, followed by abdominal pain with vomiting and leakage of loose stools while awake. The symptoms ability to strain at stool and incomplete bowel emptying were more prevalent among survivors treated with a combination of surgery and radiotherapy (Table 3).

4. Discussion

Among long-term gynaecological cancer survivors treated during the period 1991–2003 with pelvic radiotherapy alone or as a part of combined treatment modality, we observed an increased occurrence and intensity of long-lasting gastrointestinal symptoms. The greatest relative risk between cancer survivors and population control women is for the symptom emptying of all stools into clothing without forewarning, while the greatest absolute difference is for the symptom defaecation urgency with faecal leakage.

The extent to which cancer survivors experience symptoms as a result of radiotherapy and surgery depends on, among other things, the available technology and level of knowledge among those providing medical care. These

factors vary from country to country, from one hospital to another, and are continuously changing with further development. No general conclusions may therefore be drawn concerning the unwanted side-effects of radiotherapy, from either our data or data published in other studies. The available literature demonstrates that individuals who have been cured of cancer do experience symptoms with a higher frequency and intensity than those that occur in the population at large.[2,12,17,18]

Andreyev and co-workers have previously shown that gastrointestinal symptoms after pelvic radiotherapy are far more common than those generally recognised.[19] Olopade and co-workers have modified a questionnaire developed for a population with inflammatory bowel diseases and by adding the Vaizey Incontinence questionnaire they studied cancer survivors after treatment.[20] They captured different entities of faecal incontinence and social functioning among cancer survivors and in a cohort of 62 gynaecological cancer patients 31% were incontinent for solid stools, 47% incontinent for liquid stools and 58% incontinent for gas.[20] A comparison between the measured prevalence of solid, liquid and gas incontinence in our study and in the study that Olopade and co-workers conducted might be compromised by different methods used to assess faecal incontinence and time since treatment. In the study by Olopade and co-workers the follow-up after radiotherapy was a mean of 27 months compared with 86.1 months in our study.

There is no standard definition of faecal incontinence.[21] The International Continence Society (ICS) collaboration recommends the definition involuntary loss of liquid or solid stool. The severity can range from mild soiling to emptying of *all* stools and can be categorised into passive, urge incontinence or a combination of both. We have, however, used phrasings reported by the patients themselves in order to discriminate different symptoms of faecal incontinence. The reason for this approach is twofold; by describing a symptom as detailed as possible we may improve our understanding of the underlying mechanism. It is quite clear that defaecation urgency with faecal leakage is a different symptom from emptying of all stools into clothing without forewarning and probably has a different patho-physiology. The second reason is our ambition to help improve communication between professional health-care providers and patients when cancer survivors seek help and treatment options for faecal incontinence, a social disabling and embarrassing condition.

Emptying of all stools into clothing without forewarning occurred in 70 of 606 survivors who responded to this question and in three of 344 controls, giving an age-adjusted absolute risk difference of 10 percentage points. This translates into that around 60 (10% of 606) of the 70 afflicted cancer survivors would not have experienced this symptom if the groups were the same. It is not reasonable to believe that confounding factors explain more than a small part of this difference. Available data support the conclusion that absorbed ionising radiation in excess of a specific dose and volume to the anal sphincter leads to leakage of faeces[22–24] and that absorbed ionising radiation delivered to the rectum can cause chronic ischaemic change and submucosal fibrosis resulting in defaecation urgency.[25] It is therefore likely that absorbed ionising radiation to the rectum or anal sphincter causes some type of long-lasting damage explaining part of the increased occurrence of emptying of all stools into clothing without forewarning.[25] We observed this symptom during the initial qualitative phase of the project and described it in the study-specific questionnaire as one of 32 symptoms assuming to arise in the rectum or anal sphincter. So far we have found only one article reporting passive faecal incontinence, as a possible effect of radiation to the pelvic region.[25]

Defaecation urgency resulting in faecal leakage occurred occasionally in almost half of the survivors treated with surgery and radiotherapy. In a prospective randomised trial Haddock and co-workers evaluated the impact of sucralfate on bowel function in patients receiving pelvic radiotherapy. One year after completion the most common adverse bowel function was urgency affecting 53% of the cancer survivors.[4] Previous studies within our group have shown that diminishing the dose to the rectum might reduce the risk of defaecation urgency.[22]

A challenge in interpreting the statistical analysis is created by the fact that many symptoms are more or less strongly associated with one another. The simultaneous occurrence of two or more symptoms may arise because they depend on the same physiological process. After surgery and radiotherapy, fibrosis may damage nerves and blood vessels. Given improved insight into how symptoms co-vary, we should be able to improve our understanding of which symptoms diminish the quality-of-life among women who have been cured of cancer by different therapy modalities.

Some of the strengths of the study are that it is large, includes a population-based patient cohort, and has a high participation rate (78%). Application of multiple-validated measurements, comprehensive face-to-face validation of outcomes (exposures) and use of a privately answered questionnaire lowered the risk for measurement errors and eliminated interviewer-induced bias. The unwanted difference in age may influence the comparison between survivors and population controls; however, adjustment for age changed the relative risks little, if at all. Based on our results, we cannot judge to what degree radiotherapy, surgery, chemotherapy, or any other factor, induces the increased occurrence among cancer survivors. The results are time- and place specific and may not be relevant for other settings than ours. We have not studied subjects more than 80 years old and do not know whether or not results differ among the elderly.

Successful cancer treatment generates new cancer survivors but also brings new challenges to the entire health-care system. Symptoms such as leakage of faecal material and flatus as a consequence of cancer treatment can evolve many years after completion of therapy and when patients are no longer in oncology health-care. Consequently, these cancer survivors may show up anywhere in the health-care system with undefined symptoms resulting in sometimes extensive and expensive investigations and treatments with poor results. A well-informed patient on the other hand is more inclined to recognise symptoms as possible effects of cancer treatment and to take necessary action. For today's cancer survivors, our data may raise awareness of gastrointestinal symptoms and of faecal incontinence in particular, with the potential benefit of promoting care-seeking, management and hopefully reduced suffering. For tomorrow's cancer

survivors, it is possible that our data can be used to identify underlying treatment-induced mechanisms and thereby provide a way for prevention. We will investigate whether or not absorbed dose to volumes of normal tissue in the small pelvis can be linked to the symptoms presented.

Conflicts of interest statement

None declared.

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