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Moderate progress for ovarian cancer in the last 20 years: prolongation of survival, but no improvement in the cure rate

J. Engel[a,*], R. Eckel[a], G. Schubert-Fritschle[a], J. Kerr[a], W. Kuhn[b], J. Diebold[c], R. Kimmig[d], J. Rehbock[e], D. Hölzel[a]

[a]*Munich Cancer Registry of the Munich Comprehensive Cancer Center, Department for Medical Informatics, Biometry and Epidemiology, Ludwig Maximilians University, Marchioninistraße 15, 81377 Munich, Germany*

[b]*Center for Obstetrics and Gynaecology, Hospital of the University, Sigmund-Freud-Straße 25, 53105 Bonn, Germany*

[c]*Department of Pathology, Ludwig Maximilians University, post-office box, 81366 Munich, Germany*

[d]*Clinic for Gynaecology and Obstetrics, Hospital of the University, Hufelandstraße 55, 45147 Essen, Germany*

[e]*Clinic for Gynaecology, Hospital of the Ludwig Maximilians University—city center, Maistraße 11, 80337 Munich, Germany*

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Abstract

Although ovarian cancer treatment has advanced in the last 20 years, long-term survival remains stable. The purpose of this study was to determine whether survival has improved in line with treatment advances in a population-based prospective cohort of ovarian cancer patients (1978–1997, with a follow-up through to 2000). The 10-year overall survival rate for cancer patients was similar before and after 1988: 32.2% ($n=1661$) and 34.4% ($n=2089$). For patients after 1988, a 12-month prolongation of median survival was observed. In terms of stage according to the International Federation of Gynecology and Obstetrics (FIGO), only FIGO I and FIGO II patients showed, in addition to a prolongation in survival, an absolute improvement of 12.9 and 12.6% after 5 years and of 13.2 and 8.6% after 10 years. This hardly affected the survival of the total sample. For the most frequent stage FIGO III patients and for FIGO IV patients, a prolongation in survival time, but no improvement in survival rate, was seen after five or 10 years. The progress in FIGO I and II patients may be due to more accurate staging. More effective chemotherapy may also explain some of the improvement. The prolongation in FIGO-stages III-IV may be due to more radical surgery. Patient selection criteria, not only the treatment modalities, may be responsible for the superior results reported in clinical trials. Cancer registries are important for evaluating the quality of healthcare delivery.

Keywords: Ovarian cancer; Survival; Cancer registry; Surgery; Chemotherapy; Epidemiology

1. Introduction

In the last two decades, much progress in the treatment of ovarian cancer has been reported. Since 1975, when Griffiths related the duration of survival to the diameter of the largest residual cancer [1], several studies have addressed the importance of residual disease [2–6]. At approximately the same time, irradiation was withdrawn as a primary treatment for ovarian cancer [7,8]. Ovarian cancer was also one of the first solid tumours treated with cytotoxic drugs [9,10]. In the last 20 years, many therapeutic studies in select samples have reported improvements in different chemotherapy treatments on response rate, side-effects and survival [11–17]. Routine chemotherapy regimens were frequently changed because the prognosis of advanced disease was unacceptable. Monotherapies, non-platinum combination therapies, cisplatin, and carboplatin combination therapies, and, in the last few years, taxanes, have been employed, depending on the latest study results [9,12,18,19].

Parallel to this development, over 20 years of epidemiological data from the US and Europe revealed a remarkable stability in mortality while incidence rates also remained stable [20–22]. The conclusions of the Advanced Ovarian Cancer Trialists Group confirmed

* Corresponding author. Tel.: +49-89-7095-4489; fax: +49-89-7095-4753.

E-mail address: engel@ibe.med.uni-muenchen.de (J. Engel).

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this trend: "For non-platinum regimens compared with the same regimen plus cisplatin, the survival hazard ratio was 0.88 in favour of the addition of platinum to drug regimens". "The available evidence, although not conclusive, suggested that platinum-based chemotherapy was better than non-platinum therapy" [23].

The secular developments over the past 20 years, the present state of ovarian cancer and the effects of treatment will be highlighted by the data from the Munich Cancer Registry (MCR), part of the Munich Comprehensive Cancer Center (MCCC). The contradiction between medical progress and stable mortality rates will be discussed. This paper presents population-based data of survival analysis by FIGO-stage and crucial treatment variables over a long time period. These additional data allow some interpretation of success or limited success in treating ovarian cancer, comparison with the results of randomised clinical trials and feedback to clinicians concerning their own achievements.

2. Patients and methods

2.1. Data collection

The MCCC has a catchment area of approximately 2.3 million inhabitants (1.2 million in Munich, 1.1 million in the surrounding area). The MCR data collection began in 1978 in three gynaecological departments of two medical faculties. Co-operation was increasingly expanded. Approximately 10 years later, since 1988, all the hospitals in the region have been more or less involved. Six gynaecological departments were responsible for over 70% of all primary treatment of ovarian tumours. Initially, all patients were registered, irrespective of their place of residence. However, approximately 45% of the patients treated in the region live outside of the defined registry catchment area. Results and primary treatment are routinely collected in the hospitals through tumour-specific forms. Additionally, doctors' letters, irradiation reports and pathology results are processed, the latter have been comprehensively available since 1994. Nevertheless, like every tumour registry, the MCR has had problems with the quality of its data. Only certain data are recorded: the International Federation of Gynecology and Obstetrics (FIGO)-stage, histology, grading and the extent of the operation. Treatment by chemotherapy or radiotherapy, is recorded, but no details of course or dosage are noted.

For follow-up, the hospitals also provide details about disease progression. Additionally, life-status is systematically ascertained by the inhabitant registration office. In 1998, the Bavarian Cancer Registration Law also came into force enabling all death certificates to be processed. Thus, at present, follow-up in terms of life-status is available for over 95% of patients.

2.2. Guidelines

For the interpretation of the data, it should be noted that the MCCC issue recommendations to hospitals and general practitioners in the region on diagnosis, treatment and aftercare. These are regularly revised in line with the latest advances in knowledge. The first edition appeared in 1984 and described best practice at that time. Cisplatin combination therapy or, for the ambulatory supply, monotherapy with melphalan was recommended. In the first two editions, radiotherapy was still mentioned as a possible adjuvant measure following radical operation. In 1991, in the third edition, the less toxic combination therapy with carboplatin was endorsed. In 1996, at the time of the fourth edition, taxanes were not yet certified for adjuvant therapy in Germany. Since the fifth edition in 1998, standard recommendations of taxanes for FIGO stages II to IV apply.

2.3. Patients

Altogether, 4564 patients with a single malignant ovarian tumour were documented from 1978 to 2000 (patients with synchronous or metachronous secondary malignancies were not included). Sarcomas were only considered when describing the prognostic relevance of histology. In all other evaluations, sarcomas were excluded. Thus, in the 20-year period from 1978 to 1997, 3750 patients with ovarian cancer were evaluated, irrespective of place of residence. This interval has been split, *a priori*, into two halves up to and beyond 1988. 1997 was selected as the cut-off point to enable evaluation of new cases every 5 years while allowing for a median follow-up of over 3 years for the 1997 cohort. Survival analyses were conducted in patients from the 2.3 million catchment area. For an overall description of the current state of ovarian cancer, the population-based data from 1988 to 2000 were evaluated. For this overview of the present epidemiological situation, only 1695 representative patients, resident within the Munich region, were considered.

2.4. Statistical analysis

The MCR handles the data in an Oracle database. For the statistical analyses, Statistical Analysis System (SAS) (version 6.1) was employed. Due to the large sample size, the appropriate tests for the categorical and survival data were significant, even if not explicitly mentioned. Survival was established using Kaplan–Meier estimates and compared by log-rank χ^2 statistic. In the multivariate procedures, the Cox proportional hazard model was used to assess the prognostic effects of patient, tumour and treatment characteristics on survival. The proportional hazards assumption was

confirmed by inspection of log (−log [survival]) curves and by examination of time-dependent covariates. For the 20-year period from 1978 to 1997, three models were tested. For the time period from 1978 to 1987, for 1988 to 1997 and for the whole time from 1978 to 1997. Each model included age, FIGO-stage, histology, radicality of the operation, chemotherapy and radiotherapy as covariates. After backward elimination, radiotherapy remained in the model only during the first time period. As no details were available concerning the specifics of the chemotherapy treatment, the chemotherapy variable was subdivided into four dummy variables, each representing a 5-year time interval. These proxy variables try to reflect advances in chemotherapy treatment over time.

3. Results

To describe developments over time, the results from 1978 to 1987 are compared with those from 1988 to 1997 in Table 1. In Tables 2 and 3 only new ovarian cancer patients between 1988 and 2000 and resident in the catchment area were considered. These tables present a clear epidemiological picture of the state of ovarian cancer today. The mean age-standardised incidence for 1996 and 1997 was 16.7 (raw) and 9.1 (world standard). In Table 2, elementary clinical characteristics according to FIGO-stage are shown. The stage-specific mean age value clearly reflects tumour growth. In addition, Table 3 describes the relevant biological factors. As this table presents the data from a clinical perspective, sarcoma is specified. Fig. 1 shows overall survival differentiated by FIGO-stage. Limitations can be seen with such a detailed stage classification by tumour size and spread as stages IIc and IIIa did not follow the expected prognostic sequence.

The prognostic value of maximal tumour reduction is shown impressively in Fig. 2. The survival rates attained here depend crucially on the extent of the operation. Even a radically treated stage IV shows a better survival rate than any other stage where some tumour remains. Fig. 3 shows the decrease in adjuvant radiotherapy over a 10-year period. Those receiving both chemotherapy and radiotherapy were recorded in each treatment group.

Taking a longitudinal view of the data, in Fig. 4 it is evident that since 1988 an improvement in survival has been achieved. However, only in FIGO I and II can an improvement in the long-term survival rate be seen. Only FIGO I and FIGO II showed, in addition to a prolongation in survival, an absolute improvement of 12.9% and 12.6% after five years and of 13.2% and 8.6% after 10 years. FIGO-stage III (the most frequent stage) shows only a prolongation of survival, but not a significant improvement of cure rate after 6–8 years, when life expectancy is nearly comparable to the normal population. In addition, FIGO IV shows only a prolongation in survival time. Altogether, stage-independently, 5- and 10-year overall survival improved only slightly (5-year survival before and after 1988: 40.8 and 45.7%; 10-year survival before and after 1988: 32.2 and 34.4%). The relative survival showed a similar pattern (5-year survival before and after 1988: 42.9 and 49.0%; 10-year survival before and after 1988: 35.9 and 39.9%).

Table 4 shows the results of the Cox analyses. After adjustment for age, FIGO-stage and histology, the following relative risks (RR) for treatment methods resulted for the 20-year period: A residual tumour greater than 2 cm or biopsy only were designated as the referent group. In comparison, the RR for a residual tumour $\leqslant 2$ cm was 0.6 while following radical operation the RR was 0.3. Compared with patients without chemotherapy, the RR for chemotherapy between 1978 and 1982 was 0.9, between 1983 and 1987 was 0.7, between 1988 and 1992 was 0.6, and between 1993 and 1997 was 0.6 as proxies for improved chemotherapy schemes. The influence of radiotherapy was not significant.

Since there are no differentiated results for population-based cohorts, only comparisons with randomised trials can be considered. The extensive exclusion criteria (e.g. comorbidity) of randomised controlled trials, however, leads to results which are incompatible with simple population-based registry data. Age, however, can serve as a proxy-variable for comorbidity and general health state, even if insufficiently. Fig. 5 illustrates overall survival by FIGO-stage, for patients presenting with new disease after 1988. Three groups are shown: all patients (median age: 60.0 years), patients under 75 years old (median age: 58.1 years) and patients under 70 years old (median age: 56.1 years). These results stratified by stage and age can be compared with randomised clinical trials.

4. Discussion

The data submitted here are population-based and compare with present day international incidence rates, at least since 1988 (1996/1997 raw incidence: 16.7; world standard: 9.1) [24]. The distribution of age and FIGO-stages are also comparable with the SEER data [20,25].

Incidence and mortality rates for ovarian cancer have remained constant for decades [20,21]. However, the 20% absolute improvement in 5-year survival between 1950 and 1995 in the USA, for example, only corresponds to a 2% decline in mortality [26]. A remarkable 10% improvement in 5-year relative survival between 1987 and 1988 is visible in the SEER data [20]. However, this apparent improvement stems from additional documentation of histology codes for cystadenomas of the ovary and borderline malignancies that started in

1988 (L.A. Ries, National Cancer Institute). Thus, since 1973, the SEER data also only show a small improvement in long-term survival. In Europe (at least for the northern countries with excellent cancer registration), standardised mortality rates have been stable since 1979 and are comparable to our data [22]. A small improvement in mortality was only evident in the under 65 year old age group, in the USA as well as in Europe [20,22,27,28]. This decline in mortality may not necessarily be a consequence of extended oral contraception use [29] because the incidence rate in this age group was stable [20]. In contrast to the small improvements seen in population-based data, many randomised trials show a continuous improvement in survival [9,10].

Changes to three treatment components may help to explain the apparent improvement in outcome: the development of more radical surgery, the employment of radiotherapy and, as the third component, regular adoption of the latest chemotherapy treatments. All three treatment components were implemented to a large extent in the Munich region in line with the five editions of the MCCC guidelines. First, the development of more radical surgery should be considered. The size of the tumour remaining after operation is an important prognostic factor [2–6,10]. Such surgical improvements also seem to have a consistent effect on survival. In our multivariate analyses, a radical operation demonstrated a positive influence in each time

Table 1
Clinical characteristics for tumours diagnosed between 1978–1987 and 1988–1997

Characteristics			1978–1987 ($n=1661$[a])	1988–1997 ($n=2089$[a])
Age				
	Mean (median)	(years)	57.1 (57.0)	59.6 (60.0)
	Age $\geqslant 70$ years	(%)	18.1	26.0
	Age $\geqslant 75$ years	(%)	7.6	15.0
FIGO-stage		(%)		
	FIGO I		25.1	27.8
	FIGO II		16.8	7.7
	FIGO III		42.6	46.9
	FIGO IV		15.5	17.6
	FIGO missing values[b]	(%)	*6.6*	*5.3*
Histological type[c]		(%)		
	Borderline tumours		4.0	6.6
	Mucinous carcinoma		7.4	6.9
	Clear cell carcinoma		2.2	1.5
	Endometroid carcinoma		8.2	7.9
	Serous carcinoma		47.9	54.8
	Adeno carcinoma NOS		15.5	8.4
	Undifferentiated carcinoma		6.2	3.5
	Germ cell tumours		1.6	1.3
	Sex cord/stromal tumours		3.5	2.0
	Brenner tumour		0.2	0.1
	Multiple types (without sarcoma)		2.8	5.2
	Sarcoma[d]		1.0	1.8
	Histological type missing values[b]	(%)	*2.3*	*4.4*
Histological grade		(%)		
	GB		5.1	10.0
	G1		19.2	13.7
	G2		46.3	36.1
	G3/4		29.4	40.1
	Grading missing values[b]	(%)	*47.8*	*13.2*
Tumour site				
	Both adnexes	(%)	50.7	51.1
	Tumour site missing values[b]	(%)	*11.3*	*12.1*
Debulking surgery		(%)		
	Radical operation for FIGO I		98.7	99.3
	Radical operation for FIGO II		64.3	86.1
	Radical operation for FIGO III		19.6	32.7
	Radical operation for FIGO IV		11.5	13.7
	Operation missing values[b]	(%)	*26.2*	*29.5*

FIGO, International Federation of Gynecology and Obstetrics; NOS, not otherwise specified; GB, Grading for Borderline tumour.

[a] All patients are considered, irrespective of their place of residence at the time of diagnosis.

[b] The percentage of the sub-categories is related to the sum of each item with available data; missing values are not taken into account.

[c] Histological type of 1678 (1978–1987) and 2126 patients (1988–1997) because sarcomas are included.

[d] Inclusive of Müllerian mixed tumour.

period. Since the proportion of radical operations being performed was greater in the years after 1988, this change contributes crucially to the improvement in survival. Second, use of adjuvant radiotherapy in Germany was practically obsolete by the 1980s [24]. A comparable development was observed in the USA approximately 8 years prior to this [7]. Third, chemotherapy treatment has advanced. In our data only the use of chemotherapy is recorded, no details about the drugs, dosage or combinations were known. However, approximately 90% of the hospitals co-operating with the MCR are represented by members in the MCCC, responsible for the latest treatment guidelines. It seems likely, therefore, that the members of the MCCC (ovarian cancer group) implemented the new chemotherapy recommendations in their own institutes. To reflect these advances in the multivariate analyses, chemotherapy was compared across 5-year periods. An increasingly protective influence on survival was demonstrated, in particular in the comparisons after 1988.

The survival curves show an improvement in cure rate mainly in stage I (stage II is only a small cohort). In FIGO I, the difference is 12.9% after 5 years and 13.2% after 10 years. A part of this improvement may be attributed to increased survival in the four histological groups, germ cell and sex cord/stromal tumours as well as mucinous and endometrioid carcinomas. These four histological groups constitute 35.2% of all cases in stage

Table 2
Clinical characteristics according to FIGO-stage between 1988 and 2000

Characteristics ($n=1695$[a])			FIGO I	FIGO II	FIGO III	FIGO IV	All	*Missing*[b]
FIGO-stage ($n=1538$)		(%)	28.3	6.6	43.2	21.9	100.0	*9.3*
Age								
	Mean	(years)	57.0	61.7	62.6	68.1	62.4	
	Median	(years)	56.7	62.5	63.0	68.8	63.0	
	Proportion	(%)						
	$\geqslant 70$ years		22.9	27.7	30.4	46.9	32.9	
	Proportion	(%)						
	$\geqslant 75$ years		3.6	0.8	8.3	7.5	20.2	
Histological type ($n=1575$[c])		(%)						*9.1*
	Borderline tumours		17.8	4.9	0.6	0.0	7.1	
	Mucinous carcinoma		14.5	3.9	4.5	3.5	7.0	
	Clear cell carcinoma		3.5	1.0	0.8	1.1	1.6	
	Endometroid carcinoma		14.8	12.8	5.7	7.0	8.5	
	Serous carcinoma		31.9	50.0	66.8	58.5	51.5	
	Adeno carcinoma NOS		3.8	7.8	8.4	15.6	9.0	
	Undifferentiated carcinoma		0.5	2.9	4.2	3.5	2.9	
	Germ cell tumours		1.2	0.0	0.3	0.4	1.2	
	Sex cord/stromal tumours		4.7	2.9	0.3	0.0	2.0	
	Brenner tumour		0.5	0.0	0.0	0.0	0.2	
	Steroid cell tumour		0.0	0.0	0.2	0.0	0.06	
	Multiple types (without sarcoma)		6.3	8.8	6.5	8.5	6.6	
	Sarcoma[d]		0.5	4.9	1.8	1.8	2.3	
Histological grade ($n=1341$)		(%)						*10.9*
	GB		26.7	6.7	2.0	0.0	10.3	
	G1		27.0	18.9	7.9	3.6	13.2	
	G2		29.3	43.3	36.5	27.7	32.9	
	G3/4		17.1	31.1	53.7	68.7	43.7	
Tumour site ($n=1342$)		(%)						*10.8*
	Both adnexes		15.0	42.1	64.1	60.3	45.5	
Debulking surgery ($n=1046$)		(%)						*38.3*
	Radical		99.4	89.4	33.8	15.9	54.3	
	Remaining tumour $\leqslant 2$ cm		0.0	6.1	37.1	34.1	23.3	
	Remaining tumour > 2 cm		0.6	4.6	21.6	42.6	17.7	
	Laparotomia probatoria		0.0	0.0	7.5	7.4	4.8	

[a] Only patients resident in Munich or surrounding area at time of diagnosis are considered.
[b] The percentage of the sub-categories is related to the sum of each item with available data; missing values are not taken into account.
[c] Histological type of 1732 patients because sarcoma are included.
[d] Inclusive Müllerian mixed tumour.

I. All other histological types showed almost no improvement over the 20-year period. If we exclude these four histological types the improvement in FIGO I is 9.7% (after 5 years) and 10.2% (after 10 years). If radically operated patients alone are considered, survival-analysis showed an improvement only in FIGO-stages I and II, which partly can be attributed to better chemotherapy. Additionally, this progress in cure rate could be explained by more accurate stage classification, demonstrated by the shift between stages in our data. However, the improvement in cure rate was limited to Stages I and II. Stage III and IV showed no rise in cure rate, only a prolongation of the survival period. The median survival time improved in stage II cases by 33.6 months, in stage III by 6 months, in stage IV by 7.2 months and over all stages by 12 months.

Table 3
Histological type according to FIGO-stage between 1988 and 2000

Histology ($n=1732$[a,b])	Distribution (%)	Age mean (years)	Age median (years)	Proportion of FIGO I (%)	Proportion of FIGO II (%)	Proportion of FIGO III (%)	Proportion of FIGO IV (%)
Histological type ($n=1575$)							
Borderline tumours	7.1	55.8	56.2	89.4	5.9	4.7	0.0
Mucinous carcinoma	7.0	57.9	56.8	58.5	3.8	28.3	9.4
Clear cell carcinoma	1.6	60.4	59.9	62.5	4.2	20.8	12.5
Endometroid carcinoma	8.5	61.7	61.1	47.0	9.7	28.4	14.9
Serous carcinoma	51.5	62.4	62.9	17.1	6.4	55.7	20.8
Adeno carcinoma NOS	9.0	64.5	64.2	12.8	6.4	44.8	36.0
Undifferentiated carcinoma	2.9	64.5	65.9	4.7	7.0	65.1	23.3
Germ cell tumours	1.2	33.0	28.5	62.5	0	25.0	12.5
Sex cord/stromal tumours	2.0	53.5	54.3	80.0	12.0	8.0	0
Brenner tumour	0.2	67.9	64.9	100.0	0.0	0.0	0.0
Steroid cell tumour	0.06	63.8	63.8	0.0	0.0	100.0	0.0
Multiple types (without sarcoma)	6.6	62.0	61.0	26.2	8.7	41.8	23.3
Sarcoma[c]	2.3	65.4	68.5	8.3	20.8	50.0	20.8
Missing[d]	*9.4*	*74.5*	*77.0*	[e]	[e]	[e]	[e]

[a] Only patients resident in Munich or surrounding area at time of diagnosis are considered.
[b] Histological type of 1732 patients because sarcoma are included.
[c] Inclusive Müllerian mixed tumour.
[d] The percentage of the sub-categories is related to the sum of available data to histological type; missing values are not taken into account.
[e] 14.7% of FIGO-stages according to histological type are missing.

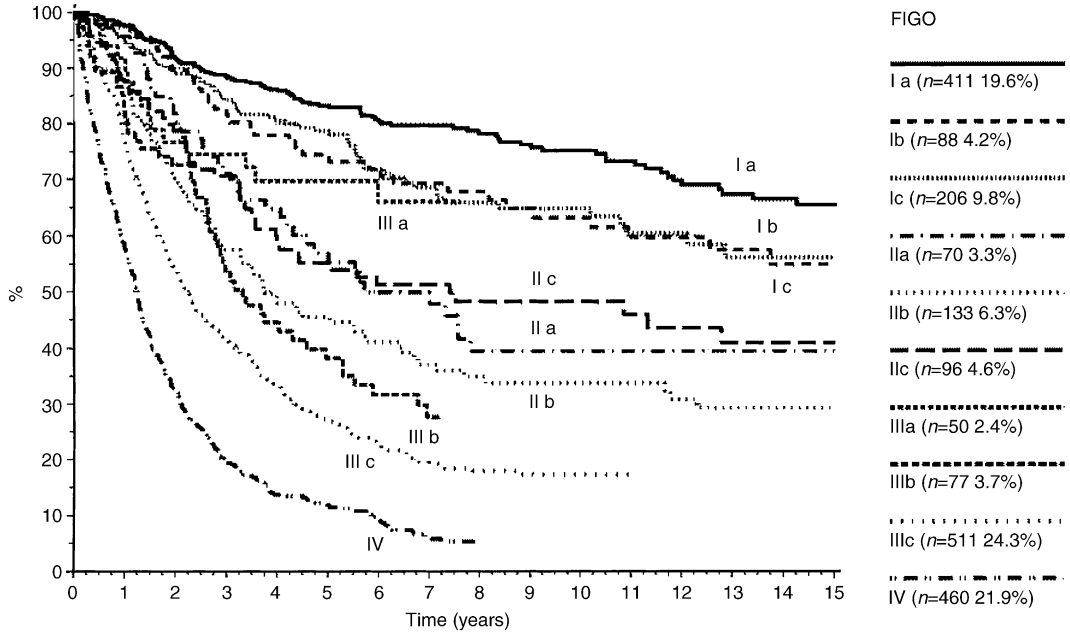

Fig. 1. Overall survival according to FIGO-stage.

The Cox analysis separated for the two time periods showed higher relative risks for increasing FIGO-stages in the period since 1988. This can be interpreted as more exact staging. In the first period (until 1987), radiotherapy still showed a risk reduction in the same way as chemotherapy does later. Given that chemotherapy is more effective for certain histological types and especially in FIGO-stages I and II, the prolongation of survival in the most frequent stage, FIGO III, can be explained by the strongest factor for risk reduction, the radical operation.

Can survival rates in the MCR compare with a randomised controlled trial? A direct comparison is not possible as population-based studies do not employ selection criteria. Using age as a proxy-variable to reflect comorbidity and excluding over 75 or over 70 year olds, survival rates in our sample improved. When only under 75 year olds were considered, the median age

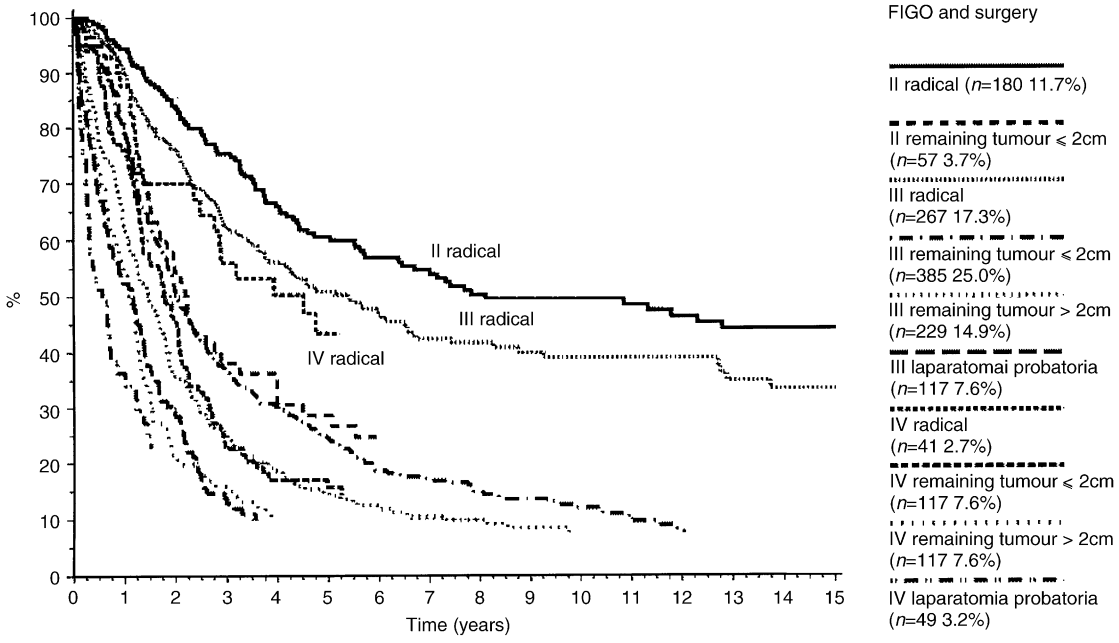

Fig. 2. Overall survival according to radicality of surgery for FIGO-stages II–IV.

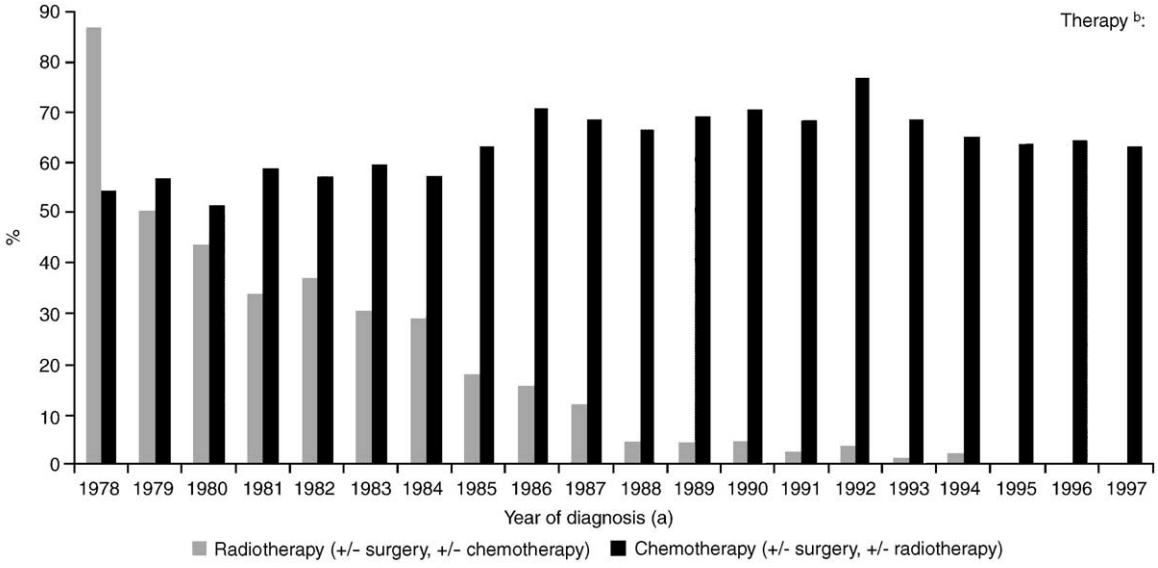

Fig. 3. Decrease in adjuvant radiotherapy for tumour diagnosis between 1978 and 1997. [a]All patients are considered, irrespective of their place of residence at the time of diagnosis. [b]Kind of therapy missing values 4.2%.

Table 4
Cox proportional hazards analysis of time to death for patients diagnosed between 1978 and 1997[a]

Covariates		Relative risk	95% Confidence interval
Age (years)			
	<50	1	Reference
	50–59	1.4	1.2–1.7
	60–69	1.9	1.6–2.3
	⩾70	2.8	2.3—3.3
Histology			
	Serous/adeno NOS carcinoma	1	Reference
	Undifferentiated carcinoma	1.1	0.9–1.3
	Mucinous/endometrioid/clear cell carcinoma	1	0.8–1.2
	Germ cell/sex cord-stromal tumours	0.6	0.4–0.9
	Borderline tumours	0.3	0.2—0.4
FIGO			
	FIGO I	1	Reference
	FIGO II	1.8	1.4–2.2
	FIGO III	2.7	2.2–3.4
	FIGO IV	4.2	3.2—5.5
Debulking surgery			
	Remaining tumour > 2 cm	1	Reference
	Remaining tumour ⩽2 cm	0.6	0.5–0.7
	Radical operation	0.3	0.3–0.4
Chemotherapy			
	No chemotherapy	1	Reference
	Chemotherapy 1978–1982	0.9	0.8–1.1
	Chemotherapy 1983–1987	0.7	0.6–0.9
	Chemotherapy 1988–1992	0.6	0.5–0.7
	Chemotherapy 1993–1997	0.6	0.5–0.7

[a] Follow-up to the end of 2000.

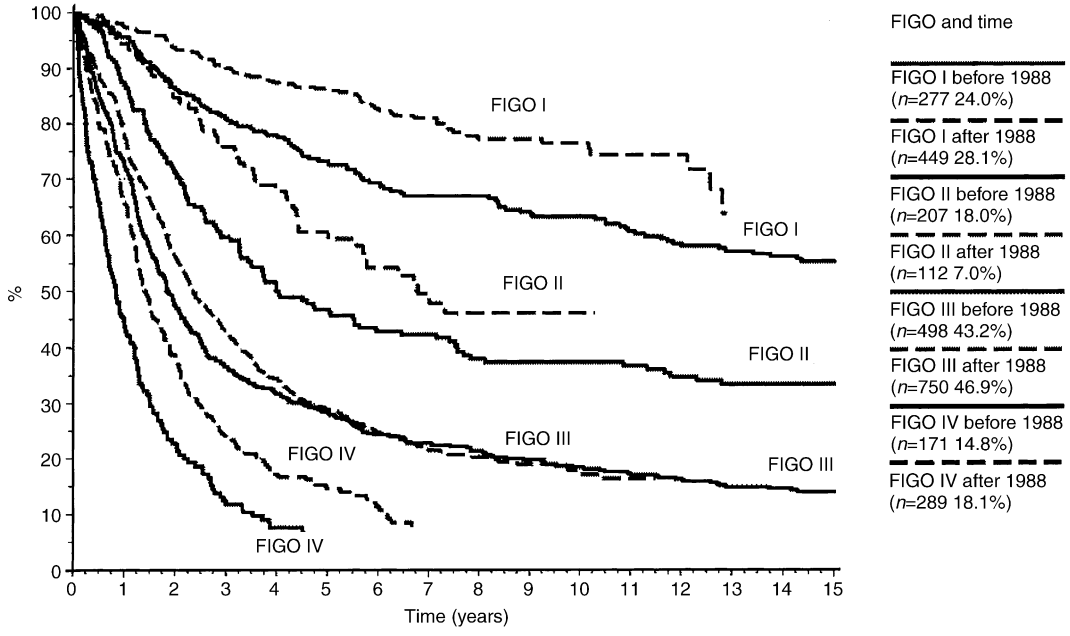

Fig. 4. Overall survival according to FIGO-stage for the two time periods, before 1988 and afterwards.

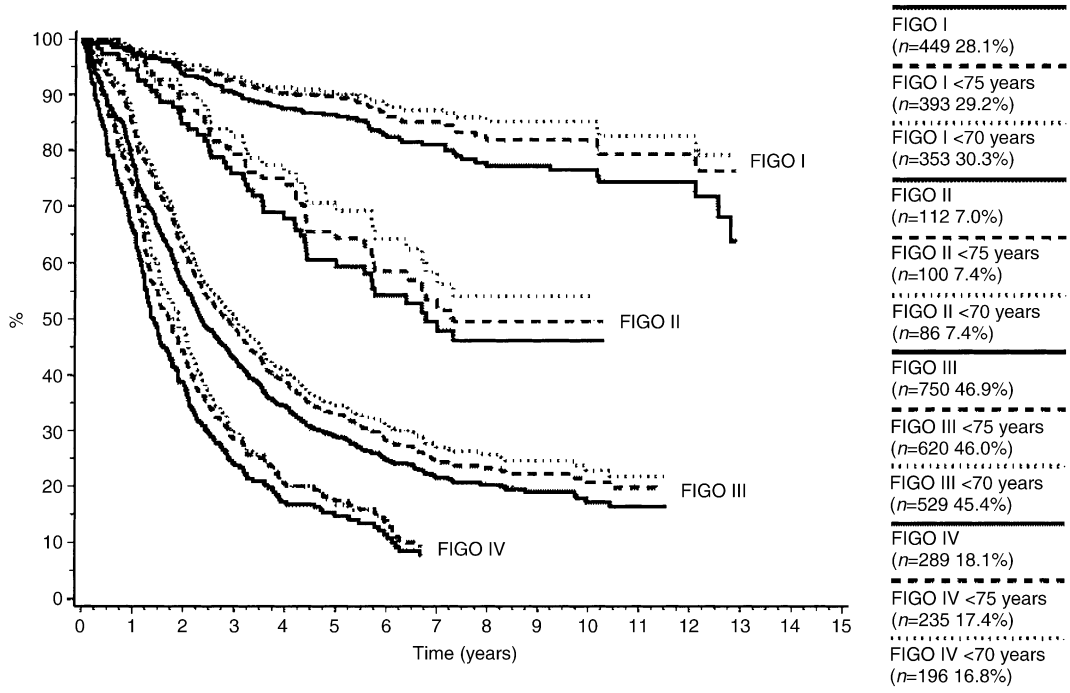

Fig. 5. Overall survival according to FIGO-stage for different age groups for the time period from 1988 to 1997.

in our sample was similar to that reported in the Gynaecologic Oncology Group clinical trial [13]. The MCR data were then weighted to reflect the stage distribution of the randomised controlled trial data. In this instance, the 3-year survival rates were almost identical in the two studies. This seems to demonstrate that, when age (or comorbidity) was controlled for, the survival rates in our sample matched the survival rates with treatment in a randomised controlled trial. Better survival rates in trials may, therefore, stem mainly from the use of exclusion criteria.

In summary, the results of the MCR data analyses demonstrate that, for ovarian cancer, a longer observation time is necessary. The survival curves show an improvement in cure rate in stages I and II of approximately 10%. This hardly affected the survival of the total sample. Some of this improvement can be explained by the increased survival of patients with specific histological types, which may respond better to newer chemotherapy regimens. Another contributor may be a more accurate stage classification. For stages III–IV, an extension of the survival time, but no improvement in long-term survival was observed, as in previous meta-analyses [9,18,23]. The main cause appears to be the increase in the proportion of radical operations performed. The implementation of new chemotherapy treatments is also an important factor, but to a lesser extent. These results explain the concurrent stability of survival and incidence rates.

Our analyses illustrate the scope of tumour registries using the example of ovarian cancer. Annual tumour registry cohorts should be regarded as observational studies. Thus, over time, tumour registries can also monitor the implementation and effect of innovative treatments in the population as a whole. The value of observational studies and the public health relevance of tumour registries are still underestimated [30]. As long as analyses of population-based data consider external factors, such as changes in treatment, even limited data can be used by tumour registries to monitor treatment progress and to assess the quality and effectiveness of care in a region. Tumour registries, in this way, are important healthcare research instruments. Finally, although randomised trials report high treatment success, such levels are not always possible in population-based research because patient exclusion criteria are not employed. In fact, tumour registries can show that the actual progress is smaller. The consensus that clinical trials show superior results may stem from underestimating the effects of patient selection.

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