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(Accepted 3 June 1997)

Time since childbirth and prognosis in primary breast cancer: population based study

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Abstract

Objective: To investigate whether time since birth of last child was of prognostic importance in women with primary breast cancer.
Design: Retrospective cohort study based on a population based database of breast cancer diagnoses with detailed information on tumour characteristics, treatment regimens, reproductive factors, and vital status.
Setting: Denmark.
Subjects: 5652 women with primary breast cancer aged 45 years or less at the time of diagnosis.
Main outcome measures: 5 and 10 year survival; relative risk of dying.
Results: Women diagnosed in the first 2 years after last childbirth had a crude 5 year survival of 58.7% and 10 year survival of 46.1% compared with 78.4% and 66.0% for women whose last childbirth was more than 2 years before their diagnosis. After adjustment for age, reproductive factors, and stage of disease (tumour size, axillary nodal status, and histological grading), a diagnosis sooner than 2 years since last childbirth was significantly associated with a poor survival (relative risk 1.58, 95% confidence interval 1.24 to 2.02) compared with women who gave birth more than 5 years previously. Further analyses showed that the effect was not modified by age at diagnosis, tumour size, and nodal status.
Conclusion: A diagnosis of breast cancer less than 2 years after having given birth is associated with a particularly poor survival irrespective of the stage of disease at debut. Therefore, a recent pregnancy should be regarded as a negative prognostic factor and should be considered in counselling these patients and in the decisions regarding adjuvant treatment.

Introduction

An early first delivery and a large number of childbirths are among the best established factors conferring a low risk of breast cancer.[1] Recent studies have described a dual effect of full term pregnancy on the risk of breast cancer, with a transiently increased risk immediately after childbirth followed by a long term reduction in the risk .[2-4]

Although these findings relate to the risk of developing breast cancer, they could also have implications for the prognosis of this disease. A breast cancer that is established before or during pregnancy might accelerate its growth under the influence of high

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BMJ 1997;315:851–5

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concentrations of pregnancy hormones, primarily oestrogens. However, reports on this point are conflicting because of problems with small study sizes or the lack of adjustment for relevant tumour characteristics and reproductive history.[5-7]

We used three nationwide Danish registries, one containing detailed information on tumour characteristics, treatment regimens, and clinical outcome and two others containing complete information on parity, to evaluate the influence of reproductive history on breast cancer survival.

Methods

Population registries

The Danish Breast Cancer Cooperative Group, DBCG, started its national prospective studies in 1977. Three treatment programmes have been run, DBCG 77 (patient accrual from 1978 to 1982), DBCG 82 (patient accrual from 1983 to 1989), and DBCG 89 (ongoing accrual started in 1990). The Danish cancer registry contains information on almost all cases of malignant neoplasms diagnosed in Denmark since 1943.[8] The Danish Breast Cancer Cooperative Group has information on 93% of all breast cancer patients aged under 45 at diagnosis reported to the registry.

Since 1968, the civil registration system has assigned a unique 10 digit identification number to all residents in Denmark, which permits accurate linkage of information from different registries. The system's registry also keeps updated files on dates of childbirths and vital status. Information about stillbirths was added from the national birth registry.

Table 1 Distribution of 5652 breast cancer patients aged 45 or less at diagnosis according to tumour characteristics, age, risk group allocation, and time since birth. Values are numbers (percentages)

	Time since last childbirth				
Variable	**Nulliparous (n=695)**	**< 2 years (n=201)**	**2-3 years (n=280)**	**4-5 years (n=349)**	**⩾6 years (n=4127)**
Age (years):					
<30	46 (6.6)	33 (16.4)	24 (8.6)	16 (4.6)	4 (0.1)
30-34	92 (13.2)	84 (41.8)	93 (33.2)	77 (22.1)	180 (4.4)
35-39	169 (24.2)	60 (29.9)	188 (42.1)	147 (42.1)	977 (23.7)
40-45	388 (55.8)	24 (11.9)	45 (16.1)	109 (31.2)	2966 (71.9)
Tumour size (cm):					
⩽2	299 (43.0)	94 (46.8)	134 (47.9)	167 (47.9)	2240 (54.3)
>2 ⩽5	260 (37.4)	74 (36.8)	94 (33.6)	115 (33.0)	1308 (31.7)
>5	72 (10.4)	14 (7.0)	33 (11.8)	33 (9.5)	266 (6.5)
No information	64 (9.2)	19 (9.5)	19 (6.8)	34 (9.7)	313 (7.6)
No of positive nodes:					
0	328 (47.2)	81 (40.3)	129 (46.1)	153 (43.8)	2180 (52.8)
1-3	200 (28.8)	56 (27.9)	86 (30.7)	115 (33.0)	1134 (27.5)
4-9	85 (12.2)	34 (16.9)	33 (11.8)	44 (12.6)	449 (10.9)
⩾10	24 (3.5)	18 (9.0)	10 (3.6)	17 (4.9)	135 (3.3)
No information	58 (8.4)	12 (6.0)	22 (7.9)	20 (5.7)	229 (5.6)
Histological grading:					
I	146 (21.0)	30 (14.9)	52 (18.6)	71 (20.3)	994 (24.1)
II+III	394 (56.7)	132 (65.7)	166 (59.3)	205 (58.7)	2219 (53.8)
Other*	155 (22.3)	39 (19.4)	62 (22.1)	73 (20.9)	914 (22.2)
Protocol allocation:					
Yes	523 (75.3)	156 (77.6)	228 (81.4)	289 (82.8)	3442 (83.4)
No					
Not treated according to surgical guidelines	100 (14.4)	35 (17.4)	42 (15.0)	44 (12.6)	521 (12.6)
Not allocated for other reasons†	72 (10.4)	10 (5.0)	10 (3.6)	16 (4.6)	164 (4.0)

*Including patients with non-ductal carcinomas and patients without information on histologic grading.
†Medical contraindications, bilateral breast cancer, distant metastasis, or inflammatory cancer.

Subjects

Permission was obtained in advance from the national scientific ethics committee and the data protection board to link information on patients in the Danish Breast Cancer Cooperative Group's registry with the civil registration system registry. This registry does not systematically link women born before 1935 to all their children; therefore, to obtain the complete reproductive histories of the women we restricted our study group to women born since 1 April 1935. Because our objective was to study the influence of time since birth on breast cancer survival and because we also wanted to limit the analysis to premenopausal women, we included only women aged 45 or less at the time their breast cancer was diagnosed. All women diagnosed before 1 October 1994 were included and followed until 1 October 1995 with respect to vital status.

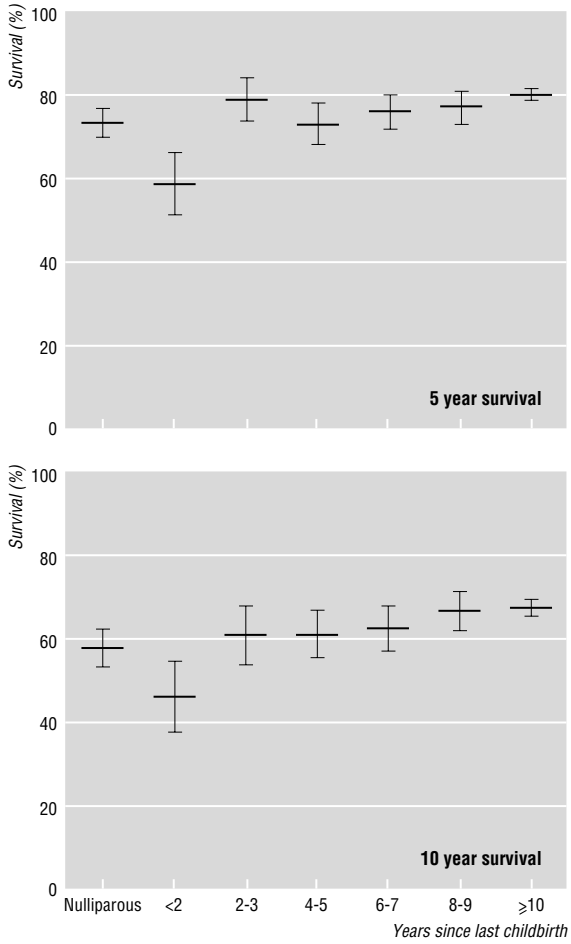
Treatment

Primary surgical treatment was total mastectomy plus axillary sampling (90% of the population) or lumpectomy with axillary sampling, after which patients were classified as low risk or high risk according to histopathological criteria. Low risk patients had tumours <5 cm in diameter without axillary lymph node metastases and without invasion into the skin or the deep resection line (DBCG 77 and DBCG 82); in the DBCG 89 programme, premenopausal node negative patients had tumours classified as histological grade I. High risk patients were those with a primary tumour >5 cm or with lymph node metastases in the axilla or with tumour growth into the skin or the deep resection line (DBCG 77 and DBCG 82). In the DBCG 89 programme, premenopausal patients with grade II and III anaplasia were classified as high risk patients. Patients with bilateral breast cancer, distant metastases, or inflammatory cancer or with contraindication to the planned postoperative treatment or who were not treated according to the surgical guidelines were not allocated to treatment protocols.

In all three programmes, low risk patients were given no systemic treatment after surgery. In the DBCG 77 programme, high risk patients were allocated to either postoperative radiotherapy or radiotherapy and systemic treatment, as described elsewhere.[9] In the DBCG 82 programme, high risk patients were allocated to systemic treatment and radiotherapy or to systemic treatment alone.[9] The target for radiotherapy after mastectomy included the chest wall and regional lymph nodes (axillary, supraclavicular, infraclavicular, and parasternal nodes). In the DBCG 89 programme, high risk patients were given systemic treatment according to steroid hormone receptor status. Radiotherapy including the chest wall was given if the tumour invaded the deep resection line. All patients who had lumpectomy were given radiotherapy to the residual breast tissue.

Statistical analysis

The associations between the study variables and survival were investigated using the Cox proportional hazards method.[10] Multivariate analyses included tumour characteristics, time between diagnosis and



Five year survival (top) and 10 year survival (bottom) according to time since last childbirth in 5652 women with primary breast cancer. Bars indicate 95% confidence intervals

most recent childbirth, age at diagnosis, year of treatment, and protocol allocation. Parity was eliminated from the final multivariate model as it was not significant. Because survival for the age categories representing six and more years after childbirth was similar, we defined a reference category for the variable "time since birth" as ⩾6 years to be used in the multivariate analyses. The adequacy of the proportional hazard assumptions for the included variables was checked by log(−log) plots from stratified multivariate analyses. The Cox regression was performed in four strata (information on tumour size and lymph node status available, only tumour size missing, only lymph node status missing, both missing). Estimation was done using the SAS procedure PROC PHREG.[11]

Results

Overall, 5752 women aged 45 years or less were identified for our study. The influence of pregnancy subsequent to treatment of breast cancer has been debated,[12] and hence 100 patients were excluded due to delivery after the time of their diagnosis, leaving 5652 patients for further analyses. Follow up ranged from 13 months to 17 years, representing a total of 34 130 person years of follow-up. Overall, 4957 women (87.7%) were parous and 695 (12.3%) were nulliparous. Table 1 shows the distribution of patient age, tumour characteristics, and risk group allocation according to time since last birth.

The figure shows the overall 5 year and 10 year survival for women according to time since birth. Women whose breast cancer was diagnosed less than 2 years after they gave birth had a crude 5 year survival of 58.7% and a 10 year survival of 46.1%, compared with 78.4% and 66.0% for women who had their last delivery more than 2 years before their cancer diagnosis. Recent pregnancy had a negative effect in patients who received adjuvant treatment and those who did not. Women with a recent birth (<2 years) who were classified with low risk breast cancer and thus did not receive adjuvant systemic treatment had a crude survival of 75.0% (5 year) and 55.6% (10 year) compared with 88.5% and 77.8% for women whose last childbirth was more than 2 years before their diagnosis. Women classified with high risk disease, who received adjuvant treatment, had a crude survival of 53.2% (5 year) and 41.2% (10 year) compared with 72.0% and 58.2% for women whose last childbirth was more than 2 years before their diagnosis.

The effect of time since last childbirth was further evaluated for parous women in a multivariate analysis that considered the influence of age at diagnosis, tumour size at diagnosis, numbers of positive axillary lymph nodes, grade of anaplasia, protocol allocation, and year of treatment. The prognosis remained significantly worse for women who gave birth to a child within the past 2 years (relative risk 1.58 (95% confidence interval 1.24 to 2.02)) than for women who had given birth six or more years ago (P=0.0002) (table 2). The risk associated with a recent birth was increased 2.1-fold in the first year and 1.3-fold in the second year.

To investigate whether the negative effect of a recent birth was modified by age at diagnosis, stage of

Table 2 Adjusted relative risk of dying according to prognostic factors, age at diagnosis, and time since birth among 4957 parous women with breast cancer

Variable	Adjusted relative risk (95% CI)*
Age at diagnosis (years):	
<30	1
30-34	0.88 (0.61 to 1.28)
35-39	0.88 (0.61 to 1.27)
40-45	0.79 (0.58 to 1.15)
Tumour size (cm):	
⩽2	1
>2 ⩽5	1.67 (1.48 to 1.89)
>5	2.46 (2.06 to 2.95)
No of positive nodes:	
0	1
1-3	1.56 (1.37 to 1.78)
4-9	3.01 (2.58 to 3.50)
⩾10	3.87 (3.09 to 4.83)
Histological grade:	
I	1
II + III	2.28 (1.93 to 2.68)
Non-ductal carcinoma	1.26 (1.04 to 1.54)
Years since last childbirth:	
<2	1.58 (1.24 to 2.02)
2-3	0.96 (0.77 to 1.21)
4-5	1.15 (0.95 to 1.40)
⩾6	1

*Adjusted for characteristics listed and for year of treatment, and protocol allocation.

Table 3 Adjusted relative risk (95% confidence interval) of dying according to age at diagnosis, nodal status, tumour size, and time since birth among 4957 parous woen with breast cancer aged 45 or less

	Time since last childbirth			
	< 2 years	2-3 years	4-5 years	⩾6 years
Age at diagnosis (years):†				
⩽33	1.6 (1.1 to 2.3)*	1.1 (0.8 to 1.6)	1.2 (0.8 to 1.9)	1
>34	1.6 (1.2 to 2.3)*	0.9 (0.7 to 1.2)	1.1 (0.9 to 1.4)	1
Tumour size (cm):				
⩽2	1.6 (1.1 to 2.3)*	1.3 (0.9 to 1.9)	1.3 (1.0 to 1.8)	1
>2	1.4 (1.0 to 2.0)*	0.8 (0.6 to 1.1)	1.0 (0.8 to 1.3)	1
Nodal status:				
Negative	1.5 (1.0 to 2.4)*	1.1 (0.7 to 1.6)	1.0 (0.7 to 1.4)	1
Positive	1.4 (1.1 to 2.0)*	1.0 (0.7 to 1.3)	1.3 (1.0 to 1.6)*	1

Relative risk adjusted for age at diagnosis, tumor size, moal status, histological grade, years of treatment, and protocol allocation.
*P<0.05.
†Patients separated into two groups according to median age among patients with childbirth <2 years before diagnosis.

disease (measured by number of positive axillary lymph nodes), or tumour size, we performed tests for effect modification with adjustment as given above (table 3). Neither age at diagnosis, nodal status, nor tumour size had any significant modifying effect on the poor survival for the group of women who had recently (<2 years) given birth.

Discussion

Using a large and complete population based database with detailed information on tumour characteristics, treatment regimens, reproductive factors, and vital status, we documented a particularly poor survival for women who were diagnosed with breast cancer within 2 years after giving birth. The adverse effect on the prognosis was seen irrespective of the woman's age, the size of the tumour, and the stage of the disease. In a small multicentre study involving nine centres and a total of 152 young mothers (<30 years) with breast cancer, Guinee et al found an increased mortality in women who had given birth up to four years before their diagnosis.[6] Other studies indicate that breast cancer diagnosed during lactation is associated with poor survival,[13 14] though one recent study failed to support such an association [7]. A limitation in all these studies has been their sample size. Furthermore, they have generally been unable to adequately adjust for confounders such as other reproductive history, tumour size, axillary lymph node status, and histological grading.

Delayed diagnosis

The difficulty of diagnosing breast cancer in young women in general and pregnant and lactating women in particular, because of the density of the mammary glands, is reflected in a significant diagnostic delay among these patients.[12 15] In our study the tendency for recently pregnant women to have more advanced disease could, at least to some extent, be caused by delayed diagnosing. However, our detailed information on each woman's tumour characteristics allowed us to adjust for this. Thus, independent of the influence caused by delayed diagnosis, a recent birth before the diagnosis of breast cancer conferred an increased risk of dying of about 60% in comparison to other women with breast cancer.

Influence of breast feeding

Breast feeding was earlier considered to influence the risk of developing breast cancer, but most recent evidence suggests that there is no important overall association.[19] Whether breast feeding influences the prognosis of the disease is unknown, but the lack of effect on the risk of disease does not necessarily strengthen a possible effect on its prognosis. In our study, we did not have information on breast feeding. Lactation entails a different hormonal environment to that in non-lactating women after delivery, which makes the group of women with recent pregnancy heterogeneous. However, poor survival was observed when breast cancer was diagnosed not only in the first but also in the second year after birth, at which time most women have stopped breast feeding.

Influence of pregnancy

In 1988, Mohle-Boetani and colleagues observed an insignificantly increased risk of relapse among women with a recent delivery and suggested that the special hormonal and immunological conditions associated with pregnancy might lower the survival of breast cancer patients.[5] Although immunological changes occur during pregnancy, it is no longer widely accepted that pregnancy results in a state of immunodeficiency.[16 17] Even if some kind of immunosuppression should occur during pregnancy, this would not necessarily be expected to have a negative influence on the course of breast cancer.[18]

In vitro experiments show that pregnancy may confer a growth enhancing effect on tumour cells.[20] However, a simple growth enhancing effect would tend to increase the volume of the tumour at time of diagnosis shortly after pregnancy. The negative effect of a recent birth remains present after factors that reflect the volume of the tumour (tumour size and nodal status) are taken into account (table 3). Therefore, the most likely explanation for our finding is that the pregnancy changes the course of the disease by increasing the risk of a highly malignant growth pattern of already existing tumour cells.

It has long been known that early age at first full term pregnancy is associated with a low risk of developing breast cancer, whereas women aged 35 years or more at first childbirth are at a particularly high risk.[1] In our study, neither tumour size, nodal status, nor age modified the specific prognostic effect of recent last delivery. Because breast cancer is rare before

Key messages

- A childbirth close to subsequent diagnosis of breast cancer has a negative effect on the woman's cancer prognosis
- The negative effect of recent childbirth is not affected by age at diagnosis, nodal status, and tumour size
- The negative effect is found both in patients who receive adjuvant treatment and those who do not
- Childbirth history should be taken into account when counselling young women with breast cancer

the age of 30,[21] the likelihood of giving birth near the time of a breast cancer diagnosis is significantly greater for women who have their children at an advanced age. Therefore, the adverse influence of pregnancy on breast cancer survival will be greatest when women postpone childbearing to older ages.

The negative effect of recent pregnancy was pronounced in women who did not receive adjuvant treatment (low risk group) as well as among those who did (high risk group). Therefore, it is not known whether more intensive adjuvant treatment will change the course of the disease in these patients. These findings need be considered in counselling such patients and in deciding on adjuvant treatment. Pregnancy history should be recorded for premenopausal breast cancer patients and in prospective clinical trials so that response to adjuvant treatment according to time since last childbirth can be assessed.

Funding: Danish National Research Foundation; US Army Medical Research and Material Command under DAMD17-96-1-6321; grants from the O Bryde Nielsen foundation and the Tvergaard foundation.

Conflict of interest: None.

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(Accepted 3 June 1997)

Audit of child protection procedures in accident and emergency department to identify children at risk of abuse

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Hospital accident and emergency departments are often the first place where injured children come into contact with the health services. Children who are victims of or at risk of abuse may be passing through these departments unrecognised. Accident and emergency departments must have clear protocols for recognising and handling suspected abuse and for training staff and updating that training.[1 2]

Triage by nurses of all children arriving in the accident and emergency department at the Royal United Hospital in Bath includes checking the child protection register and assessing five indicators of risk for child abuse. These indicators are: whether the child has previously been seen at the department, whether there is an inconsistent medical history, whether the findings on examination match the history, whether there was a delay in bringing the child to the department, and whether there is a head injury or fracture in a child younger than 1 year old. The department has a clear and accessible protocol for the management of suspected cases of child abuse.

Methods and results

A two part audit was undertaken in May 1995 and 1996 to determine the extent to which procedures for identifying and referring children at risk of abuse were being followed in the accident and emergency department. During the two-month audits the record cards of all children attending the accident and emergency department were reviewed. After the initial audit, meetings were held with the local area child protection review panel, hospital management, and accident and emergency staff to share the information and stimulate debate. As a result a number of changes were introduced to the protocol including updating the knowledge of the staff in the accident and emergency department, clarifying which children should be discussed, instituting regular training and feedback sessions, and revising the checklist system for risk indicators.

A total of 1357 cards were reviewed in the first audit and 988 in the second. The table summarises the standards that were achieved. During both audits only five children were identified as being on the child protection

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BMJ 1997;315:855–6