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Original Paper

Pain and Discomfort During Mammography

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The aim of this prospective study was to investigate associations of mammography pain and discomfort with sociodemographics, personal history and psychological and situational factors. Subjects were women with a negative screening finding ($n = 883$) from a random sample of 50-year-old Finnish women attending their first breast cancer screening. Questionnaires were sent 1 month before the screening invitation and 2 months after screening. Sixty-one per cent reported painful and 59% uncomfortable mammograms (4% severely). Linear regression analyses showed that anticipation of pain and discomfort was the most powerful factor explaining pain and discomfort among women with earlier mammography. However, it had no effect among women without earlier mammography, for whom screening-related nervousness and perceptions of staff were crucial. Suggested interventions include better information before screening, a friendly screening atmosphere and empathetic, supportive staff behaviour, especially towards women having their first mammogram, encouraging them to feel more at ease and distracted from pain. Copyright © 1996 Elsevier Science Ltd

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INTRODUCTION

MAMMOGRAPHY is the most effective method for the early detection of breast cancer [1, 2]. In order to improve image quality, separate overlapping structures and decrease the radiation dose, a certain amount of compression of the breast is needed [3, 4]. Research has shown that women frequently find mammography uncomfortable and even painful [5–17], although severe pain seems to be rare [5–9, 11]. Painfulness of the procedure has been claimed to contribute to non-participation [5–7].

Discomfort and pain in mammography have been explained by sociodemographics [12–15] and personal history [8, 18], as well as by physiological [6–9, 11, 13, 19] and psychological factors [7, 8, 12, 13] thought to render some women more sensitive. Situational factors, especially the role of staff [15, 16], have also been shown to affect the mammography experience. The marked disparity of research findings may be attributable to shortcomings such as unrepresentative study populations, retrospective study designs and variation in measures. The difference between the notions of 'pain' and 'discomfort' has remained unclear when only one or the other has

been measured [6, 11, 18], or both have been combined on the same scale [7–9]. A prospective design and a study population representative of healthy middle-aged women were used in this study, which aimed to examine mammography related discomfort and pain separately, as well as their correlates, i.e. sociodemographics, personal history and psychological and situational factors.

PATIENTS AND METHODS

Subjects

The subjects were a random sample ($n = 1680$, age 50 years) of Finnish women due to be invited to their first mass screening. Those in provincial areas were to attend one of eight Cancer Society screening centres, and those in the Helsinki area a municipal or one of three private clinics. No information about how mammograms are taken or their potential painfulness was included in the invitation. Data were collected by postal survey (with prepaid envelopes) in two phases: baseline, 1 month before the screening invitation, and a 2-month postscreening follow-up. One week after the baseline letter, all subjects were sent a reminder, but the screening timetable did not permit a targeted reminder to the non-respondents. Of the 1009 respondents (60% response rate), 93% participated in screening. The non-respondents

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were slightly more often from urban areas (response rates 57% in urban areas versus 62% in rural areas), but were as likely as the respondents to participate in the actual screening. Follow-up questionnaires were sent to women who received a normal screening finding ($n = 883$, 94% of those screened). Reminders and new questionnaires were sent to all non-respondents. Of the 765 respondents (87% response rate), 65 were excluded from analyses for the following reasons: (1) respondent had received screening invitation before returning the baseline questionnaire ($n = 35$), (2) questionnaire was incompletely filled in ($n = 17$), and (3) respondent reported having cancer ($n = 13$). There were 700 respondents to both questionnaires analysed in this study.

Measures

Sociodemographic and personal history factors related to breast cancer and mammography, as well as trait anxiety, depression and anticipation of mammography pain, were measured at baseline. Experience of pain and discomfort, breast sensitivity at the time of screening, worry about breast cancer evoked by the screening invitation, nervousness before screening, as well as perceptions of the situational factors at screening, were measured at the follow-up. The questionnaires included psychological inventories, limited choice questions and single, structured, ordinal scales that included the additional option "cannot tell".

Sociodemographic variables recorded were marital status (1 = "married or cohabiting", 2 = "single", 3 = "separated or divorced", 4 = "widowed"), type of residential area (1 = "urban", 2 = "semi-urban", 3 = "rural", classification by the Central Statistical Office of Finland), and years of education (in the contingency tables classified as 1 = "<9 years" elementary school only, 2 = "9–12 years" vocational school or high school, 3 = ">12 years" college, university). Education seems to be a good indicator of socio-economic status in the Finnish population, which has a very homogeneous ethnic background and sociocultural traditions, and good access to health services [20].

Personal history factors measured were history of breast cancer in family or friends (1 = "no", 2 = "yes"), perception of own breast cancer risk (1 = "non-existent" to 5 = "very high"), earlier experience of mammography (1 = "yes", 2 = "no"), and knowledge of how the breast is imaged (1 = "do know", 2 = "do not know").

Anticipation of pain and discomfort were assessed with separate items (1 = "not at all", 2 = "moderately", 3 = "severely", 4 = "cannot tell"). Considerable proportions of women had failed to answer these questions (22% for pain, 5% for discomfort, 11% for both), or chosen "cannot tell" (18% in both questions). Those responding "cannot tell" were more likely to lack any previous experience of mammography. The answers were combined in a sum score that was found to be fairly reliable (Cronbach alpha 0.76). Disposition to anxiety was measured with the trait scale of the Spielberger State-Trait Anxiety Inventory (STAI) [21] and depressive mood with the Beck Depression Inventory (BDI) [22]. Cronbach alpha reliabilities were 0.90 for STAI and 0.86 for BDI.

Situational factors measured were: worry about breast cancer evoked by the invitation; nervousness experienced before screening; feelings of tenseness and fear, relaxation, and embarrassment evoked by the screening situation (all ranging from 1 = "not at all" to 4 = "very"; relaxation vice versa). Perceptions of the staff were measured with a graphic scale of

adjective pairs ("friendly"–"unfriendly", "helpful"–"unhelpful", "reassuring"–"worrying", "interested"–"indifferent"). Breast sensitivity at the time of screening was assessed with one dichotomous question (1 = "no", 2 = "yes").

A factor analysis was performed on anxiety and depression scores, and on variables measuring situational factors excluding breast sensitivity. A three-factor maximum likelihood solution with eigenvalues greater than one explained 58% of the variance. The constructs emerging from the factor analysis were 'pre-existing anxiety and depression', 'screening related nervousness' and 'positive perceptions of the staff'. General reliability coefficients [23] ranged between 0.74 and 0.88.

Pain and discomfort during mammography were measured with separate items (1 = "not at all" to 4 = "severely painful/uncomfortable"). They had virtually identical frequency distributions (Table 1) and were found to be strongly related ($r = 0.67$, $P < 0.001$). The items were thus combined into a sum score ($\{\text{pain} + \text{discomfort}\}/2$) for the correlational analyses; in the contingency analyses, the sum scores were reclassified as 1–1.5 = "not at all", 2–2.5 = "slightly", 3–3.5 = "moderately" and 4 = "severely painful or uncomfortable". The sum score was found to be fairly reliable (Cronbach alpha 0.83). Intention to attend further screening was also recorded (1 = "yes", 2 = "no", 3 = "cannot tell").

Data analysis

Reliabilities of sum scores were assessed using the Cronbach alpha coefficient, and reliabilities of factors using the general reliability coefficient. Associations of reported pain and discomfort with the factor score variables were assessed using Pearson correlation coefficients, and with the sociodemographic and personal history variables using two-way contingency tables and chi-square tests. To examine the effects of several variables on pain and discomfort, all three factor score variables as well as other variables shown to have univariate associations ($P < 0.05$) with pain and discomfort were included in a linear regression analysis. All the analyses were performed using the SURVO software package (Version 4.20, Survo Systems Ltd, Helsinki, Finland). All the "cannot tell" responses, as well as cases with missing values, were excluded from the correlational analyses.

RESULTS

Almost two-thirds of respondents reported experiencing at least some pain (61%) or discomfort (59%) during mammography, and 4% reported severe pain or discomfort (Table 1).

Women with higher education or urban background more often reported painful and uncomfortable mammography than

Table 1. Reported pain or discomfort in mammography ($n = 700$)

	Pain		Discomfort	
	<i>n</i>	(%)	<i>n</i>	(%)
Severe	27	(4)	29	(4)
Moderate	75	(11)	63	(9)
A little	327	(47)	320	(46)
Not at all	269	(38)	281	(40)
Cannot tell	1	(<1)	5	(1)
Frequency missing	1	(<1)	2	(<1)

Table 2. Background factors explaining experienced pain or discomfort during mammography†

	Experience of pain or discomfort during mammography				P value*
	Severe n (%)	Moderate n (%)	Slight n (%)	None n (%)	
Years of education (n = 694)					0.0006
Less than 9 years (n = 178)	3 (2)	7 (4)	65 (36)	103 (58)	
9–12 years (n = 309)	5 (2)	22 (7)	129 (42)	153 (49)	
More than 12 years (n = 207)	10 (5)	24 (12)	95 (46)	78 (38)	
Residential setting (n = 700)					0.0221
Urban (n = 449)	14 (3)	43 (10)	196 (44)	196 (44)	
Semi-urban (n = 117)	3 (3)	4 (3)	44 (38)	66 (56)	
Rural (n = 134)	1 (1)	8 (6)	49 (36)	76 (57)	
Earlier mammography (n = 684)					0.0269
Yes (n = 402)	11 (3)	31 (8)	185 (46)	175 (43)	
No (n = 282)	6 (2)	21 (7)	100 (35)	155 (55)	
Breast sensitivity (n = 672)					0.0011
No (n = 634)	11 (2)	42 (7)	260 (41)	321 (51)	
Yes (n = 38)	2 (5)	8 (21)	18 (47)	10 (26)	

*Using chi-square tests of association. †Some data missing within categories.

those with lower education or rural or semi-urban background (Table 2). Women with earlier mammography also tended to report more pain and discomfort, but the other personal history factors (i.e. history of breast cancer in family or friends, own perceived risk of breast cancer) as well as marital status were unrelated to pain and discomfort.

Anticipation was found to predict the actual experience of mammography pain and discomfort, but only among the women with previous mammography. In this group, the women who had expected pain and discomfort were more likely to report experiencing them (Table 3). Pre-existing anxiety and depression did not predict the experience of pain and discomfort.

Pain and discomfort was associated with all the situational factors measured: breast sensitivity, screening-related nervousness and perceptions of the staff. Women with current breast sensitivity tended to experience pain and discomfort during mammography more often: 74% reported at least some

pain and discomfort during mammography, compared to 49% of those with no current breast sensitivity (Table 2). Positive perceptions of the staff had a low negative correlation and screening-related nervousness a moderate positive correlation with pain and discomfort (Table 4).

Linear regression analyses with experienced pain and discomfort as the regressand were performed separately for subjects with or without earlier mammography. The factor score variables pre-existing anxiety and depression, positive perceptions of the staff, and screening-related nervousness, as well as all the other variables shown to have significant associations with pain and discomfort, were entered simultaneously into the models. For women with earlier mammography, anticipation of pain and discomfort proved the most powerful factor explaining experienced pain and discomfort and screening-related nervousness the second. In the model for women with no earlier mammography, anticipation of pain and discomfort had no effect, but in this case screening-related nervousness

Table 3. Anticipation and experience of mammography pain or discomfort among women with and without earlier mammography†

	Experience of pain or discomfort during mammography			P value*
	Severe/moderate n (%)	Slight n (%)	None n (%)	
Anticipation of pain or discomfort				
Women with earlier mammography (n = 186)				0.0001
Very/moderately painful and uncomfortable (n = 82)	14(17)	46(56)	22(27)	
Not at all painful or uncomfortable (n = 124)	6(5)	52(42)	66(53)	
Women without earlier mammography (n = 75)				0.6334
Very/moderately painful and uncomfortable (n = 25)	5(20)	7(28)	13(52)	
Not at all painful or uncomfortable (n = 50)	6(12)	14(28)	30(60)	

*Using chi-square tests of association. †Data missing within categories.

Table 4. Linear regression models of pain or discomfort for women with and without earlier mammography

	<i>r</i>	beta	<i>t</i>
Women with earlier mammography			
Anticipation of pain and discomfort	0.43	0.31	4.608‡
Screening-related nervousness	0.41	0.30	4.415‡
Years of education	0.15	0.13	2.115*
Positive perceptions of the staff	-0.15	-0.12	-1.870
Area	-0.19	-0.04	-0.614
Pre-existing anxiety and depression	0.00	-0.03	-0.444
Breast sensitivity	0.13	-0.02	-0.306
Df = 193, <i>R</i> = 0.550, <i>R</i> ² = 0.3027			
Women without earlier mammography			
Screening-related nervousness	0.38	0.35	3.123‡
Positive perceptions of the staff	-0.35	-0.26	-2.296*
Area	-0.12	-0.15	-1.371
Years of education	0.17	0.14	1.324
Pre-existing anxiety and depression	0.05	0.07	0.604
Breast sensitivity	0.10	0.06	0.519
Anticipation of pain and discomfort	0.17	0.00	0.031
Df = 67, <i>R</i> = 0.525, <i>R</i> ² = 0.2761			

**P* < 0.05, †*P* < 0.01, ‡*P* < 0.001.

and positive perceptions of the staff (reversed effect) were significant. The two models explained 30% and 28%, respectively, of the variance in experienced pain and discomfort (Table 4).

Intention to attend further screening

None of the respondents reported no intention to attend further screening if invited. However, all 5 (1% of all the respondents) who were undecided about whether to re-attend had experienced severe or moderate pain during mammography.

DISCUSSION

Our study is the first to explain both pain and discomfort by multiple factors using a representative study population in a prospective design. The frequencies of experienced pain and discomfort reflect the average found in previous research [5–17] and confirm that severe pain is relatively infrequent [5–9]. When explaining pain and discomfort, we found that the association between anticipation and experience of pain depended on whether there had been earlier mammography or not: the women with previous experience were naturally better aware of what to expect. Earlier studies have provided contradictory findings on the associations between earlier mammography and either anticipation or reported experience of pain [7, 8, 13, 18], but have not investigated the inter-relationship of all three factors. Our study showed that when anticipation could be based on earlier personal experience of mammography, it was the most important predictor of pain and discomfort. When personal experience was lacking and expectations were based on other factors, they tended to be less correct; instead, the impact of situational factors—screening-related nervousness and perceptions of the staff—on pain and discomfort became more important. This is in line with the findings by Boer [17], who reported an association between pain and “nervousness before screening”, and Nielsen and associates [13], who found a similar association but used the concept “mammography-specific anxiety”.

The association of pain with staff behaviours confirms earlier findings by Vaile and associates [15] and Elkind and Eardley [16]. The rôle of attention distraction in reducing pain has been demonstrated in both experimental research [24] and psychological interventions [25]. Simply talking with the woman in an interested and friendly manner can help to shift attention away from any pain of the procedure [15, 16]. Specific techniques for relaxation, such as deep breathing, can also be explained to women during screening [10, 16]. The fact that the association between staff behaviour and pain and discomfort was only evident among women with no earlier mammography stresses the importance of the staff paying special attention to first-timers.

The importance of screening-related nervousness in pain and discomfort might also suggest that a more general disposition to feeling anxious, i.e. trait anxiety, would have explained pain. Experimental research [26] has shown that dispositional anxiety may increase pain indirectly by inducing pain-specific anxiety. Alternatively, depression has previously been shown to raise pain thresholds, at least in clinical populations [27, 28]. In our study, trait anxiety and depression emerged as one factor, which was not associated with experience of pain. The lack of association could not be explained by anxiety and depression having opposing individual effects on pain and discomfort, because neither had any effect on it. Rutter and associates [12], using the same anxiety measure as in this study, were also unable to establish any association between anxiety and pain.

Our results support previous findings that women with higher education [12] and urban background [15] are more prone to pain during mammography. The impact of breast sensitivity on pain also confirms earlier research [8, 9]. In line with Nielsen and associates [13] we found no association between history of breast cancer in family or friends and mammography pain. Neither knowledge of mammography procedure nor perception of own breast cancer risk were associated with pain.

Among our study participants, no one reported having no

intention to re-attend screening. However, all of the few who were undecided about re-attendance reported painful mammography—a tendency also detected by Jackson and associates [6] and Cockburn and associates [7]. Moreover, among non-participants of a second round of screening, pain has been mentioned as a reason for non-attendance [5]. We have findings of our own [29] showing that, among non-participants of a first round of screening, a small percentage of women—some with and some without earlier mammography—report pain as one of their reasons for not participating.

Most previous studies have measured either pain or discomfort [6, 11, 18] or combined both in the same scale [8, 9, 19]. Only Nielsen and associates [13] assessed pain and discomfort separately and found that both were explained by anxiety about the mammography experience. In a previous paper (Absetz-Ylöstalo and colleagues, presented at the 9th Conference of the European Health Psychology Society, Bergen 1995), we analysed pain and discomfort separately and found them to have similar explanatory models. The high correlation between pain and discomfort, as well as their similar explanatory models, suggest that there are no major differences between them in practice. Thus, it seems justifiable to combine pain and discomfort into a single construct.

Our study had certain limitations. The response rate of 60% at baseline was rather low, and probably due mainly to the lack of a targeted reminder and the length of the study questionnaire. However, the response rate at the 2-month follow-up was good. Our findings may have been weakened by the fact that, compared to the non-respondents, the baseline respondents were somewhat more often from rural areas, where pain and discomfort were found to be less common. In terms of compliance with medical procedures—reflected by participation rate in screening—the respondents were no different from the non-respondents. Interpretation of the results concerning anticipation of pain is limited by the extent of missing data and “cannot tell” choices for this item. Subjects who failed to answer the question were excluded from the analyses, and we know that those who chose “cannot tell” were less likely to have had earlier mammography than women who did answer it.

Some of the issues we were unable to examine in this study invite further research. One such question concerns the basis of the anticipation of pain; is it one's own experience, or information from friends, media or health care professionals? The rôle of pain, either anticipated or experienced at an earlier screening, as a cause of non-attendance is another such question. Patient control over the mammography procedure is a further important new issue: offering women the possibility of controlling the pressure themselves, which may become a standard procedure [30], has been shown to decrease pain without compromising image quality [19]. The fluctuation of reported pain over time should also be studied. There is evidence from dental patients that memory is reconstructed over time to become consistent with expectations and anxiety [31]. Our measurement at 2 months describes the long term memory image, which is the one most likely to influence the decision to attend further screening [7] and to be relayed to other women. For a more complete understanding of the importance of the anticipated and experienced pain, we recommend a standard measurement schedule as follows: anticipation prospectively as suggested by, for example, Keefe and associates [30], the experience during or immediately after the procedure and appraisal of the experience a few

months later when the screening finding is already known. This would allow more reliable comparisons of findings on pain both from the same stages of screening and from women with other screening findings, especially false positives.

In conclusion, women frequently experience pain during mammography, although severe pain is rare. When explaining pain, a variety of factors must be taken into account; women come to screening with pre-existing expectations and feelings which affect their personal experience, and are then influenced by the situational factors at screening. Anticipation seems to be a very strong predictor of pain, but only if it is based on earlier experience of mammography. For those who have to rely on outside information, anticipation frequently is incorrect. Among the first-timers, anticipation of pain is best managed by accurate, open information and health education about pain and discomfort associated with mammography, preferably delivered by health care professionals and screening staff [7, 8]. The rôle of professionals is especially important since there is evidence that expectations of pain tend to be lower when information about it has been obtained from professional sources as opposed to the media or friends and relatives [8]. Screening-related nervousness, the most important explanatory factor for pain and discomfort when earlier experience is lacking, can be affected both by information delivered prior to screening and by staff behaviour during the process. Emphasis should be placed on staff behaviour, especially when dealing with women attending their first mammography, in order to avoid the development of a vicious cycle of anticipation of pain—nervousness—experienced pain.

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