

Arm Morbidity after Breast-conserving Therapy for Breast Cancer

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Acta Oncologica Vol. 39, No. 3, pp. 393–397, 2000

This study reports on 110 consecutive patients, mean age 59 years, operated on for partial mastectomy and axillary dissection. Radiotherapy of 50 Gy was administered to 75 of the patients. Most tumours were T1 tumours and all patients were N0. Lymphoedema is defined as an increase in arm volume > 10% and impaired shoulder mobility as an impairment of 15° compared with the preoperative value. After operation, 21 patients developed lymphoedema, 17 in the radiotherapy group and 4 in the group without radiotherapy; 49% of the patients had reduced shoulder mobility, and of these, 57% were in the radiotherapy group and 30% in the group without radiotherapy. We found a good correlation between the number of patients stating arm swelling and patients with registered lymphoedema. There were fewer patients stating limitation of movement than patients with registered impaired mobility; 31% of patients were still perceiving some pain five years after the operation. We conclude, that breast-conserving therapy in breast cancer is afflicted with a significant arm morbidity that persists for several years after surgery.

Received 21 June 1999

Accepted 18 October 1999

Swelling of the arm and impaired shoulder mobility are well-known consequences of treatment of breast cancer. The incidence of these problems varies considerably in different studies because of differences in surgical technique and adjuvant treatment or differences in the definition of lymphoedema and decreased mobility. In many studies no definition of lymphoedema is given (1), in other studies lymphoedema is defined as an increase in volume compared with the healthy arm (2) or/and increase in circumference (3). Regarding impaired shoulder mobility, there are few studies on this topic and the way of reporting the results varies considerably (2, 4).

Postoperative radiotherapy after axillary dissection significantly increases the risk of lymphoedema and impaired shoulder mobility (2, 5, 6). Differences in age distribution can also influence the incidence of postoperative problems (3, 7). Knowledge about arm problems after modern breast cancer treatment is limited and there are often differences, depending on whether the information is collected from the patient's report or from a questionnaire with direct questions about the subject.

This prospective study reports the incidence of lymphoedema, impaired shoulder mobility and the incidence of arm symptoms registered by a questionnaire in patients surgically treated with breast-conserving operation

with or without postoperative radiotherapy to the remaining breast tissue.

MATERIAL AND METHODS

Since 1992 all patients operated on for breast cancer in Malmö have been examined for arm volume and arm mobility. This study included 110 consecutive patients, mean age 59 years, range 37–76 years, observation time 5 years. Two patients have had local recurrences in the breast during the observation time.

Operation

All patients were operated on with partial mastectomy and axillary dissection levels I and II. Median number of lymph nodes removed was 10 (range 5–22). The accuracy of the removed specimen was certified by mammography of the specimen during the operation.

Radiotherapy

During the time of this study, all patients ≤ 75 years were invited to participate in a study randomizing between postoperative radiotherapy (XRT) to the remaining breast tissue or no XRT. Patients who did not want to participate in the study were given postoperative XRT to the remaining breast tissue according to existing guidelines. Seventy-

five patients in this study had postoperative XRT and 35 patients were randomized to the control group without postoperative XRT. The XRT was given with two opposing tangential fields with fraction sizes of 2.0 Gy 5 times a week to a total dose of 50 Gy. The axilla was not included in the radiation field. Two patients in the no XRT group had local recurrences and were operated on and given XRT after the operation for recurrence one and three years, after the primary operation.

Tumour characteristics

Tumour size was categorized according to the histopathological tumour diameter and varied from microscopically invasive foci in a ductal carcinoma in situ up to a diameter of 40 mm. All specimen margins were microscopically free from tumour. All lymph nodes were free from metastasis.

Measurements of arm volume and shoulder mobility

Arm volume and shoulder mobility were measured preoperatively, bilaterally and thereafter once a year for up to 5 years after the operation.

Arm volume was measured according to the water displacement method, as described by Swedborg (1). Both arms were submerged separately in a water-filled plexi-glass tank, with the arms straight. The displaced water was weighed. By means of markings, it was verified that the patient's arm was in the same position from time to time. At the postoperative examination, measurements were corrected for changes in the volume of the healthy arm as a result of changes in body weight. Lymphoedema has been defined as an increase in volume > 10% in relation to the preoperative volume.

Measurement of shoulder mobility was done actively by means of a goniometer. Forward/upward elevation, extension and abduction were calculated with the patient sitting in an upright position with her feet on the floor and hips and knees at an angle of 90°. Inward and outward rotations were calculated with the patient lying on her back, with a 90° abduction in the shoulder. Reduced mobility has been defined as a reduction in any direction of more than 15° in relation to the preoperative value. Changes caused by intervening diseases, such as fractures in the arm in question, have been excluded.

Questionnaire

At the time of each measurement, the patients answered a questionnaire concerning their perceptions of arm swelling and limitation of movement and the degree of perceived pain was indicated on a visual analogue scale (0–100) on each occasion. Severe pain influencing activities of daily life was regarded as being commensurate with values > 50, moderate pain with values between 30 and 50.

The patients' reports were examined to identify patients with clinical data on arm swelling and other arm problems and patients who had had referrals to a physiotherapist.

Table 1

Number (%) of patients with lymphoedema and impaired shoulder mobility at one or more registrations after breast-conserving operation (BCO) ± XRT

	Lymphoedema	Impaired shoulder mobility
BCO+XRT n = 75	17 (22%)	44 (57%)
BCO-XRT n = 35	4 (12%)	10 (30%)
Total n = 110	21 (19%)	54 (49%)

The measurements were performed outside the routine check-up programme and did not influence treatment and follow-up.

RESULTS

Five patients died during the observation time, after the two-years' check-up. One patient moved to another area after the two-years' check-up and four patients refused check-up after three and four years, respectively. During the observation time, 21 patients developed lymphoedema. The distribution of these patients between the two different treatment groups is recorded in Table 1. The time to first registered lymphoedema is shown in Table 2. Two-thirds of the patients developed lymphoedema during the first two years. Median increase in arm volume at the first registration of lymphoedema was 16% (0–39%). Two patients developed oedema of the hand, one of whom had no registered increase in arm volume. The median volume for the maximum increase in arm volume registered during the observation time was 19% (0–47%). The number of patients stating swelling of the arm in the questionnaire is recorded in Table 3. This table also shows the number of patients with registered lymphoedema of the arm at the same time. Five patients with registered lymphoedema do not state problems with arm swelling. The increase in arm volume in these patients was between 11 and 22%. Seven patients complained of arm swelling where no lymphoedema was registered. Five years after surgery, all patients stating swelling of the arm had registered lymphoedema. Ten of the 21 patients with lymphoedema have had referrals to a physiotherapist. Mean maximum

Table 2

Time to first registration of lymphoedema and impaired shoulder mobility

Year after Operation	Lymphoedema	Impaired shoulder mobility
1	8	32
2	6	12
3	2	2
4	4	5
5	1	3

Table 3

Number of patients perceiving swelling of the arm and patients with registered lymphoedema one to five years after surgery

Year after operation	Perception of swelling	Registered lymphoedema
1	11	9
2	11	11
3	13	10
4	15	14
5	11	14

increase in volume registered in these patients is 20% (0–47%). Another four patients have statements in their medical records concerning swelling of their arms, but no specific measures have been taken. The increase in volume in these four patients is between 12 and 25%.

Fifty-four patients developed impaired shoulder mobility after their operations, as shown in Table 1. The decrease in shoulder mobility includes all directions of movements, with a slight predominance of the forward/upward movement (25 patients). Time to first registered impaired shoulder mobility is shown in Table 2. Thirteen patients had lymphoedema as well as impaired shoulder mobility. Median value for the first registered decrease in mobility is 20° (15–90°) and median value for registered maximum decrease in shoulder mobility as also 20° (15–90°). Six of the patients with registered decrease in shoulder mobility had other diseases influencing mobility, such as fibromyalgia and rheumatoid arthritis. The decrease in shoulder mobility in the operated side has been corrected for decrease in mobility affecting both sides. Of the patients with impaired shoulder mobility, 81% were registered during the first two years. Patients stating impaired mobility according to the questionnaire are presented in Table 4, which also shows the number of patients with registered decrease in shoulder mobility.

Seventy-two patients reported having some degree of pain at one or more times of examination. Fourteen of these patients experienced moderate pain and 11 stated having severe pain that affected their activities of daily life. Five years after the operation 31% of the patients still have perception of some pain. Twelve patients reported prob-

Table 4

Number of patients perceiving impaired shoulder mobility and patients with registered impaired mobility one to five years after surgery

Year after operation	Perception of impaired mobility	Registered impaired mobility
1	3	32
2	7	38
3	10	33
4	9	34
5	7	38

lems with decreased sensibility or perception of swelling in the axilla during the observation time, five patients at the first check-up.

DISCUSSION

A major problem when assessing the impact of breast cancer therapy on the development of lymphoedema and other arm problems is the lack of a universal working definition. Various methods have been used to measure the lymphoedematous arm. The traditional way is to measure arm circumference 10 cm below and 10–15 cm above the elbow. Such measurements can be inaccurate and tend to vary according to the degree of constriction of the soft tissues employed by the observer. This method has been used by, among others, Liljegren et al. (7) and Gerber et al. (4). Another method is the measurement of arm volume by water displacement. This method is regarded as more accurate and independent of the investigator. A correlation between the two methods has been made by Hoe et al. (8) and Kissin et al. (9), who both found a poor correlation between the two methods. Measurement of the arm circumference can be used for estimation of arm volume if measurements are made at 4-cm intervals along the arm, thereafter using a formula for calculating arm volume, as shown by Kuhnke (10). Measurement of arm circumference may be complementary to the water displacement method by indicating in which part of the arm the swelling is most pronounced and also by identifying the few cases with oedema restricted to the hand only. In the present study, we used volumetry and defined lymphoedema as an increase in value of >10%, a definition used in earlier Swedish studies (2, 11). We found 19% lymphoedema in total, which is a rather high figure for patients with disease of good prognosis. We found good correlation between the number of patients with registered lymphoedema and those perceiving swelling of the arm according to the questionnaire, which we find justifies the definition of lymphoedema used. We identified five patients with registered lymphoedema who did not state having arm swelling. The increase in arm volume in these five patients was of the same magnitude as the mean increase in arm volume in the patients with registered lymphoedema as well as perception of swelling. The incidence of lymphoedema seems to be underestimated clinically, as we found only 14 out of 21 patients with registered lymphoedema, when looking through the patients' records. We think it is important to identify patients with lymphoedema early in order to start treatment with compression therapy, which, clinically, is more effective the shorter the time the oedema has persisted. Lymphoedema persisting over a long period results in hypertrophy of the subcutaneous fat tissue and development of fibrosis, both of which make compression therapy less effective.

In addition to differences in methods of measuring lymphoedema, differences in incidence in the various studies can be explained by differences in surgery, particularly axillary surgery and adjuvant treatment, especially whether XRT is given or not. Most published studies dealing with the incidence of lymphoedema after mastectomy and axillary dissection or axillary sampling show that postoperative XRT including the axilla significantly increases the incidence of lymphoedema (2, 5). The irradiation technique used in breast-conserving therapy is not intended to include the axilla in the radiation field, but probably the lower part of the axilla is included. In their study, Kiel & Rademacker (12) show that some or all of the surgical clips from the axillary dissection were present in the tangential fields. In our study we found more patients with lymphoedema in the XRT group (22%) than in the control group (12%).

Another factor found in some studies that predisposes to the development of lymphoedema is old age (3, 12), whereas other authors have found less oedema in elderly patients (6). In our study we did not find any correlation with age. Mean age for patients developing lymphoedema was 56 years compared with 59 years in the total material. In the total material 32% of the patients were 65 years or more and among the patients with lymphoedema 33% were in the same age group. In the first two years' check-ups we found patients stating arm swelling in the questionnaire but for whom there was no registration of lymphoedema. This can perhaps be explained as decreases in sensibility in the axilla and upper arm being perceived by these patients as swelling of the arm. At the 5-years' check-up, all patients stating swelling also had registered lymphoedema.

Regarding shoulder mobility after breast cancer treatment, few studies have been published and the definitions vary considerably. Reduced mobility, using our definition, has been registered in this study in 49% of the patients. In contrast to lymphoedema, there is no correlation between the number of patients stating impaired shoulder mobility and patients with registered impaired mobility. The same was found in an earlier study (13) on elderly women (≥ 70 years of age), where we found 39% with impaired mobility. In that study we thought the lack of correlation might be due to the age of the patients and that there would be a better correlation in a study like the present one, with younger patients, many of them professional women. As the findings are similar in the two studies, it might well be that the definition of impaired shoulder mobility of 15° is too narrow and a limit of 20° or more might be more representative of the patients problems. In a study by Maunsell (14), subjective limitation in range of movement is stated to be 32% 3 months after surgery, remaining constant 15 months later. According to the questionnaire in our study, 20% of the patients complained of impaired shoulder mobility at some time during the 5 years' obser-

vation period. Nine of the 54 patients with impaired shoulder mobility have been referred to a physiotherapist, an even lower figure than that for patients with lymphoedema. In the study by Maunsell (14), 55% of the patients perceived pain. Our figures are higher if any degree of pain is included, but much lower if only moderate or severe pain is included (23%). In our study 31% of the patients perceived some pain in the arm after 5 years but little is found in the patients' records about this problem.

This study shows that a considerable number of patients with mostly small tumours and without lymph node metastasis undergoing breast-conservation treatment develop arm problems, objectively as well as subjectively, and that most of these patients are not identified at routine check-ups. We believe it is important to take these problems into consideration in routine check-ups and to identify the patients as soon as possible in order to start treatment early, and also to take account of these problems when planning future studies and treatment guidelines to avoid over-treatment of patients with a very low risk of recurrence, thereby minimizing future arm problems.

ACKNOWLEDGEMENTS

This study was supported by grants from the Swedish Cancer Society. Project nr: B97-03-X-CC.

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