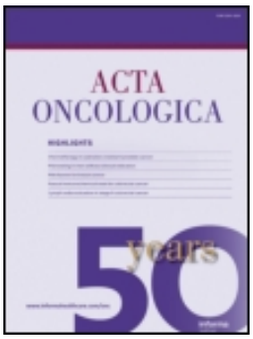

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ORIGINAL ARTICLE

Shoulder disability and late symptoms following surgery for early breast cancer

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Abstract

Introduction. Axillary dissection in combination with radiation therapy is thought to be the main reason why patients surgically treated for breast cancer may develop decreased shoulder mobility on the operated side. The surgery performed on the breast has not been ascribed any considerable importance. In order to evaluate the influence of the surgical technique and the adjuvant oncological therapy on the development of shoulder morbidity, we assessed the physical disability in 132 breast cancer patients with a median follow-up time of 3 years after surgery. *Materials and methods.* Eighty nine (67%) patients had been subjected to modified radical mastectomy and 43 (33%) to breast conserving therapy (BCT). All patients had axillary dissection of level I and II. The shoulder function was assessed by the Constant Shoulder Score including both subjective parameters on pain and ability to perform the normal tasks of daily living, and objective parameters assessing active range of motion and muscle strength. *Results.* Shoulder disability seems to be a frequent late complication to the treatment of early breast cancer (35%). When equal axillary dissection and radiation therapy had been applied, BCT patients were found to suffer less frequent from this complication than patients treated with mastectomy.

As sentinel lymph node biopsy has become the standard procedure in managing the axilla it is obvious that patients with axillary metastasis, due to the axillary dissection, probably suffer more side effects to the primary surgical and adjuvant therapy than patients with negative axillary lymph nodes [1,2]. Axillary dissection in combination with radiation therapy is thought to be the main reason why patients surgically treated for breast cancer develops decreased shoulder mobility and symptoms from the operation area on the chest wall and/or from the arm and shoulder on the operated side [3–9]. The surgery performed on the breast has not been ascribed any considerable importance. In order to estimate the magnitude of subjective side effects, and to evaluate the influence of the surgical technique and adjuvant treatment on the development of shoulder morbidity in surgical treated early breast cancer patients, we assessed the physical disability as well as the incidence of symptoms reported by the patients.

Patients and methods

Between January 1999 and June 1999, ambulatory breast cancer patients attending the follow-up clinic were asked to participate in the study. Inclusion criteria were: surgery for early breast cancer during the period 1994–1998 without recurrence of disease, no preoperatively reported illnesses in the upper extremity and no reported illness in the arm and shoulder opposite to the affected breast.

The study was approved by the local ethical committee for the County of Aarhus, and informed consent was obtained from all patients included.

A total of 160 patients was asked to participate and were booked for examination at the time for their following 6-month appointment. One hundred and thirty-two of these were finally enrolled in the study. Excluded were 11 patients who did not fulfil the inclusion criteria, four who had recurrence of disease and 13 patients did not show up. Of the 132 included patients, 89 (67%) had been subjected to a modified radical mastectomy (MRM) including

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axillary lymph node dissection of level I and II (ALND). Forty-three (33%) patients had breast conserving therapy (BCT), including ALND, followed by radiation therapy of the residual breast (48 Gy/ 24 fractions+boost 10 Gy/ 5 fractions). Sixty-two (47%) patients were classified as low risk patients and 70 (53%) as high risk patients according to guidelines from the Danish Breast Cancer cooperative Group (DBCG). Low risk patients had no adjuvant therapy except radiation treatment to patients given breast conserving surgery. High risk patients were given adjuvant therapy according to the DBCG 89 protocol. Adjuvant therapy to premenopausal patients included chemotherapy CEF (cyclophosphamide 600 mg/m^2, epirubicin 60 mg, 5-fluorouracil 600 mg/m^2) or CMF (cyclophosphamide 600 mg/m^2, methotrexate 40 mg/m^2, 5-fluorouracil 600mg/m^2). A few patients were randomized to castration (radiotherapy/surgery) instead of chemotherapy. Postmenopausal patients were treated with Tamoxifen. Patients with tumours larger than 5 cm or with tumour invasions of the profound fascia had additional radiation therapy of the chest wall (48 Gy/24 fractions). Radiotherapy (48 Gy in 24 fractions) of the parasternal, infra- and supraclavicular lymph nodes were given to patients younger than 45 years, having more than four axillary lymph nodes with metastatic involvement. The patients were divided into three groups according to surgical technique and adjuvant radiation therapy: mastectomised patients given adjuvant radiation therapy to the chest wall and/or lymph node basins (MRM+RT), mastectomised patients who had not been given adjuvant radiation therapy (MRM), and BCT patients who all had radiation therapy to the remaining breast. Patients in this group also had additional radiation therapy to the relevant lymph nodes if according to protocols.

A median of 13 lymph nodes was removed by ALND (range 3–34). Eleven (9%) patients had less than ten lymph nodes removed. Fifty three (40%) patients had metastatic involvement of the axillary lymph nodes. Additional patient characteristics are listed in Table I.

Physical disability was assessed by the *Constant Shoulder Score* (CSS) [10–12]. To estimate the incidence and discomfort of late symptoms (defined as symptoms from the operated area, the shoulder, arm, or neck on the operated side present after the immediate postoperative discomfort had passed) the patients answered a questionnaire previously used by the authors [12,14].

The *Constant Shoulder Score* is a 100-point score composed of a number of both *subjective parameters* and *objective measurements* of active motion range and shoulder strength. In the CSS, 35 points are allocated for subjective assessment of shoulder pain and assessment of the ability to perform the normal activities of daily living. Forty points are allocated for objective measures of range of movement (ROM). The assessment of ROM is based on the active range of composite movements that allow placement of the upper limb in functionally relevant positions. A goniometer is used to measure forward and lateral elevation. Positioning of the hand in relation to the head and trunk is used for the assessment of inner and outer rotation. Twenty-five points are allocated for the assessment of strength in lateral elevation. Strength is measured with the patient sitting upright with the arm in 90 degree of elevation in the scapular plane, the elbow extended and the forearm pronated. A strap is placed around the wrist and attached to an ISOBEX device. The ISOBEX measures the relatively constant upward force 10 times per second for 5 seconds and calculate a mean value. The average of five measurements is used for allocating points [10,11].

The CCS was assessed on both the operated and on the non-operated side, using the non-operated side as reference. The CSS on the operated side was subtracted from the CSS on the non-operated side, thus, generating the difference in CSS (CSS).

The *Constant shoulder score* excluding the assessment of power was also calculated because the

Table I. Patient characteristics according to radiation treatment and surgical technique.

	Number of patients (%) median values and range			
	BCT n=43	MRM n=67	MRM+RT n=22	ALL n=132
Age (years)	54 (26–75)	59 (31–78)	51 (43–65)	55 (26–78)
Follow-up (months)	33 (18–54)	42 (18–102)	27 (18–60)	36 (18–102)
Lymph nodes removed	13 (5–24)	14 (3–34)	16 (7–26)	14 (3—34)
Axillary metastasis	13/43 (30%)	21/67 (31%)	19/22 (86%)	53/132 (40%)
Tumour size (mm)	14 (5–70)	15 (3–60)	22 (15–50)	19 (5–70)
Chemotherapy	10/42 (24%)	16/67 (24%)	14/22 (64%)	40/130 (28%)
Radiotherapy to regional lymph nodes	2/43 (4%)	0/67 (0%)	22/22 (100%)	24/132 (18%)

muscles on the handed side where expected to be stronger compared to the muscles on the non-handed side. As half of the patients had surgery on the non-handed side, their full CSS score could be biased.

The patients completed a questionnaire concerning the presence of six late symptoms, and the extent to which the symptoms affected them. The patients were questioned as to the presence of the following in the axilla or arm on the treated side:

> "pain or a feeling of tightness in the scar and/or operative area ";
> "pain in the treated arm or shoulder";
> "feeling of swelling in the arm or armpit on the treated side";
> "feeling of reduced movement in the arm or shoulder on the treated side";
> "feeling of reduced strength in the shoulder";
> "abnormal sensations"

The patients answered each of these questions employing the terms: the symptoms never occurred; rarely occurred; were present more than a couple of times per week; or occurred daily. In addition the patients were asked to specify the degree of inconvenience to everyday life using the terms: no, minor, moderate, or major inconvenience.

Statistical considerations

Logistic regression analysis was performed in order to describe the relation between radiation therapy, surgical technique and active range of motion. Patients were separated into three groups according to surgical technique and radiation treatment: MRM+RT, MRM, and BCT. Reduced range of motion was the dependent variable. The BCT patients were used as reference group. Adjustment for chemotherapy made no difference in outcome.

No difference in age and follow-up time was found between the group of patients with reduced ROM and the group of patients with normal range of motion. Mantel-Hanszel analysis including age and follow-up time (>36 months) was performed in the three subgroups respectively and confirmed this result. Thus, age and follow-up time was left out of the regression model.

The Mann-Whitney U-Test with a 95% level of significance was used to analyse the differences in CSS. For analysing the difference in proportions the χ^2 test was used with a 95% level of significance. A two-sided p-value less than 5% was considered statistically significant.

The statistical analyses were performed by using the computer program SAS/WINDOWS (version 6.2) and SPSS/WINDOWS (version 9.0).

Results

Shoulder disability

Regardless of surgical technique and adjuvant radiotherapy patients in all three sub-groups showed significantly lower CSS on the treated side compared to the non-treated side, when analysed as paired data. ($p<0.05$). BCT patients above the age of 59 had equally good scores on both sides when the measurement of strength was excluded from the total score. The CSS was found to be significantly larger in the MRM+RT group as compared to both the BCT and MRM groups ($p<0.01$), whereas no difference was found between the MRM and BCT groups.

The median points allocated for both the subjective part and the objective part of the total score is shown in Table II**.**

In order to evaluate the objective shoulder mobility separately, the *range of motion* was separated from the CSS. Overall 46 patients (35%) showed a reduction in ROM in one or more directions on the operated side. In all cases, the non- treated shoulder had normal ROM in all directions. Lateral and forward elevation was the most frequent motions compromised. Thirty-six patients (27%) had reduced lateral elevation and in ten patients it was the only motion compromised. The reduction in lateral elevation was less than 30 degree in 20 patients (15%), between 30 and 60 degrees in 13 patients (10%), and three patients (2%) had more than a 60 degree reduction in elevation range. Thirty-three patients had reduced forward elevation. In seven patients it was the only motion affected. The reduction in forward elevation was less than 30 degree in 30 patients (23%), between 30 and 60 degree in two patients (2%). Two patients (2%) had more than a 60 degree reduction in elevation range. Nine patients had reduction in inner and/or outer rotation. In only three patients it was the single motion compromised.

The median total score including median points allocated for the subjective part of the score as well as median points allocated for strength is shown in relation to ROM in Table III and, additional patient characteristics are listed in Table IV.

Forty-three (50%) of the patients with normal ROM, and 23 (50%) of the patients with decreased ROM received postoperative radiation therapy. In the group with normal shoulder movement 81% of the patients had received radiation treatment as part

Table II. Median points (quartiles) allocated for the individual parts of the CSS score on the treated and non-treated side, in relation to surgical technique and radiation therapy.

	MRM+RT n=22		MRM n=67		BCT n=43	
Median points allocated	treated	non treated	treated	non treated	treated	non treated
Subjective part	31 (29;35)	35 (35;35)	35 (27;35)	35 (35;35)	35 (31;35)	35 (35;35)
Range of motion (ROM)	35 (29;35)	38 (38;40)	38 (38;40)	40 (38;38)	38 (38;40)	40 (38;40)
Strength	7 (5; 9)	7 (6;10)	7 (5; 9)	8 (6;11)	8 (7;10)	8 (6; 8)
Total CSS score	72 (32–84)	81 (73–87)	78 (24–89)	82 (67–91)	81 (43–87)	82 (76–87)

Table III. Median points (quartiles) allocated for the individual parts of the CSS score on the treated and non treated side, in relation to surgical technique and radiation therapy.

	Normal ROM n=86		Reduced ROM n=46	
	treated	non-treated	treated	non-treated
Subjective part	35 (32;35)	35 (35;35)	31 (24;31)	35 (35;35)
Range of motion	40 (38;40)	40 (38;40)	33 (28;36)	38 (38;40)
Strength	8 (6;10)	8 (6;10)	7 (4;8)	8 (6;11)
Total CSS score	81 (77; 83)	82 (79;85)	71 (58;76)	81 (79;83)

of BCT. In the group with reduced ROM, significantly more patients were subjected to MRM ($p = 0.005$), and a significant higher proportion of these ($p = 0.004$) received radiation therapy to the chest wall.

The MRM+RT patients had a significantly higher frequency of reduced ROM as compared to the BCT patients (OR = 8.5, 95%CI 2.2-33.2, $p = 0.002$). More MRM patients as compared to BCT patients were found to have reduced ROM. However, the difference was not statistically significant (OR = 2.5, 95%CI: 1.0–6.6, $p = 0.06$).

Table IV. Patient characteristics and late symptoms according to ROM.

Patient characteristics'	Normal ROM n=85	Reduced ROM n=43
BCT	35/42 (83%)	7/42 (17%)*
MRM	43/66 (65%)	23/66 (35%)*
MRM+RT	7/20 (35%)	13/20 (65%)*
chemotherapy	23/83 (28%)	17/43 (40%)
Age (years)	56 (26–78)	55 (30–77)
No of lymph nodes removed	13 (3–34)	14 (7–24)
Follow-up (months)	36 (18–102)	36 (18–102)
Pain in the scar or operating area	17/86 (20%)	22/44 (50%)**
Pain in the neck, arm or shoulder	19/86 (22%)	21/44 (48%)**
Swelling in the arm or armpit	20/82 (24%)	12/42 (29%)
Reduced movement in the arm or shoulder	0/86 (0%)	11/42 (26%)**
Reduced strength in the shoulder on the treated side	7/85 (8%)	12/41 (29%)**
Paresthesia in the axilla on the treated side	10/85 (13%)	7/41 (18%)

* $p < 0.05$; ** $p < 0.01$.

The median CSS on the non-operated side was 83 (73–89) for patients younger than 50 years, 79 (67–86) in the age group 50–59, and 80 (67–86) for patients older than 60 years.

Late symptoms

Among the 132 patients, 32 (24%) stated that they never experienced any late symptoms. Thirty-one (24%) had never or rarely experienced any, while 69 (52%) experienced one or more late symptoms more than twice a week or daily. The late symptoms varied in incidence and inconvenience to the individual patient. "Pain in the neck, arm and shoulder" was the most frequent (31%) late symptom present more than twice a week, and "Reduced strength and decreased shoulder mobility " the least frequent (9%).

Of the women experiencing the individual late symptom more than twice a week, 7 to 82% (depending on the specific type of late symptom) stated that it was a moderate or major problem. The presence of parasthesia was described as being the least and the decreased shoulder mobility as being of the most inconvenience, when present. Hence, a late symptom was considered to be a moderate or major problem in up to 18% of all patients. The percentage of patients experiencing the individual late symptom more than twice a week or daily is shown in relation to surgical technique and adjuvant radiation therapy in Table V.

Table V. The incidence of the individual late symptom if present more than twice a week, in relation to surgical technique and adjuvant radiation therapy.

	Treatment and number of patients (%)			
Late symptoms	BCT n = 43	MRM n = 67	MRM + RT n = 22	ALL N = 132
Pain in the scar or operating area	11/42 (26%)	16/66 (24%)	12/22 (55%) *	39/130 (30%)
Pain in the neck, arm or shoulder	9/42 (21%)	22/66 (33%)	9/22 (41%)	40/130 (31%)
Swelling in the arm or armpit	10/42 (24%)	14/60 (23%)	8/22 (38%)	32/124 (26%)
Reduced movement in the arm or shoulder	2/42 (5%)	5/62 (8%)	4/22 (18%)	11/126 (9%)
Reduced strength in the ipsilateral shoulder"	5/42 (12%)	10/62 (16%)	4/22 (18%)	19/126 (15%)
Paresthesia in the axilla	7/42 (17%)	8/62 (13%)	2/22 (9%)	17/126 (14%)

Patients with reduced ROM reported a significantly higher frequency of the late symptoms: "Pain in the scar or operating area" ($p < 0.001$), "Pain in the ipsilateral shoulder, arm or neck" ($p < 0.003$) and reduced movement ($p = 0.003$) and strength ($p = 0.002$) as compared to patients with normal ROM. These four late symptoms were also of more inconvenience to the patients ($p < 0.01$) when present.

The experience of "swelling of the armpit or arm" and "presence of paraesthesia" were equally distributed in both groups. The frequency of the different late symptoms in relation to ROM is shown in Table IV.

Discussion

Surgery for breast cancer including axillary dissection has become less invasive and the technique of radiation therapy has improved during recent years. Still, subjective and objective complications to the treatment of breast cancer are frequent [13,15–21].

Several methods have been used to evaluate shoulder movement making it difficult to compare results. Both passive and active movements have been assessed, as well as tests of the patients' ability to perform different tasks of daily living. We have chosen to use the *Constant Shoulder Score*. This score is widely used and accepted in functional assessment of the shoulder and for the initial assessment and follow-up of most types of pathological shoulder conditions. By using this score, assessing both the subjective and objective aspects of shoulder function, all patients had statistically significant decreased shoulder function on the treated side compared with the non-treated side. The allocation of points for the subjective part of the score and for strength corresponded well with the allocation of points for range of motion.

A single motion only is often used as an indicator of the objective reduction in shoulder motion. In this situation the lateral elevation is frequently preferred as it is the motion most often compromised. However, if we had used lateral elevation only as a single indicator of ROM, we would have missed ten patients who only had reduced forward elevation/inner-outer rotation.

Objective reduction in shoulder movement was present in one third of the patients. Patients with decreased ROM also experienced more frequent and more severe pain in the scar, in the operation area, and in the treated arm neck and shoulder, than did the patients with normal ROM. The majority of patients with decreased ROM were mastectomised. Others have reported an incidence of reduced ROM in mastectomised patients ranging from 13 to 77% [4,5,15,22]. Comparing the results is difficult, as different surgical techniques and different radiation therapy regimes have been applied. Both axillary sampling and full axillary dissection of level I-III, and in some cases resection of the pectoral muscle has been performed in the different studies. Only eight (20%) of the 43 BCT patients in the present study had reduced ROM. Tengrup et al. [16] followed 110 patients for 5 years after BCT and found that 49% of these patients developed impaired shoulder mobility. The lower frequency of reduced ROM among the BCT patients in our study could be explained by the fact that reduced mobility was defined as a reduction in any direction of more than 15 degree in the Swedish study but as at least a 30 degree of reduction in active lateral or forward elevation when the CSS was used. Where as lymph oedema is known to develop years after the initial treatment, the Swedish study concluded that the majority of cases with reduced range of motion would develop during the first postoperative year. Segerstrom et al. [23] found that shoulder mobility may decrease or increase in up to two years postoperatively. This is in accordance with our results. Long follow-up (>36 months) did not influence the frequency of patients with reduced shoulder mobility.

Despite the fact that both MRM + RT and BCT patients had axillary lymph node dissection of level I and II and equal radiation therapy was applied, the

MRM +RT patients had a significantly higher frequency of reduced ROM as compared to the BCT patients (OR = 8.5, p = 0.002). More MRM patients as compared to BCT patients were found to have reduced ROM. However, the difference is not statistically significant (OR = 2.5, p = 0.06). Our results is supported by the findings of others, the type of operation on the breast is an important factor in the development of decreased shoulder movement [15,24,25].

In Denmark, mastectomy is performed as a modified radical mastectomy ad modem Cady including axillary dissection of level I and II. The breast ablation includes removal of the fascia overlying the major pectoral muscle. The subcutaneous tissues of the skin flaps grow to the raw muscle and adhere firmly, and may inhibit the usual smooth sliding between muscle and subcutaneous tissue when the arm is abducted, flexed or outer rotated maximally and the pectoral muscle has to be fully extended. Adjuvant radiation therapy adds to the fibrous firm attachment. For cosmetic reasons, and in order to ensure an appropriate attachment of a prosthesis, it is surgically aimed to create a firm, smooth chest wall. This might add to the problem, as the skin is "too tight" for maximal movement of the shoulder. In breast conserving surgery the pectoral fascia is not removed in but a small area and the pectoral muscle can be extended normally.

The age of the patient was not found to influence the development of decreased shoulder function in the present study. An explanation could be that only patients without previous shoulder illness were enrolled in our study and that the physiological decrease in shoulder mobility with increasing age was taken into account by using the mobility on the non treated side as baseline reference in the individual patient.

Fifty-two per cent of the patients experienced one or more of the six late symptoms more than twice a week. Depending on the specific type of late symptom, from 10 to 17% of all the patients considered it a moderate or major problem. Also Kakuda et al. [26] found, in a similar cross sectional study of 95 patients, that 70% experienced one or more of the late symptoms; swelling, arm pain, chest wall pain and stiffness or weakness in the shoulder. In the latter study, the individual symptom was characterised as moderate/severe in 15 to 23% of all patients, depending on the specific symptom.

Patients with reduced shoulder mobility experienced more frequent pain in the neck, arm, and shoulder as well as in the scar and operative area. The reduced shoulder mobility may alter the upper body posture, because the patients try to compensate for the decreased ROM. This may cause a straining of the muscles in the shoulder and neck and thereby result in a more frequent experience of pain.

The current study implies that reduced shoulder mobility is a frequent complication to the treatment of early breast cancer. When corrected for the extend of radiation therapy and axillary surgery, the frequency of shoulder disability and late symptoms was most pronounced in patients given mastectomy compared to those who received breast conserving surgery.

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