World Journal of Surgery

Breast-conserving Therapy for Palpable and Nonpalpable Breast Cancer: Can Surgical Residents Do the Job Irrespective of Experience?

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Abstract

Background The aim of this study was to evaluate the influence of operative experience in obtaining tumor-free margins in breast-conserving therapy. In the case of palpable breast cancers, lumpectomies can safely be performed by any surgical resident. For nonpalpable breast cancers, lumpectomies should be treated only by senior residents or attending surgeons, even if supervision during the operation is given by an attending surgeon for junior residents. Radicality of breast carcinoma excision, defined by the tumor-free margin of the removed specimen has been determined to be the major prognostic factor for local recurrence. The aim of this study was to evaluate the influence of operative experience in obtaining tumor-free margins in breast-conserving therapy (BCT). Can lumpectomy for breast carcinoma be performed by surgical residents safely?

Methods All lumpectomies for breast carcinoma between 1999 and 2003 were included out of a prospective database of a single institution. Radicality of resection and patient and histopathologic tumor characteristics were analyzed for 660 lumpectomies. Operative experience of the surgeon performing the lumpectomy was staged as junior residents (JR, years 1–3 in residency), senior residents (SR; years 4–6 in residency), and attending surgeon (AS).

Results A significant difference in obtaining tumor-free margins for palpable tumors was found between ASs (81%) vs. SRs assisted by another resident (92%). For nonpalpable tumors, a significant difference was found in two groups: (1) SRs assisted by another surgical resident (86%) vs. JRs assisted by another surgical resident (61%) and (2) ASs (83%) vs. JRs assisted by another resident (61%) or assisted by an AS (73%).

Conclusion Surgical residents can safely perform BCT in patients with palpable breast cancer. The level of experience has no statistical significance for palpable tumors in a high-volume center. Nonpalpable lesions should be treated only by SRs or ASs.

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In the past decades screening mammography has become widely used so, consequently, tumors are being detected at earlier stages. Earlier detection of malignant breast tumors results in an increase in the incidence of small tumors. Breast-conserving therapy (BCT) has become a possible treatment option for most breast tumors. Large prospective randomized trials demonstrate a similar survival rate for breast cancer patients treated with BCT or radical mastectomy, making BCT the treatment standard [1, 2].

Patients treated with BCT carry the lifelong risk of local recurrence, which occurs at or near the surgical site

[3–5]. Completeness of tumor excision, defined by the tumor-free margin of the removed specimens, has been determined to be the major prognostic factor for local recurrence, with a close correlation to patient survival [6, 7].

In recent years growing attention has been given to the performance of surgical treatment, whether within institutions ("auditing of own performance") or between institutes. This resulted in debates about whether low-volume hospitals should perform surgical procedures with a low incidence and a high morbidity and mortality rate (like esophageal and pancreatic cancers) [8, 9]. The survival of patients treated for a high-incidence disease like breast cancer has been shown to be dependent on surgical expertise. Skinner et al. [10] reported a reduction of risk of death at five years to 33% when patients were treated by a surgical oncologist versus a general surgeon. These data raise the question of whether surgical residents can safely perform BCT without limiting patient outcome. Limited data are available on the effects of surgical experience on completeness of tumor excision [11–13].

Available studies did not explicitly differentiate between levels of experience, whether supervision was given during the operation, or between palpable and nonpalpable tumors. Since BCT is a procedure performed daily in our hospital, the aim of this study was to audit our own performance and to test if completeness of resection of both palpable and nonpalpable breast tumors is dependent on surgical experience. Furthermore, we tested the association between completeness of resection with several other clinical and pathologic parameters.

Patients and methods

Patients

All patients treated for breast carcinoma between 1999 and 2003 at a major General District Hospital (Atrium Medical Centre, Heerlen, The Netherlands) were enrolled in a prospective database. Data on the patients who underwent BCT were extracted and analyzed. Missing data were retrieved retrospectively if possible. The following parameters were included in the analysis: age, mode of presentation (palpable or nonpalpable tumor), clinical stage, radiologic classification, cytologic and histologic stage, presence of microcalcifications, experience of the operating surgeon, experience of operating resident, quality of wire localization, volume of resection specimen, tumor size, nuclear grade of ductal-carcinoma-*in-situ* (DCIS), margin status, completeness of excision, and preoperative tumor classification.

Surgical experience

Surgical experience was divided into three levels: attending surgeon (AS), senior residents (SR, years 4–6 in residency), and junior residents (JR, years 1–3 in residency). For all ASs and all SRs, the number of breast-conserving operations performed at the start of the time interval for inclusion was more than 75 and 25, respectively. JRs mean number of performed breast-conserving operations was less than 10. The experience level of the combination of operating surgeons was also taken into account. When another resident assisted a SR or JR, no distinction was made for the level of experience of the assisting resident. Allocation of the performing surgeon or resident was considered random on the basis of availability for scheduled operations.

Preoperative workup

The surgeon attending the outpatient clinic provided the clinical data. All mammograms and ultrasounds were judged by a single senior breast radiologist (I.S.) and classified according to the level of suspicion (R1–5 and U1–5) as defined in the Breast Imaging Reporting and Data System (BIRADS). Poor palpability during preoperative workup was objectivated for each case by an AS which resulted in a nonpalpable classification for the lesion of interest. A single breast radiologist (I.S.) performed the preoperative wire localizations for the nonpalpable tumors. A standard mammogram was taken for evaluation of wire localization. Wire situation through the lesion or less than 1 cm from the edge of the lesion on a standard control mammogram after localization was considered optimal. Any localization more than 1 cm from the lesion of interest was classified as suboptimal.

A multidisciplinary team reviewed the mammogram, ultrasound, and clinical findings if the preoperative workup revealed a diagnosis of unconfirmed malignancy (C1–4 and/or H1–4). Patients suspected of having malignancy were operated on as if having proven malignancy. Patients with preoperative cytologic or histologic diagnosis of malignancy with early stage at clinical presentation (cT1–2) underwent BCT.

Tumor excisions were performed with the aim of complete tumor removal and a macroscopic surgical margin of at least 1 cm.

Pathology

All preoperative biopsies were performed according to a standardized protocol that did not change during the study period. Extended carcinoma *in situ* (ECI) was considered present when *in situ* cancer occupied 25% or more of the

area encompassed by infiltrating tumor, or sections of grossly unremarkable breast tissue, or clearly extending beyond the infiltrating edge of surrounding breast tissue. Microscopic examination included tumor classification according to WHO [14]. For infiltrating tumors, Bloom and Richardson's classification was used for grading [15]. In all specimens the proximity of tumor to the surgical margin was defined with measurement in millimeters. T3 or T4 pathologic staging after resection was considered inadvertent stage migration after pathology review. Involvement of lumpectomy specimens' margins was defined with presence of microscopic invasive carcinoma or DCIS. Massive involvement as in diffuse or multiple microscopic foci was regarded an an indication for re-excision. Focal margin involvement did not require re-excision. In these cases further treatment constituted specified radiotherapy. If no residual tumor was found in re-excision specimens, the margin was considered clear in retrospect but was classified as nonradical. A single senior breast pathologist (M.N.) re-examined any specimen report without exact specification of resection margins in millimeters.

Statistics

All data were analyzed using SPSS version 12.0 (Statistics Package for the Social Sciences, SPSS Inc., Chicago, IL). Significance of differences in continuous variables was evaluated using Student's t test. One-way analysis of variance (ANOVA) was performed to determine the relationship between independent variables and margin status. Significance was considered present at $p < 0.05$. Data are expressed as mean ± standard deviation (SD).

Results

Between January 1999 and December 2003, 922 patients with breast carcinoma underwent surgical treatment. All patients were female with a mean age at diagnosis of 61.3 ± 11.8 years. Six hundred forty-four patients underwent BCT, of which 16 underwent bilateral BCT for bilateral carcinoma.

Preoperative diagnosis

The tumor was palpable in 53% ($n = 352$) of 660 cancers. Diagnosis of cancer was made by fine-needle aspiration cytology in 35.2% ($n = 232$) and by stereotactic large-core needle biopsy in 52.7% ($n = 348$) of cases. The remaining 12.1% ($n = 80$) did not have pathologic confirmation of tumor characteristics preoperatively. All nonpalpable carcinomas ($n = 308$) were marked for excision by wire localization with ultrasound assistance.

Tumor characteristics

On preoperative physical examination, 49.7% of breast tumors had a high index of suspicion for malignancy, 49.8% were identified as uncertain, and 0.5% were identified as benign. Tumors ranged in size from 2.0 to 45.0 mm with a mean of 14.9 ± 7.3 mm. The following subtypes were identified in resection specimens: invasive ductal carcinoma (28.8%, $n = 190$), invasive with a DCIS component (47.1%, $n = 311$), pure DCIS (11.2%, $n = 74$), lobular invasive carcinoma (7.7%, $n = 51$), and others (5.2%, $n = 34$).

Tumors were well differentiated in 23.2% of the specimens, moderately differentiated in 52.0% ($n = 343$), and poorly differentiated in 22.4% ($n = 148$), and in 16 specimens (3%) the differentiation grade was not specified.

Radiology

A majority of the palpable cancers (83.2%, $n = 293$) had a high radiologic index of suspicion for malignancy (score of R5/U5). Microcalcifications were seen in 16.8% ($n = 59$) of mammograms. In the nonpalpable group, 78.6% ($n = 242$) of tumors had a score of R5/U5, and 35.4% ($n = 109$) of the mammograms showed microcalcifications.

Operator combination and completeness of excision

Nonpalpable tumors

Table 1 shows the different combinations of surgeons that performed the BCT surgery and the effect of combination on completeness of excision. The SRs performed the major part of lumpectomies ($n = 309$, 46.8%), followed by ASs ($n = 204$, 30.9%) and JRs ($n = 147$, 22.2%). Similar percentages for negative margins in the nonpalpable tumor group were found for ASs (82,7%), SRs supervised by a surgeon (80.4%), and SRs assisted by another resident (86.4%). The percentage of tumor-free margins was significantly lower in the group operated by the JRs, both when assisted by a surgeon or by another resident ($p = 0.017$ and $p = 0.006$, with two-tailed Student's t test)(73% and 61%, respectively; Table 1).

Palpable tumors

The percentage of tumor-free margin achieved by JRs in patients with palpable tumors did not differ from the results of the SRs or the attending consultants (Table 1). Specimens resected by SRs who were assisted by another resident had significantly less positive margins than those resected by ASs (8% vs. 19%, $p = 0.038$). No other significant differences were observed between groups.

Table 1 Surgeon combination and completeness of excision

Surgeon	Nonpalpable tumors			Palpable tumors		
	radical	nonradical	n	radical	nonradical	n
AS	67 (83%)	14 (17%)	81	100 (81%)	23 (19%)	123
SR-AS	37 (80%)	9 (20%)	46	49 (88%)	7 (12%)	56
SR-resident	60 (86%)	10 (14%)	70	77 (92%)	7 (8%)	84
SR	24 (77%)	7 (23%)	31	18 (82%)	4 (18%)	22
JR-AS	35 (73%)	13 (27%)	48	34 (90%)	4 (10%)	38
JR-resident	17 (61%)	11 (39%)	28	26 (93%)	2 (7%)	28
JR	1 (25%)	3 (75%)	4	1 (100%)	0 (0%)	1

Factors of influence for positive margins

For all tumors, completeness of excision was significantly influenced by the palpability of the tumor ($p = 0.001$), the presence of microcalcifications ($p = 0.000$), lumpectomy volume ($p = 0.03$), and (pT) status ($p = 0.000$). A mulitvariate analysis showed the presence of microcalcifications ($p = 0.001$) and (pT) status ($p = 0.019$) to be independant factors for positive margins. Lumpectomy volume ($p = 0.230$) and palpability ($p = 0.359$) failed significance in multivariate testing.

With ANOVA there was no significant relationship between completeness of excision and tumor size in millimeters ($p = 0.354$), tumor localization ($p = 0.816$), histopathologic subtype ($p = 0.058$), differentiation level ($p = 0.473$), presence of *in situ* component ($p = 0.835$), and age ($p = 0.629$).

Table 2 shows the influence of microcalcifications on obtaining tumor-positive margins. The presence of microcalcifications in lumpectomy specimens of nonpalpable cancers resulted in a significantly higher percentage of positive tumor margins [36.7% vs. 13.6% if microcalcifications were not present ($p = 0.000$)]. In palpable cancers the presence of microcalcifications did not influence completeness of excision (10.2% vs. 14.0%, $p = 0.531$).

The influence of pathologic classification (pT) on completeness of excision is shown in Table 3. There was a significant influence of pT class on completeness of resection ($p = 0.000$), with high percentages of incomplete resections for (pT) in both palpable and nonpalpable disease. There was no significant difference in completeness of excisions for tumor pathologic classification between nonpalpable and palpable tumors (44.1% and 38.5%, respectively). However, the influence of pT classification for positive margins is mainly the result of failure to obtain negative margins in the pTis-classified tumors (for both palpable and nonpalpable disease).

Interestingly, there was no significant difference in the completeness of excision between specimens with optimal or suboptimal wire localization for nonpalpable disease. Failure to achieve completeness of excision in nonpalpable tumors was associated with a smaller lumpectomy volume (124 ± 12 cm^3 for incomplete and 155 ± 7 cm^3 for complete excisions, $p = 0.020$). There was no significant difference in lumpectomy volume for positive and negative margins in palpable tumors (169 ± 22 cm^3 vs. 170 ± 7 cm^3, $p = 0.745$).

Of the patients with incomplete resections ($n = 114$), 37 were treated with radiotherapy, 34 underwent a mastectomy, and 43 underwent a relumpectomy. In 67.4% ($n = 29$) of the relumpectomy specimens, no residual tumor could be found. The relumpectomy specimens revealed incomplete tumor-free margins in 2 of the 14 patients in which residual tumor was found in the relumpectomy specimens.

Discussion

The aim of this study was to evaluate the feasibility of BCT performed by residents in training. Our data confirm that lumpectomy for carcinoma can be performed safely by residents in training, resulting in comparable numbers of negative margins for palpable carcinomas in resection

Table 2 Influence of microcalcifications on completeness of excision

Microcalcifications	Nonpalpable tumors			Palpable tumors		
	radical	nonradical	n	radical	nonradical	n
yes	69 (63%)	40 (37%)	109	53 (90%)	6 (10%)	59
no	172 (86%)	27 (14%)	199	252 (86%)	41 (14%)	293

Table 3 Influence of pT classification on completeness of excision

Classification	Nonpalpable tumors			Palpable tumors		
	radical	nonradical	n	radical	nonradical	n
pTis	33 (56%)	26 (44%)	59	8 (61%)	5 (39%)	13
pT1	188 (83%)	39 (17%)	227	179 (87%)	26 (13%)	205
pT2	20 (91%)	2 (9%)	22	109 (89%)	13 (11%)	122
pT3	–	–	–	2 (100%)	0 (0%)	2
pT4	–	–	–	7 (70%)	3 (30%)	10
total	241 (78%)	67 (22%)	308	305 (87%)	47 (13%)	352

specimens for operations performed by SRs, ASs, and JRs when supervised by an attending surgeon or assisted by another resident.

Nonpalpable carcinomas, however, show a substantial increase in the number of positive margins when operated on by JRs. Data show that this increase in nonradical resections is absolute and not dependent on the level of supervision given during the operation. This suggests that JRs do not have the necessary surgical skills to perform a lumpectomy for a nonpalpable carcinoma resulting in negative margins in resection specimens.

Reported rates of incomplete excisions

The rates of 13% for incomplete excisions for palpable tumors and 22% for nonpalpable tumors are comparable with rates found in literature. Moorthy et al. [13] reported a re-excision rate of 21% for palpable tumors and 32% for nonpalpable tumors. Regarding re-excisions, Dixon et al. [11] reported on patients with nonpalpable tumors who were operated on by unsupervised residents resulting in a higher rate of re-excisions (57% vs. 4%). However, no distinction was made in level of experience of the resident. Recently, Moorthy et al. [13] showed no difference in re-excision rates between attending surgeons and residents who were in their final years of training (AS 27.8% and SRs 25.7%). Furthermore, Landheer et al. [12] reported no difference in margin-free resection between surgeons and residents, but made no distinction between palpable and nonpalpable tumors or level of experience of the residents. Our findings support the idea that BCT for palpable tumors can be performed safely by residents in training. Extrapolation of our data to other clinics should be made with caution because our hospital is a high-volume center for breast surgery (approximately 200 cases/year). Treatment in hospitals that perform more than 150 operations per year have a reduced risk of death by 33% compared to low-volume hospitals [10, 16].

The present study shows that obtaining tumor-free margins is dependent on whether the breast carcinoma is palpable or nonpalpable when performing a lumpectomy.

We also demonstrated that the lumpectomies that were performed for nonpalpable tumors resulting in positive margins had a significantly smaller volume compared to radical resections. Secondary tumor characteristics were not shown to differ or have significant influence between operator groups.

In contrast to previous reports, we could not show a significant influence on completeness of excision for age of the patient, tumor size, tumor localization, histopathologic subtype, differentiation grade, presence of *in situ* component, and adequacy of wire localization [17–21]. Previous reports suggest a higher risk for incomplete excisions in younger patients [17, 18] and when dealing with larger tumor sizes [19–21]. Horiguchi et al. [22], however, could not show that age, tumor size, lymph node status, and clinical stage had an effect on completeness of excision. Moorthy et al. [13] and Tarrter et al. [17] showed that patients who underwent a lumpectomy in the absence of a positive tissue diagnosis had a higher risk for re-excision. This could not be confirmed by our data.

Essentially, lumpectomy for nonpalpable tumors is different from lumpectomy for palpable tumors in that the former requires higher surgical skills such as the ability to make a three-dimensional mental image of the operating field. With palpable lesions the performing surgeon has a constant reference of macroscopic tumor margins by palpation of the tumor. Results of the present study show that surgical residents in training can safely perform BCT for palpable breast tumors. Senior residents can perform the operation without the supervision of an attending surgeon.

For all attending surgeons and all senior residents, the number of breast-conserving operations performed at the start of the time interval for inclusion in this study was more than 75 and 25 procedures, respectively. Junior residents had a mean number of performed breast-conserving operations of less than 10. Accordingly, the minimum experience for breast-conserving surgery for nonpalpable breast carcinoma should be 25 procedures. It should be kept in mind, however, that ongoing experience and thus adequate surgical exposure each year for the surgeons performing these operations should be available. We state

that for training hospitals, "senior residents after proper training and exposure can do the job."

Ideally, nonpalpable tumors should be reserved for a dedicated surgeon. Palpable tumors can be managed by a nonspecialized surgeon, but it should be kept in mind that adequate exposure is mandatory.

Successful complete excisions of nonpalpable breast tumors are dependent on the level of experience of the operating surgeon. Our data indicate that nonpalpable tumors should not be operated on by junior residents, even if supervised by an attending surgeon. This suggests that for nonpalpable breast cancer, radicality of resection is strongly influenced by the surgical experience of the resident performing the operation.

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