

Original Article

Niko Heiss^{1,2} / Valentin Rousson³ / Assia Ifticene-Treboux² / Hans-Anton Lehr⁴ /
Jean-François Delaloye²

Risk factors for positive resection margins of breast cancer tumorectomy specimen following breast-conserving surgery

¹ Gynécologie-Obstétrique, 65, Avenue Jean Jaurès, F-30900 Nîmes, France, Phone: +0033/466047720, Fax: +0033/466047722, E-mail: docteur.heiss@orange.fr

² Centre du sein, CHUV Lausanne, Lausanne, Switzerland, E-mail: docteur.heiss@orange.fr

³ Institut de médecine sociale et préventive, CHUV Lausanne, Lausanne, Switzerland

⁴ Institut für Pathologie im Medizin Campus Bodensee, Friedrichshafen, Germany

Abstract:

Background: The aim of the study was to identify risk factors for positive surgical margins in breast-conserving surgery for breast cancer and to evaluate the influence of surgical experience in obtaining complete resection.

Methods: All lumpectomies for invasive breast carcinoma and ductal carcinoma in situ (DCIS) between April 2008 and March 2010 were selected from the database of a single institution. Re-excision rates for positive margins as well as patient and histopathologic tumor characteristics were analyzed. Surgical experience was staged by pairs made of Resident plus Specialist or Consultant. Two periods were defined. During period A, the majority of operations were performed by Residents under supervision of Specialist or Consultant. During period B, only palpable tumors were operated by Residents.

Results: The global re-excision rate was 27% (50 of 183 patients). The presence of DCIS increased the risk for positive margins: 60% (nine of 15 patients) in the case of sole DCIS compared to 26% (41 of 160 patients) for invasive cancer ($p = 0.005$) and 35% (42 of 120 patients) in the case of peritumoral DCIS compared to 11% (seven of 62 patients) in the case of sole invasive cancer ($p = 0.001$). Re-excision rate decreased from 36% (23 of 64 patients) during period A to 23% (27 of 119 patients) during period B ($p = 0.055$). There was no significant difference between the surgical pairs.

Conclusion: In our study, DCIS was the only risk factor for positive surgical margins. Breast-conserving surgery for non-palpable tumors should be performed by Specialists, however, palpable tumors can be safely operated by Residents under supervision.

Keywords: breast cancer, breast-conserving surgery, palpable tumor, surgical margins, surgical experience

DOI: 10.1515/hmbci-2017-0023

Received: April 27, 2017; **Accepted:** September 20, 2017

Introduction

Conservative treatment, consisting of combined breast conserving surgery (BCS) and radiotherapy (RT) is well established today for early invasive breast cancer and ductal carcinoma in situ (DCIS) [1], [2]. BCS followed by RT yields survival data that are similar to patients who undergo mastectomy [3], but have a higher risk of involved resection margins. The aim of conservative treatment is complete tumor resection and a satisfying esthetic result by conserving a maximum of breast tissue.

Positive resection margins in BCS have been determined to be the major prognostic factor for local recurrence [4], [5], independently of adjuvant treatments or favorable tumor biology [6]. Limited data are available on the effects of surgical experience on completeness of tumor excision [3], [7], [8], but the correlation between high procedural volume and improved surgical outcomes has been demonstrated [9]. In fact, the increase of surgical experience should lead to a better clinical and surgical judgment of adequate margins and in the interest of the patients, an experienced surgeon should carry out the excision. However, training of residents must be guaranteed to obtain adequate surgical experience without detriment to the patients [3].

Niko Heiss is the corresponding author.
©2017 Walter de Gruyter GmbH, Berlin/Boston.

The aim of our study was to find risk factors for positive surgical margins and to compare re-excision rates between consultants, specialists and higher level surgical trainees in patients who underwent BCS.

Materials and methods

Patient population

This retrospective study included patients with preoperative diagnosis of invasive breast cancer or DCIS who underwent BCS between April 2008 and March 2010 in the department of Obstetrics and Gynecology of the Centre Universitaire Vaudois (CHUV), Lausanne (Switzerland). Patients who received neoadjuvant therapy or with personal history of breast cancer were excluded.

Study design

Variables included age at diagnosis, invasive or in situ carcinoma, histologic type, grade, pTNM staging, estrogen (ER) and progesterone receptor (PR) status, presence or not of extratumoral DCIS, vascular invasion, Her2/neu expression and nodal status. Margins were considered as positive according to the criteria “no ink on tumor” for invasive cancer and a margin <2 mm for DCIS. Surgical experience was divided into three levels: Residents (R), Specialists (S) and Consultants (C).

The re-excision rates of surgical pairs composed of Resident + Specialist (R + S), Residents + Consultant (R + C), Specialist + Consultant (S + C), Specialist + Resident (S + R) and Consultant + Resident (C + R) were compared and divided into period A (between 01/04/2008 and 31/03/2009), and period B (between the 01/04/2009 and the 31/03/2010). During period A, most of operations were performed by residents (R + S, or R + C), irrespective of whether the tumors were palpable or not. Difficult lumpectomies were systematically performed by the Consultant (C + R). During period B, only palpable tumors were operated by Residents, and all non-palpable tumors were operated by Specialist (S + R) or Consultant (C + R).

Surgical procedure

Preoperative localization of non-palpable tumors was performed by ultrasound- or mammography-guided wire placement the day preceding the operation.

The surgical procedure includes tumor excision with simple glandular defect recovery.

Complex oncoplastic procedures were not included in the study.

The surgical specimens were orientated by threads and ink in the OR. Macroscopic assessment of tumor margins was performed intraoperatively by the pathologist for palpable tumors. Radiologic assessment by X-ray or sonography was performed intraoperatively for non-palpable lesions. If a positive margin was identified, the surgeon proceeded immediately to a re-excision during the same intervention.

Statistical analysis

Proportions of positive margins were compared among the different groups of patients studied (e.g. patients younger than 60 years versus patients older than 60 years) using chi- (χ^2)-tests. p-Values smaller than 0.05 were considered statistically significant.

Results

One hundred and eighty-three of 278 patients who underwent surgery during that period were eligible for BCS (Table 1). Ninety-five patients underwent mastectomy and were excluded from the study. Ninety-eight of the eligible 183 patients (54%) were more than 60 years old.

Table 1: Age and histologic variables.

	Total (n = 183)	Positive margins (%)	p-Value
Histology			
DCIS	15	9 (60)	0.005
Invasive cancer	160	41 (26)	
Extratumoral DCIS			
Yes	120	42 (35)	0.001
No	62	7 (11)	
Tumor size			
<15 mm	113	28 (25)	0.297
>15 mm	69	22 (32)	
Grade			
1 + 2	126	30 (24)	0.591
3	43	12 (28)	
Nodal status			
Positive	141	35 (25)	0.138
Negative	41	15 (37)	
Vascular invasion			
Yes	19	5 (26)	0.905
No	163	45 (28)	
HER 2			
Negative	161	41 (25)	0.738
Positive	14	3 (21)	
ER/PR			
Negative	18	4 (22)	0.785
Positive	127	32 (25)	
Age			
<60 years	98	30 (31)	0.284
≥60 years	85	20 (24)	

Re-excision was performed in 50 of 183 (27%) patients with positive margins. No statistically significant association was found between margin status and most of the patient and tumor variables (e.g. age at diagnosis, tumor size, tumor grading, nodal status, vascular invasion, hormone receptors and Her2/neu). Solely, the presence of DCIS increased significantly the risk for positive margins compared to invasive carcinoma (60% and 26%, respectively, $p = 0.005$). Presence of peritumoral DCIS was also significantly associated with an increased risk for positive margins (35% and 11%, respectively, $p = 0.001$). No significant increase of positive margins was noted for larger tumors, nodal positive tumors and younger patients (aged <60 years).

Considering the role of the surgeon in re-excision rates, we noted a decrease of positive surgical margins during the period B compared to the period A. Forty-three of 64 (67%) operations were performed by residents (pairs R + S, and R + C) during the period A, whereas 91 of 119 (76%) operations were performed by experienced surgeons (pairs S + C, S + R, and C + R) during the period B (Table 2).

Table 2: Re-excision rates by surgeons experience and period.

Pairs	Period A (%)	Period B (%)
Resident + Specialist (R + S)	8 of 25 (32)	3 of 20 (15)
Resident + Consultant (R + C)	7 of 18 (39)	2 of 8 (25)
Specialist + Consultant (S + C)	1 of 5 (20)	13 of 47 (28)
Specialist + Resident (S + R)	1 of 3 (33)	5 of 21 (24)
Consultant + Resident (C + R)	6 of 13 (46)	4 of 23 (17)
	p-Value = 0.847	p-Value = 0.783
Total	23 of 64 (36)	27 of 119 (23)
		p-Value = 0.055

During the period A, 23 of 64 (36%) patients had positive margins compared to 27 of 119 (23%) patients during the period B ($p = 0.055$). However, no significant heterogeneity in re-excision rates among the five surgical pairs could be detected, neither in period A ($p = 0.847$), nor in period B ($p = 0.783$) (Figure 1).

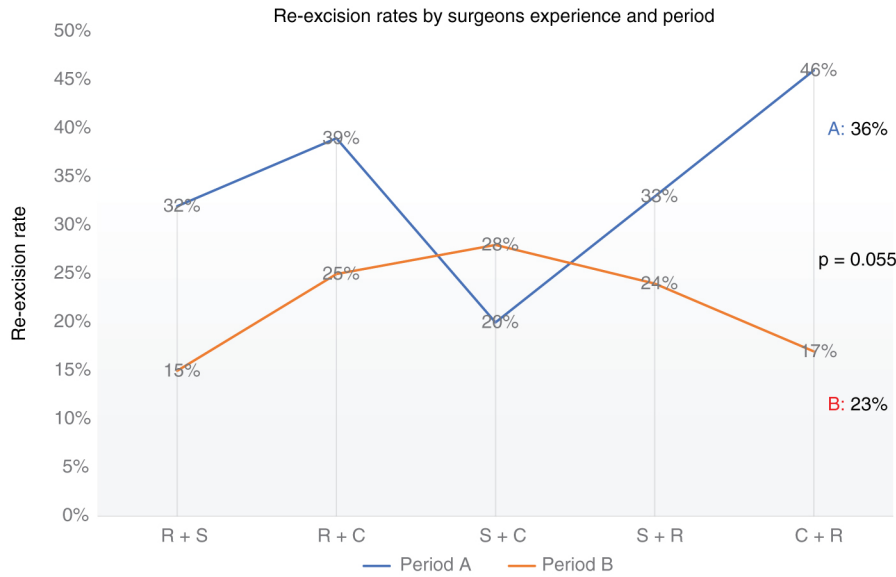


Figure 1: Re-excision rates by surgeons experience and period. See Table 2 for details.

Discussion

The aim of this study was to identify risk factors for positive surgical margins in BCS and to evaluate the role of surgical experience for complete resection. The only parameter significantly associated with an increased rate of positive resection margins is the presence DCIS. These findings are consistent with the literature [10]. Several features such as age <60 years, tumor size, high grade, positive ER/PR status or nodal positive patients increased non-significantly the rate of positive margins.

The global re-excision rate in our study was 27%. Considering that oncoplastic procedures were excluded, these findings are comparable to re-excision rates in the literature, generally about 20%–40% [11]. With the introduction of oncoplastic procedures some authors relate a decrease of margin involvement rates to values about 10%–20% [12]. Introducing these procedures can probably reduce the re-excision rates, especially in the groups of experienced surgeons, apt to employ these techniques.

Concerning the role of surgical experience in the efficiency of BCS, we did not find a significant heterogeneity between the different surgical pairs, but a difference at the limit of significance ($p = 0.055$) between the two periods. Even though this should be confirmed in larger studies, our data support the idea, that BCS for palpable tumors can be performed safely by residents in training, resulting in comparable re-excision rates for palpable tumors (18% for pairs R + S or R + C compared to 24% for pairs S + C, S + R, and C + R). Re-excision rates seem to be high during the period A, when also non-palpable tumors were operated by residents. The re-excision rates in period A were 35% for pair Resident plus Specialist and Resident plus Consultant compared to 26% for pair Specialist plus Consultant and Specialist plus Resident. The most difficult lumpectomies were performed by pair Consultant plus Resident with a high re-excision rate (46%). Residents do not have the necessary surgical skills to obtain negative margins in non-palpable tumors, confirming the results of Cleffken et al. [6].

In contrast to our study, Moorthy and coworkers and Landheer and coworkers found no difference in margin-free resection between Specialists in surgery and Residents [3], [8]. However, Landheer and coworkers made no distinction between palpable or non-palpable tumors. Dixon and coworkers [7] reported a higher rate of re-excisions on patients with non-palpable tumors who were operated by unsupervised Residents. This is supported by the fact that DCIS, which is the only clearly demonstrated risk factor for positive margins in our present study does usually not produce palpable tumors.

Limitation

Our results are not significant and the decrease of positive margins during the period B could be biased by other factors, for example, general improvement of performances with a higher case load (119 lumpectomies compared to 64 cases during the period A).

Conclusion

Operations of non-palpable tumors require higher surgical skills and should be performed by experienced surgeons. However, palpable tumors can safely be operated by supervised residents, without detriment of the patient. Guidelines for specialized breast-units request at least two dedicated breast surgeons carrying out the primary surgery on at least 50 newly diagnosed cancers per annum [13].

Author Statement

Research funding: Authors state no funding involved.

Conflict of interest: Authors state no conflict of interest.

Informed consent: Informed consent is not applicable.

Ethical approval: The conducted research is not related to either human or animals use.

References

- [1] Bani MR, Lux MP, Henninger K, Wenkel E, Magener A, Schulz-Wendtland R, et al. Factors correlating with reexcision after breast conserving therapy. *Eur J Surg Oncol.* 2009;35:32–7.
- [2] Morrow M, Strom EA, Bassett LW, Dershaw DD, Fowble B, Giuliano A, et al. Standard for breast conservation therapy in the management of invasive breast carcinoma. *CA Cancer J Clin.* 2002;52:277–300.
- [3] Moorthy K, Asopa V, Wiggins E, Callam M. Is the reexcision rate higher if breast conservation surgery is performed by surgical trainees. *Am J Surg.* 2004;188:45–8.
- [4] Meric F, Mirza NQ, Vlastos G, Buchholz TA, Kuerer HM, Babiera GV, et al. Positive surgical margins and ipsilateral breast tumor recurrence predict disease-specific survival after breast-conserving therapy. *Cancer.* 2003;97:926–33.
- [5] DiBiase SJ, Komarnicky LT, Schwartz GF, Xie Y, Mansfield CM. The number of positive margins influences the outcome of women treated with breast preservation for early stage breast carcinoma. *Cancer.* 1998;82:2212–20.
- [6] Cleffken B, Postelmans J, Olde Damink S, Nap M, Schreutelkamp I, van der Bijl H. Breast-conserving therapy for palpable and nonpalpable breast cancer: can surgical residents do the job irrespective of experience? *World J Surg.* 2007;31:1731–6.
- [7] Dixon JM, Ravisekar O, Cunningham M, Anderson ED, Anderson TJ, Brown HK. Factors affecting outcome of patients with impalpable breast cancer detected by breast screening. *Br J Surg.* 1996;83:997–1001.
- [8] Landheer ML, Hoorntje LE, Klinkenbijnl JH, Borel Rinkes IH. The surgical treatment of nonpalpable breast carcinoma in a university teaching hospital and a general teaching hospital by residents-in-training and surgeons; comparable results. *Ned Tijdschr Geneesk.* 2004;148:1724–7.
- [9] Zork NM, Komenaka IK, Pennington RE Jr, Bowling MW, Norton LE, Clare SE, et al. The effect of dedicated breast surgeons on the short-term outcomes in breast cancer. *Ann Surg.* 2008;248:280–5.
- [10] Van Deurzen CH. Predictors of surgical margin following breast-conserving surgery: a large population-based cohort study. *Ann Surg Oncol.* 2016;23:627–33.
- [11] Pleijhuis RC, Graafland M, De Vries J, Bart J, De Jong JS, Van Dam GM. Obtaining adequate surgical margins in breast-conserving therapy for patients with early-stage breast cancer: current modalities and future directions. *Ann Surg Oncol.* 2009;16:2717–30.
- [12] Clough KB, van la Parra RF, Thygesen HH, Levy E, Russ E, Halabi NM, et al. Long-term results after oncoplastic surgery for breast cancer: a 10-year follow-up. *Ann Surg.* 2017. DOI: 10.1097/SLA.0000000000002255.
- [13] Wilson AR, Marotti L, Bianchi S, Biganzoli L, Claassen S, Decker T, et al. The requirements of a specialist Breast Centre *Eur J Cancer.* 2013;49:3579–87.