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April 2018

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Recommended Citation

Naz, S., Masroor, I., Saeed, S., Akhtar, W., Butt, S., Sajjad, Z., Ahmad, A. (2018). Accuracy of specimen radiography in assessing complete local excision with breast-conservation surgery. *Asian Pacific Journal of Cancer Prevention*, 19(3), 763-767.

Available at: https://ecommons.aku.edu/pakistan_fhs_mc_radiol/110

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RESEARCH ARTICLE

Editorial Process: Submission:09/22/2017 Acceptance:01/21/2018

Accuracy of Specimen Radiography in Assessing Complete Local Excision with Breast-Conservation Surgery

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Abstract

Objective: The aim of this study was to evaluate the accuracy of “X- ray examination of surgically resected specimen“ in assessing complete local excision (CLE). **Materials and Methods:** In this retrospective cross sectional study, data were collected for all female breast cancer cases who underwent breast-conserving surgery after needle localization of mammographically visible disease. Males, patients with mammographically invisible disease and cases with benign or inconclusive histopathology, those undergoing modified radical mastectomy and individuals with dense breast parenchyma were excluded. We evaluated radiography of resected specimens to assess margin spiculation, distance of mass/microcalcification from the excised margin, presence of a mass, and presence of any adjacent microcalcification, Other features including mass size, nuclear grade and patient’s age were also recorded and all were analyzed for any association with CLE. **Results:** Absence of adjacent microcalcification and the presence of a mass on radiographs showed significant associations with CLE, but no links were evident with other features. Specimen radiography was found to be a sufficient tool to predict CLE with a positive predictive value of 83.3%, a sensitivity of 80.7% and a specificity of 81%. **Conclusion:** Specimen radiography is an important and sensitive tool to predict CLE.

Keywords: Breast cancer- breast conservation- complete local excision- specimen radiography- mammogram

Asian Pac J Cancer Prev, 19 (3), 763-767

Introduction

Breast cancer is the most common cancer world-wide accounting for 21% of all cancers diagnosed in women. Females with breast cancer are now offered a choice of breast conservation with complete local excision (CLE) whenever indicated. Prospective randomized studies have proven that there is no survival dissimilarity between breast- conserving treatment either wide local excision (WLE), or quadrantectomy with radiotherapy and mastectomy (Fisher et al., 1991). However there is always a risk of recurrence of breast cancer in same breast after breast conservation. In this context complete local excision is an integral component in the final outcome as patient with CLE has reduced risk of local recurrence as in case of CLE there is no residual tissue to regrow. (Recht et al., 1985; Veronesi et al., 1990; Ghossein et al., 1992; Schnitt et al., 1994).

Breast needle localization followed by excision of localized tissue is an important procedure in breast conservation when disease is localized in breast and also depends on patient’s will to conserve the breast. After excision, X- Ray examination of breast specimen is performed to assess CLE or incomplete local excision (ILE) on the basis of radiographic findings and then

histopathology confirms the presence of lesion/calcification and its marginal status (Britton et al., 2011). Prevalence of ductal carcinomas in situ (DCIS) is increasing worldwide and its management with preservation of breast is also acceptable even without radiotherapy. WLE is the choice of management due to less chances of recurrence if whole of the disease has been successfully removed leaving healthy breast (Page et al., 1995; Schwartz et al., 2000).

Previous studies (Fisher et al., 1999; Fisher et al., 1999) prove that a ‘clear margin’ of specimen is related with reduced tumor recurrence. A study by Silverstein (Silverstein, 1997) claimed that even radiotherapy can be skipped if the clear margins are more than 10 mm in thickness. The specimen margins on X Ray would be labeled as ‘clear or negative’ with CLE when it has 10 mm thickness of normal parenchyma or fat around the mass, and it would be labeled as involved or positive with ILE when lesion/suspicious calcifications reaching up to the excised margins with less than 10 mm thickness of healthy looking tissue around the disease (Silverstein, 1997; Holland et al., 1997; Barnes et al., 1999), so in the presented study we follow the same criteria. Almost 10 year results of the European Organization for Research and Treatment of Cancer (EORTC) 1080 and the EORTC boost trial concluded that there is 8 % risk of recurrence

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with clear margins and 15 % risk with incomplete resection in patients with breast conservation (Van et al., 2000; Poortmans et al., 2009).

Histologically a “positive margin or ILE” represents the detection of malignancy, either invasive and/or ductal carcinoma in situ at the surgical resection line. However “close margin” represents distance of excised margin from disease ranging from 1–3 mm. But when there is lymphatic infiltration at a margin and atypical ductal hyperplasia and lobular carcinoma in situ at the margin, specimen would not be considered to have a positive margin (Rajyasree and Elizabeth., 2012). For the declaration of negative margins the bulk of the wide-ranging literature seems to consider 2mm as the cutoff point (Rajyasree and Elizabeth., 2012), with anything less than that being considered a close margin. According to the other studies any specimen which has margin thickness equal to or more than 3 mm represents negative margin or CLE (Singletary, 2002). In this study there were two groups of patients i.e. one group with positive as ILE and other one with negative margins as CLE.

Materials and Methods

This study is a retrospective cross sectional study. Retrospective data of all females who underwent breast-conserving surgery for breast cancer management was collected. Specimen radiography after needle localization of mammographically visible lesion/ microcalcification from January 2014- January 2015 was reviewed. However male patients, patients with mammographically invisible disease, cases with benign or inconclusive histopathology, patients with modified radical mastectomy and with dense breast parenchyma were excluded.

Pre- operative mammograms and specimen radiography films were reviewed independently blinded to the histo-pathological results. For breast conservation

surgery we take radiograph of the whole specimen to assess margins spiculations, distance of mass/microcalcification from excised margin, presence of mass and presence of any adjacent microcalcification. Complete local excision according to specimen radiography was assessed by a single consultant radiologist with more than 5 years expertise in breast radiology. CLE based on X- ray findings was labeled if excision margin in two dimensions were equal to or more than 10 mm and histological CLE was confirmed when specimen showed 3 mm or more of normal breast tissue or fat between tumor and circumferential excision margin. Detection of adjacent micro calcification around mass on specimen radiography is an important factor to predict involved margin as these calcification represents areas of high grade carcinoma, other radiological factor was the spiculations in margins which are serrated outlines with long or short dense fine lines originating from mass. Histological data was derived from Hospital Information System. Radiological and histological variables were compared in the assessment of complete or incomplete excision. Statistical analyses between variables were assessed using Chi-square and Fisher’s exact tests. We made three groups dividing age of all patients for reflecting the means exactly and equal distribution of data.

All data entry and analyses were conducted using SPSS version 19. Convenient sampling was done. Means and standard deviations (SD) for continuous variables, frequencies and percentages for categorical variables were calculated. The level of significance was set at p less than 0.05 for all hypotheses tests in this study. The adjusted odds ratios were estimated with 95% confidence intervals (CI).

Results

Total of fifty two patients were included. The mean age was 50.98 years (30-74years). The mean

Table 1. Various Characteristics Associated with Complete and Incomplete Local Excision

Clinical Characteristics:	Variables	Number	C.L.E. (%)	I.L.E. (%)	P-Value
Age (years)	< 45	20	12 (60)	8 (40)	0.142
	45-64	19	8 (42)	11 (58)	
	> 64	13	10 (77)	3 (23)	
X-Ray Specimen Characteristics:					
Presence of mass	Present	40	31 (77)	9 (22)	0.004
	Absent	12	0 (0)	12 (100)	
Adjacent suspicious calcification.	Present	10	6 (11)	4 (7)	0.000
	Absent	42	25 (48)	17 (32)	
Presence of spiculation	Present	24	14 (58)	10 (41)	0.248
	Absent	28	17 (60)	11 (39)	
Histopathological Characteristics:					
Tumor size (mm)	0-5	40	25 (62)	14 (38)	0.256
	6-10	8	03 (37)	05 (62)	
	11-15	4	01 (25)	03 (75)	
Tumor Grade	I	10	05 (50)	05 (50)	0.419
	II	15	11 (73)	04 (27)	
	III	27	15 (55)	12 (45)	

Table 2. Comparison of CLE and ILE by Specimen Radiography and Histological Assessment

Assessment by specimen X-Ray	Histological assessment			
		CLE	ILE	Total
CLE		25	5	30
ILE		6	16	22
Total		31	21	52

histopathological size of tumor either primary or residual was 3.4 mm (0.1-15 mm). Thirty one (58%) patients with breast cancer achieved complete local excision with conservative surgery. Relationship with different clinical, mammographic and histo-pathological variables analyzed and summarized in Table 1. Radiological features were the presence of mass, spiculations and adjacent microcalcifications. Out of these variables absence of adjacent microcalcifications with P 0.000 and presence of mass with P 0.004 showed significant association with CLE however presence of spiculations was not found to be associated with CLE.

Specimen radiography was found to be a sufficient tool to predict CLE in breast cancer conservation surgery as according to our results, CLE was predicted in 80% of patients i.e. in 31 patients CLE confirmed on histopathology and out of these, 25 patients (80%) showed CLE on Specimen radiography with positive predictive value of 83.3% and 21 patients showed ILE on histopathology out of which 16 cases (76%) showed ILE on Specimen radiography as shown in Table 2. The specimen radiography was 80.65% sensitive and 81% specific for predicting CLE.

Histo-pathological assessment showed that in twenty seven patients (52%) breast cancer was of nuclear grade 3 and tumors which were less than 5mm in size showed CLE in 62% of cases.

Discussion

For breast conservation surgery 'Complete Local Excision' is the main objective of a surgeon as this technique helps to achieve better outcome by reducing chances of local recurrence in a conserved breast risk of local recurrence is higher with ILE (Recht et al., 1985; Veronesi et al., 1990). Breast conservation is a choice of treatment compared to mastectomy as it has better cosmetic results. Specimen radiography is a sensitive tool to assess CLE and in this study sensitivity of Specimen radiography was found to be 83% which is comparable with other studies in which the sensitivity was 94% for detecting CLE (Kollias et al., 1998; Anees et al., 2003). In our institute Specimen radiography is a routine examination following needle localization which is same as practiced in Royal Adelaide Hospital (Kollias et al., 1998).

Mean age of population in this study was 50.98 years (30-74years), which is comparable with other studies (Anees et al., 2003; Walter et al., 2008) in which mean ages were 57.5 years and 55 years respectively. Patient age did not show any relationship with CLE

in this study which is comparable to other studies as well (Kollias et al., 1998; Andrew et al., 2002).

Histo-pathological assessment showed that in twenty seven patients (52%) breast cancer was of nuclear grade 3 and tumors which were less than 5 mm in size showed CLE in 62% of cases.

In this study histopathological nuclear grades and tumor size did not show any association with CLE, which is same as found by other studies (Andrew et al., 2002; Anees et al., 2003). The mean histopathological size was 3.4 mm in this study; however in other studies done by Andrew et al., (2002) and Kai et al., (2001) the mean histopathological size was 12 mm and 13 mm respectively. This difference is most likely due to a fact that in this study smaller lesions were mostly excised, this is due to a fact that we included only those surgical specimens which were excised after needle localization for small and impalpable lesion due to limited data availability and also because of post neoadjuvant chemotherapy (NAC) effect (this is one of limitations of our study that we included all surgical specimen of breast cancer both with or without NAC. Some other studies showed no relationship between mass size and CLE (Recht et al., 1985; Bartelink et al., 1988; Fowble et al., 1991) as in these studies larger masses were also excised completely this could be due to the extra attention to the margin during surgery. In present study 27 patients (52%) out of 52 were diagnosed to have histopathological nuclear grade 3 and it is comparable with a study by Kai et al., (2001) in which 61 % had histopathological nuclear grade 3 breast cancer. In this study on Specimen radiography thirty patients were labeled to have CLE and on histopathology 25 out of 30 were found to achieved CLE which was account for 83 % and it was correlated with other study (Anees et al., 2003) in which 72% of patients showed CLE on X-ray specimen. In this study larger masses were less likely to be excised completely compared to smaller lesion (25% for lesion size between 11-15mm and 62% for lesion size between 0-5mm as described in Table #1) and it is similar to study done by Kollias et al., (1998) and other studies Veronesi et al., (1990); Gwin et al., (1993), so it can be concluded that larger breast masses are likely to show ILE as compare to small lesions while conserving breast.

For predicting ILE specimen radiography was also found to be a sensitive tool as in 22 patients radiography showed ILE and on histopathology 16 out of 22 showed ILE which is approximately 72% of total ILE cases. Suspected ILE on imaging were re-excised on same sitting as surgeon was immediately informed from Radiology department.

The present study showed significant association of CLE with absence of adjacent micro calcification around mass and it is comparable with a study (Kollias et al., 1998). A study Stomper et al., (1992) described that cases with no adjacent micro calcification around mass on Specimen radiography are usually have no intraductal tumors. Surgeons should excise almost all areas of micro calcification along with the excision of mass in case of both invasive and intraductal cancer (IDC).

On mammogram, IDC may present as a high density

mass with spiculated margins and there is a concept that spiculations represent infiltration of cancer into the parenchyma (Kollias et al., 1998) however many studies have concluded that these spicules do not represent cancer invasion but a desmoplastic reaction of malignant and even benign masses can create this appearance on mammogram (Franquet et al., 1993). Magnification during mammogram can also be a cause of spicule formation (Franquet et al., 1993). In this study presence of spiculated margins was not correlated with CLE which is same as other study (Kollias, et al., 1998). Surgeons can avoid removing most of the spicules during excision so avoiding extensive tissue removal, as if primary lesion seen on mammogram with spicules reaching up to the excised margins then no re-excision is needed to remove spicules.

There were a few limitations in this study that it was a single institutional based study, single radiologist retrospectively reviewed the radiological images.

We would suggest having multi-institutional study with large data scale. More than one radiologist should be involved for reviewing the images.

In conclusion, we found that breast conservation surgery is a choice of early breast cancer management and Specimen radiography is an important and sensitive tool to predict CLE with reduction of chances of local recurrence and obtaining better cosmetic outcome. Absence of adjacent microcalcification around the mass on specimen radiography is an important factor to predict complete local excision.

Conflict of Interest

The authors declare that there is no conflict of interests regarding the publication of this paper.

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