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Prediction of Postoperative Tumor Size in Breast Cancer Patients by Clinical Assessment, Mammography and Ultrasonography

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Abstract

Background: Aim of study was to determine the most accurate optimal preoperative modality factor-physical assessment, ultrasonography or mammography- for predicting the post operative tumor size in breast cancer patients subjected to breast conserving surgery (BCS) or modified radical mastectomy (MRM).

Material and Methods: 112 confirmed breast cancer patients during February 1988 and August 2008 referred to tertiary care center for surgery were subjected to detailed physical examination, mammography and ultrasonography. Findings of physical assessment, mammography and ultrasonography were correlated with post-surgical tumor size, correlation being calculated using the Pearson correlative coefficients.

Results: Mean age of cohort was 47.0 years {range: 23–76; standard deviation (SD) 10.3}. Menopausal status, 93 patients (83.0%) were premenopausal, while 19 patients (17.0%) postmenopausal. Mean histopathological tumor size was 3.63 cm (range: 0.7–9). Preoperative ultrasonography findings were more predictive post operative tumor size (R: 0.91, R^2: 0.83, p 0.03). Physical examination and mammography overestimated the tumor size (R: 0.53, R^2:0.28, *p* 0.0001) and (R: 0.43, R^2: 1.89, p0.001) respectively.

Conclusion: Prediction of postoperative tumor size was more reliable with ultrasonography and based on findings is recommended by this study.

1. Introduction

Incidence of Breast Cancer is on the increase globally. Breast cancer accounts for 26% of newly diagnosed cancers in Saudi Arabia women. The incidence rate of 21.6 per 100,000, majority of hom are premenopausal younger age group [1]. Currently, there is no established national based breast cancer screening program in Saudi Arabia, though a number of awareness campaigns have been launched on breast cancer, educating about the importance screening for breast cancer [2].

Screening programs for breast cancer, non-palpable and palpable breast masses utilizing mammography (MG) and ultrasonography (USG) have resulted in death reduction by 30% and increased resorting to breast conserving surgery (BCS) [3]. USG is also useful in the evaluation of palpable masses in massive breasts, differentiating cystic and solid masses enabling to avoid radiation hazards to young women [4]. Tumor size has been a significant factor for locoregional recurrence (LRR) in BCS, MMR and small breast cancers data detected by clinical assessment, MG and USG can

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undergo BCS, without dissection of axillary lymph nodes [5].

However, the optimal modality for accurate estimation of tumor size in breast cancer patients requires validation, by correlation between preoperative assessment (physical examination, MG and USG) and postoperative histopathological tumor size [6]. Results of such studies are contradictory as many studies suggested that USG underestimates, while physical examination and MG overestimate the postoperative tumour size [7, 8, 9].

Thus study aims to determine the most optimal and accurate preoperative modality (physical assessment, MG and USG) to predict the tumor size in breast cancer patients treated with BCS or MRM among Saudi population.

2. Materials and Methods

On approval by Institutional Ethical Review Board (IRB) committee, between February 1988 and August 2008, 112 patients with breast cancer comprised the study population, were subjected to BCS and MRM followed by adjuvant chemotherapy and radiotherapy.

Inclusion criteria were; (a) histopathological confirmed breast cancer, (b) T1–T4, N0–N2, (c) underwent BCS or MRM with or without adjuvant hormonal, chemotherapy and radiotherapy. Exclusion criteria were; (a) presence of distant metastasis, (b) neoadjuvant chemotherapy and (c) inflammatory or inoperable tumors.

2.1 Preoperative Assessment of Tumor Size

In all 112 breast cancer patients, pre-operative assessment utilising physical examination, MG and USG was done. All physical examinations, MG and USG were performed by experienced oncologists and radiologist and re-confirmed by an experienced oncologist/radiologist by MG and USG imaging data. The reviewers were unaware of the post-operative tumor size. MG was performed with Siemens Mammomat 2 and USG was performed using GE Logiq 400 MD; transducer linear 7.5–10 MHz. All measurements of tumor size were taken on long axis of diameter and noted down on data collection proforma.

2.2 Postoperative Assessment of Tumor Size

After BCS and MRM, breast cancer specimens were fixed by 10% formalin, cut along its longest axis and, stained with Hematoxylin and Eosin. Measurements of tumor diameters made using plastic ruler and were noted down on data collection proforma, by an experienced examined pathologist.

2.3 Statistical Analysis

Mean, median and mode of different tumor sizes was described. The correlation between preoperative assessments (physical examination, MG and USG) of tumor sizes were estimated by the Pearson correlative coefficients. The degree of agreement between preoperative and postoperative readings was determined by the method described by Bland and Altman [10]. The mean differences and limits of agreement corresponding to 95% confidence interval (95% CI) was analyzed. All statistical analyses were performed using the computer program SPSS version 16.0.

3. Results

3.1 Clinical Characteristics

Patients' clinical and treatment characteristics are shown in (Table 1). Mean age of cohort was 47.0 years {range: 23–76; standard deviation (SD) 10.3}. According to menopausal status, 93 patients (83.0%) were premenopausal and 19 patients (17.0%) postmenopausal. Mean BMI was 31.8 kg/m^2 (range: 15.7–52.8; SD 7.2). According to co-morbidities, 72 patients (64.3%) had no co-morbidities. Common morbidities in 40 patients (35.7%) were; hypertension in 14 patients (12.5%), diabetes in 9 patients (8.0%) and combined hypertension and diabetes in 6 patients (5.4%). Family history was positive in 17 patients (15.2%). Majority among cohort (57 patients; 79.6%) had left side breast cancer and location outer lower quadrant being the common site (50 patients; 45.9%) followed upper outer quadrant (30 patients; 27.5%). Mean baseline CA15.3 level was 31.1 units/ml (range: 1–94.3; SD 23.9).

3.2 Tumor Size Assessment

Mean tumor size on physical examination, MG and USG was 4.62 cm (1–15), 3.42 cm (1–18) and 3.55 cm (0.8–8.2) respectively Figure 1A and B. Mean tumor size on postoperative tumour specimen was 3.63 cm (0.7–9.2) Figure 1C.

The correlation coefficients between tumor size estimation and physical examination MG and USG tumor size estimations were shown in Figure 2. A, B and C. USG underestimated the histopathological tumor size estimation; however were more accurate to tumor size estimation (R=0.9, R^2=0.83, p *0.03*). Both physical examination and

Table 1. Patients' characteristics

Variables	N (%)
Age	Mean 47.0 years (range: 23–76) SD ± 10.3
Age groups (according to years)	
<25	2 (1.8%)
25–35	13 (11.6%)
36–45	29 (25.9%)
>45	68 (60.7%)
Menopausal status	
Premenopausal	93 (83%)
Postmenopausal	19 (17%)
Co morbidities	
DM	9 (8.0%)
HTN	14 (12.5%)
HL	2 (1.8%)
DM + HTN	6 (5.4%)
HL +DM + HTN	9 (8.0%)
Laterality	
Unilateral	108 (96.4%)
Bilateral	4 (3.6%)
Side	
Right	22 (20.4%)
Left	90 (79.6%)
T Stage	
T1	95 (84.8%)
T2	6 (5.4%)
T3	6 (5.4%)
T4	5 (4.4%)
N stage	
N0	50 (44.6%)
N1	36 (32.1%)
N2	14 (12.5%)
N3	12 (10.7%)
Histological type	
IDC	95 (84.8%)
ILC	6 (5.4%)
IDC + ILC	6 (5.4%)
Others	5 (4.4%)
LVSI	
Positive	35 (31.2%)
Negative	77 (68.8%)
Receptor status	
Luminal A	36 (32.1%)
Luminal B	29 (25.9%)
Basal	11 (9.8%)
Her 2 neu	36 (32.1%)
Type of surgery	
BCS	31 (28.7%)
MRM	81 (71.3%)
Chemotherapy	
Yes	104 (92.7%)
No	8 (7.3%)
Radiation therapy	
Yes	89 (79.5%)
No	23 (20.5%)
Hormonal therapy	
Yes	66 (59.0%)
No	46 (41.0%)

Abbreviations: SD = standard deviation, DM = diabetes mellitus, HTN = hypertension, HL = hyperlipidemia, T = Tumor, N = Nodes, IDC = infiltrating ductal carcinoma, ILC = invasive lobular carcinoma, LVSI = lymphovascular space invasion, BCS = breast conservation surgery, MRM = modified radical mastectomy,

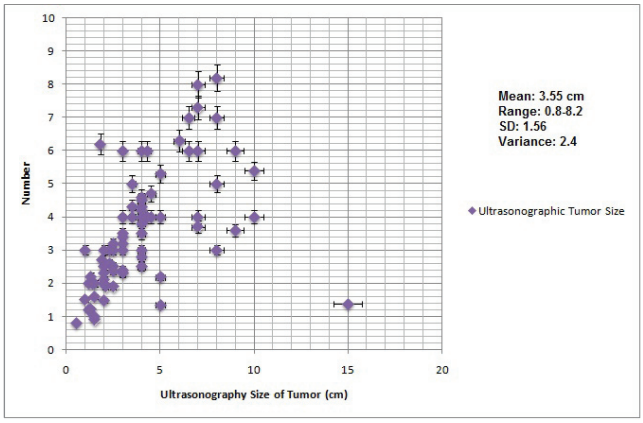

Figure 1. Mean, range and standard deviations (SD) of tumor size measured on (A) Mammography, (B) Ultrasonography, and (C) postoperative histopathology.

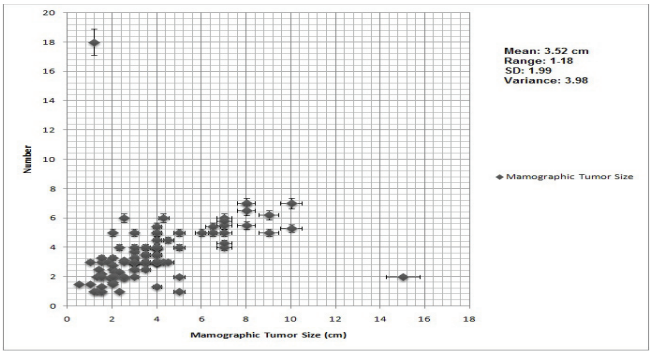

Figure 2. Pearson's correlation coefficients, mean differences, and standard deviations (SD) between (A) Physical examination and histopathologic tumor sizes, (b) Mammography and histopathologic tumor sizes, and (c) Ultrasonography and histopathologic tumor sizes.

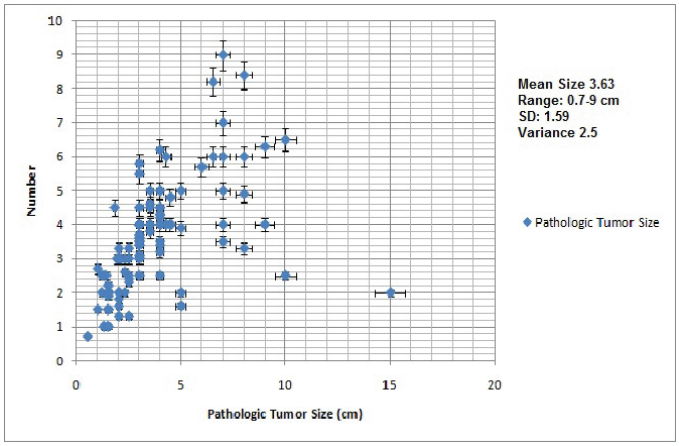

Figure 3. Pathologic tumor size.

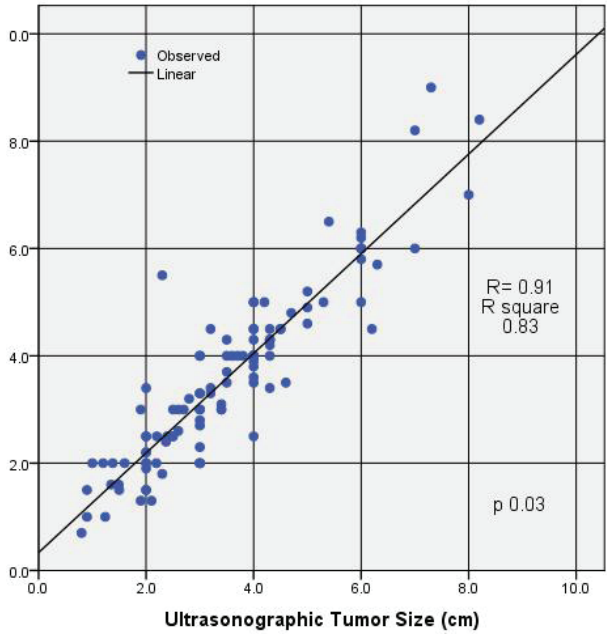

Figure 4. Ultrasonographic tunor size.

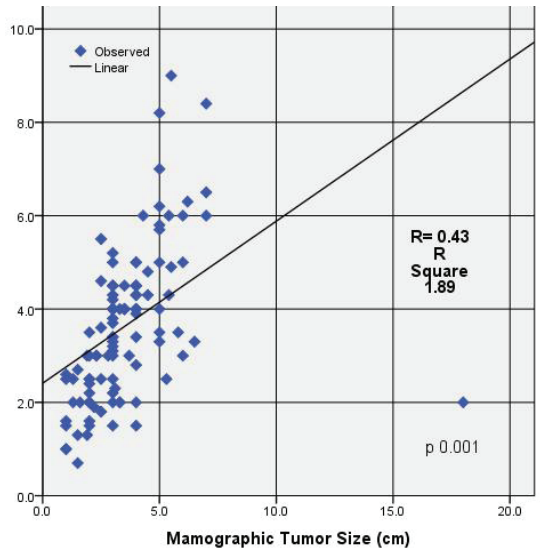

Figure 5. Mamographic tumor size.

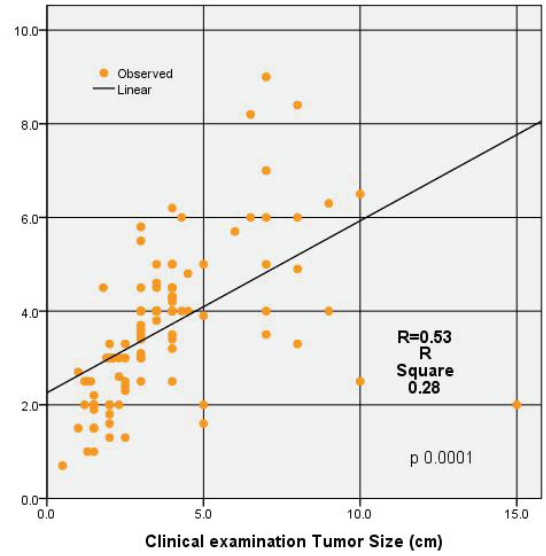

Figure 6. Clinical examination tumor size.

MG tumor sizes overestimated the tumor size estimation (R=0.53, R^2=0.28, *p 0.0001*and R *0.43,* R^2 1.89, *p 0.001*). Further for breast cancers of size < 2cm, the sensitivity of MG was found 0.86 (66/77) and specificity was 0.97 (74/77) and the sensitivity of USG was 0.98 (78/80) and specificity was found 0.90 (72/80) for breast cancers of size < 2cm.

4. Discussion

This study shows that preoperative physical examination and MG overestimate, while USG slightly underestimates the tumor size estimation. Small breast tumors of size < 2 cm, the sensitivity and specificity was increased with USG as compared to physical assessment and MG,

possibly the cohort was mainly young age group and premenopausal status, with massive breast tissue parenchyma. These results are in correlation with other studies [11, 12, 13].

This study had three limitations:

(a) This study was conducted retrospectively,
(b) MG and USG tumor size measurements were based on images only
(c) Small sample size.

In conclusion, retrospective data suggests the value of preoperative USG for postoperative tumor size estimation and high sensitivity and specificity. Premenopausal women with small size breast cancers detected by USG can be considered for BCS. On other hand physical examination and MG findings overestimated the postoperative tumor size estimation. However trials on larger scale are required to predict the postoperative tumor size to nearest estimated values in breast cancer patients by using new diagnostic modalities including CT, MRI of breast and CT positron emission tomography (CT-PET) [14, 15].

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