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ORIGINAL ARTICLE

Preoperative ultrasound guided needle localisation for non-palpable breast lesions

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Abstract

Background Breast cancer is a major cause of cancer-related morbidity and mortality in Indian women. Most cases present late and thus survival in Indian patients is poor compared to the western world. In the absence of a screening, early detection of breast cancer is a challenge in Indian subcontinent.

Method Though much is known about management of any palpable lump in breast, clear guidelines in dealing with non-palpable lesions of breast is still obscure. Careful imaging of breast followed by assignment of standard Breast Imaging Reporting and Data Systems (BIRADS) category to the finding can go in a long way to predict chances of malignancy in a non-palpable breast lesion (NPBL). Total 22 patients with impalpable lesions in the breast were localised with US guided needle and lesion excised. Applicability of Ultrasonography (USG) to detect early breast lesions and comparison with mammography in predicting malignancy was assessed by tests of proportions (z test).

Results Total of three early breast cancers and four borderline lesions were diagnosed by this method among 22 properly selected cases. Needle localisation of the lesion on sonographic guidance followed by lumpectomy can be both an accurate diagnostic and therapeutic method to deal with occult lesion in our scenario.

Conclusion US guided lumpectomy is a feasible alternative to other methods and is effective in Indian scenario to diagnose early subclinical breast cancers.

Keywords Breast cancer · NPBL · BIRADS · USG breast · Localisation

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Introduction

Breast cancer has enormous impact on health of women, all around the globe. The current life risk of a woman for developing breast cancer is 17% [1]. In India, the current urban cancer registries record breast cancer as the commonest malignancy affecting females, surpassing carcinoma cervix [2]. Tumour size at the diagnosis remains an important predictor of both disease free and overall survival in patients with breast cancer, with small tumours (<10 mm i.e. non-palpable stage) having the best prognosis [3]. In India the presentation of patients having breast cancer is late, mostly at stage IIIB, in contradiction to the west where it presents early [4]. Several randomized controlled trials have provided consistent evidence that screening mammography decreases breast cancer deaths by early detection. Breast ultrasound (BUS) is easily available, real time and accurate modality to detect breast lesions and to predict malignancy especially with the new breast imaging

reporting and data system categorization [5]. In India breast cancer tends to affect women at a relatively younger age group, most commonly in the age group 45–54 years where BUS becomes more effective [6, 7].

Materials and methods

The study was conducted in the Breast Clinic, Department of surgery, IPGME&R, Kolkata. It was a prevalidation prospective study and total cases done were 22.

Inclusion criteria: Patients attending our clinic with breast symptoms without any palpable lump but having a radiologically significant (BIRADS R3-R5) lesion in USG.

Patients presenting at our clinic were assessed clinically and radiologically. Those aged >35 years underwent screening mammogram and those <35 years BUS, with some overlap in 32–38 years age group [8]. BIRADS lexicon was used to report the finding of mammography and sonography (Table 1).

Table 1 BIRADS American college of radiology (ACR) ultrasound risk categories [5, 9]

BIRADS category	Description	Risk of cancer	Management
1	Mormal	0	Clinical lump F/U and return to routine screen
2	Benign	0	
3	Probably benign	<2%	Patient choice
4a	Mildly suspicious	>2 and <90%	Biopsy (addl. imaging)
4b	Moderately suspicious	>50 and <90 %	Biopsy
5	Malignant	>90%	Biopsy

Patients >35 years, i.e. who had mammography with BIRADS R3–R5 lesion were reassessed with BUS with an intent to identify the same lesion. Patients having microcalcification in their mammography, which were not identified in USG, were excluded since BUS has low sensitivity for such lesions [10].

Localisation procedure

In the US room patient lay comfortably supine with arm folded beneath her head and was rolled into whichever position that caused the portion of the breast containing the lesion to be as thin as possible against the chest wall. After proper positioning the patient's lesion was reviewed by hand held linear array US probe (10–14 MHz frequency, XARIO Toshiba). Under freehand guidance method the needle used for localisation was introduced and advanced under long axis of the of the US transducer under real time scanner [11]. We used small straw marks with gentian violet to mark points over the lesion and the point of needle entry. Local anesthetics were used for localisation in two apprehensive patients in our series. In 19 cases hypodermic needle and in rest Angio-cath wire were used for localisation of the non-palpable lesion.

The tip of the needle was monitored all the time as it was made to traverse the lesion by 0.5–1 cm. With the needle/wire *in situ*, sonograms were taken and archived for future references. The needle/wire was then taped loosely to the skin and the patient carried to the operating room, with all necessary precautions to prevent dislodgment of the needle.

US findings: Annotation

1. The side of the lesion - left or right
2. Clock face position
3. Distance form nipple
4. Transducer orientation
5. Depth of lesion from the entry point
6. The size of lesion-maximum and minimum diameter
7. The characteristics of the lesion
8. BIRADS nomenclature
9. Special comments, if any: compression, Doppler assessment, etc.

Completion of needle localisation was marked as endpoint for the radiographic procedure.

Surgical approach

With needle *in situ*, the patient was transferred to adjacent theatre. Radial/circum-linear incision was placed around needle base. Dissection was carried out using the line of sight technique [12]. Tunnelling and excessive raising of flap were avoided. Dissection was done down to the needle/wire.

Once course of the needle was identified and the needle tip reached, tissue on either side of wire was grasped into clamps and a cylinder of tissue was taken. Effort was made to excise the lesion completely, with rims of surrounding normal tissue (not more than 25–30 g of tissue removed). The specimen was marked by dye in its deeper aspect and packed for further action. No drains were used.

Excised specimen

Immediately after needle guided lumpectomy, sonography of the lesion was carried out using saline bag in which the specimen was introduced [13]. Finding of positive specimen sonogram was marked as surgical endpoint of the procedure and the study. The patients were reviewed with H/P reports and results were noted.

Hospital stay : 12 hours
Mean operating time : 25 minutes
Intraoperative blood loss : 25–30 ml approximately

Results and analysis

Total 22 patients with impalpable lesions in the breast were studied

1. The age group of patients included in our study ranged from 25 to 72 years. Mean age = 41.96 + 2.76 years
2. Clinical complaints of the patients in our series were observed and mastalgia was the most frequent. Nipple discharge: five patients, mastalgia: seven, family history or follow up case: five, contralateral breast lump: four same breast lump: one
3. Radiological findings

- In our study following the protocol:
  - i. All 22 patients underwent sonography as in Fig. 1.
  - ii. Out of these 22 patients, 13 patients underwent mammography first and then sonography and
  - iii. Nine patients underwent sonography only (age criterion).
- Sonographic findings were:

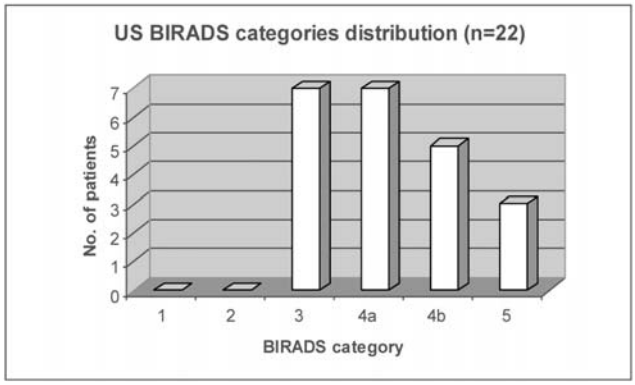


Fig. 1 Ultrasound findings in 22 patients

Thirteen patients who had mammography first, their results at mammography were BIRADS 0 category: One patient, BIRADS 3: seven patients, BIRADS 4: four patients and BIRADS 5: one patient.

In these 13 patients who had both mammogram and sonogram, eight patients had same finding (BIRADS category) and five patients had different findings, which were as follows:

Mammogram BIRADS	Sonogram BIRADS
BIRADS R3	BIRADS R4b
BIRADS R3	BIRADS R4b
BIRADS R0	BIRADS R4a
BIRADS R4	BIRADS R5
BIRADS R4	BIRADS R4b

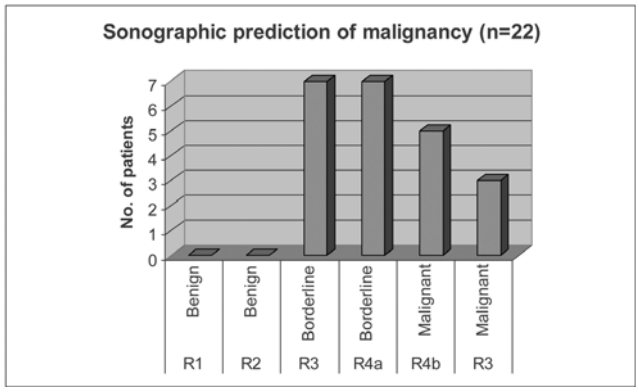
Tests of proportions (z test) applied to test the strength of association among mammographic and sonographic in the impalpable lesions shows that:

- There is statistically no significant difference ($p > 0.05$) between these two,
- Thus both findings (mammo and sonography) yield the same result.

4. The size of the lesion: Size of the non-palpable lesions in 22 cases ranged from 6 mm to 15 mm with mean size = 10.42 + 0.48 mm.
5. Histo-pathological findings: In our series of 22 cases the following histopathological findings were observed as given in Table 2.
6. Sonographic prediction: The sonographic BIRADS categories were further divided into benign, borderline

Table 2. Histopathological finding (n = 22)

Benign		Borderline		Malignant	
Duct ectasia	1	Atypical ductal hyperplasia	1	DCIS	1
Fibrocystic disease, Aberrations of normal development & involution	5	Atypical lobular hyperplasia	1	Invasive duct carcinoma $T_1N_0M_0$ $T_1N_1M_0$	2
Fibroadenoma	3	Benign FCC with complex proliferative changes	1		
Blue dome cyst	1	Juvenile papillomatosis	1		
Pseudo angiomatous hyperplasia	1				
Ductal adenoma	1				
Chronic inflammation	1				
Scleroelastosis	1				
Fat necrosis	1				
Total	15		4		3
	68.18%		18.18%		13.67%



Benign BIRADS R1, R2	Borderline BIRADS R3, R4a	Malignant BIRADS R4b, R5
0 cases	14 cases	8 cases
0%	63.64%	36.36%

Fig. 2 USG findings and cancer risk

and malignant, to compare it with the above histopathological results as in Fig. 2.

Test of proportion (z test) applied to these results show that sonography predicted borderline lesions in more cases as compared to the final histopathology and this was statistically significant ($p<0.01$). US have tendency to over diagnose benign as borderline lesions. But, in case of malignant histopathological results as compared to sonographic prediction, there is no statistically significant difference between the two in our study. Thus, ultrasonography predicts cancer of the breast with good accuracy.

Localisation process

Out of 22 cases of localisation, 19 had needle and three had wire localisations. Among three cases diagnosed as cancer by our localisation process two cases required further surgery i.e. 66.60% cases required further surgery. Complications of the procedure were found in three cases and out of that in one case dislodgement of the needle occurred and re-localisation was done. Specimen sonogram was done in 18 out of 22 cases and it was found that in all 18 cases the localised lesion was contained in the specimen.

Discussion

The recent trends in epidemiologic patterns of breast cancer shows that although there is a declining incidence of invasive cancers, more and more breast cancers are diagnosed at an early and even impalpable stage [14]. The mean breast tumour size at diagnosis in the west is around 3.1 cm and more than 52% of breast cancers are localised to the breast at detection and a sizeable number are non-invasive [15]. For this reason it is important that women receive optimal and appropriate treatment for these tiny, often impalpable tumours especially with the absence of population screening for breast cancer in our country. In most series 15–30% of impalpable lesions in breast prove to be malignant [16]. Non–palpable masses and microcalcifications in the breast may be approached via-a) Image guided needle biopsy – FNA/LCNB and b) open biopsy with needle/wire–US guided, stereotactic, MRI guided, radio guided.

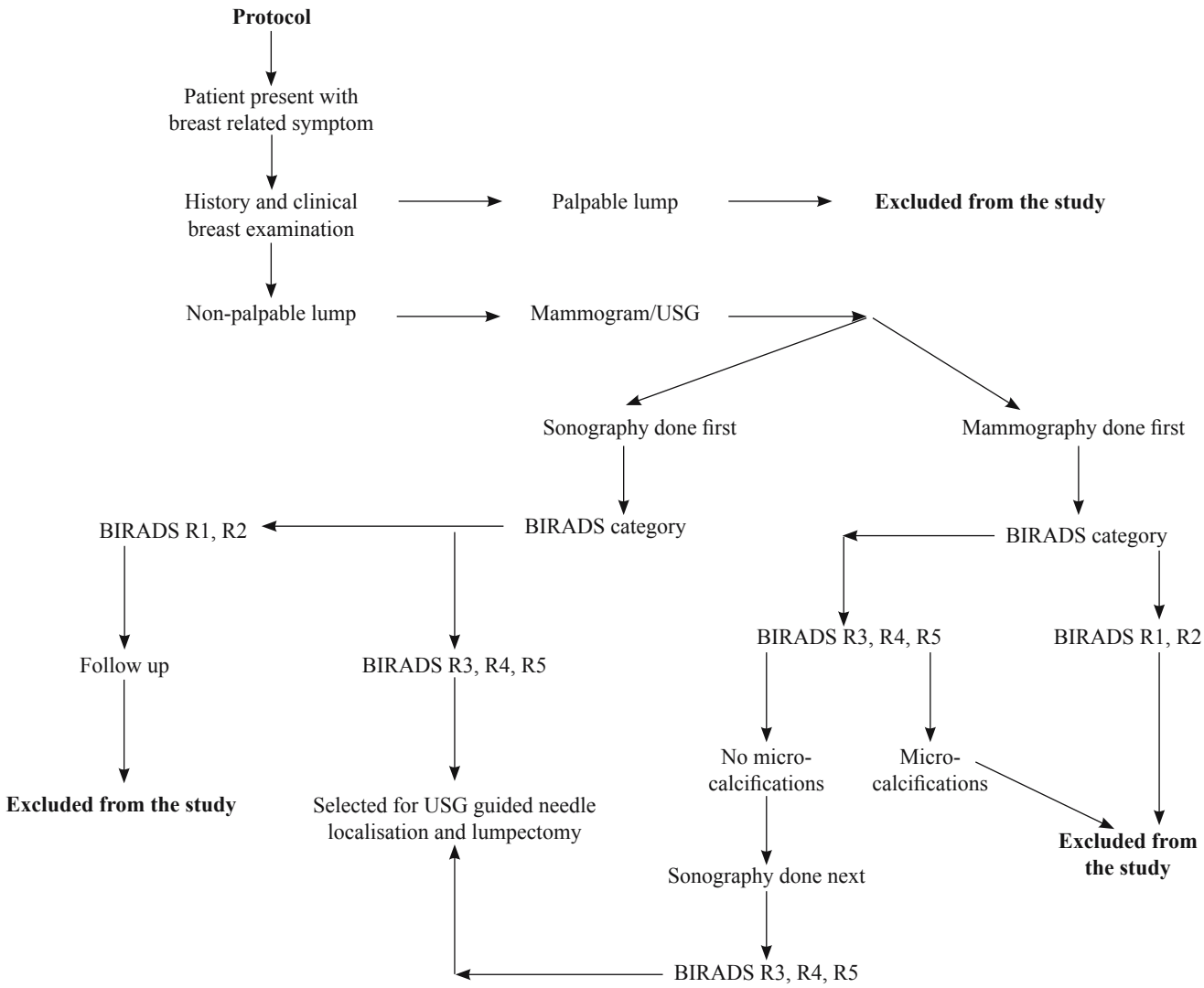
But, while it is commonly known that the mammographic screening of women without symptoms allows finding lesions at a non–palpable stage; not that well known is the capacity of echography in finding early stage lesions of the breast. Advantager for US guided needle localisation are (1) accuracy, (2) real time guidance, (3) reproducibility, (4) specimen sonography possible, (5) easily available, (6) intraoperative use and (7) cost effectiveness [17, 18]. FNAC is of limited value in NPBL due to its high miss rate as revealed in a large study by Pisano et al. from Department of Radiology, University of North Carolina, USA in 442 women. The study concluded that FNAB of NPBL has high insufficient sample rate [19].

In our study, the age group of patients was 25–72 years. Breast cancer is uncommon in women below 30 years and thereby risk increases throughout the lifetime of a women [20]. In a study of 569 cases of Indian breast cancer patients, by Saxena et al. and in a separate study by Goel et al. in 2003, commonest age-group incidence in Indian breast cancer patients was found to be in the age group of 45–54 years, i.e. a decade earlier than western group and the commonest stage at presentation in Indian patients was found to be locally advanced stage IIIB [4, 21].

If we review our knowledge of tumour kinetics, about 5–10 years is the duration of time required for a single tumour cell to grow to a stage where it is clinically manifested [22]. It is therefore evident that Indian patients require screening at ages 35–45 years to detect early cancers of breast. In our study the mean age was 41.96 + 2.76 years and thus represents an age group where our Indian patients may have occult stage lesions in the breast. Hence, the stage of non-palpability in breast cancer is present in 35–45 years age group in most Indian patients.

In a study published in *American journal of Roentgenology* in 2003, first of its kind by N. Houssami from Sydney, Australia, show that sonography of breast is an accurate imaging test in women 45 years or younger who present with breast symptoms and may be an appropriate investigation [23]. Thus, in Indian scenario with younger age of breast cancer incidence, sonographic evaluation of young patients with breast symptoms is appropriate. Hence, in our study, we have chosen USG as the method of detection and localisation.

In our study we have assigned BIRADS categories for further categorisation as BIRADS is the standard reporting



system. Among 13 patients who underwent mammography first and then BUS, in this study, eight cases documented same findings in BUS - BIRADS category 3a [24] while in five cases BUS differed from mammography. In these cases, where BUS differed, it gave more specific diagnosis i.e. more chance of being malignant (three cases upstaged to category R4b by BUS where chance of malignancy is more than 50%). Thus breast ultrasonography gives no statistically significant difference in results than mammography, to detect early lesions in this age group which are suspicious of cancer.

Sonographic findings suspicious of Cancer

- Spiculation or thick echogenic halo
- Angular margin
- Microlobulations
- Shape taller than hide
- Duct extensions and branch patterns
- Acoustic shadowing
- Calcification
- Hyper echogenicity

In our study we have found sonographic BIRADS categories quite accurate for non–palpable lesions of breast in predicting malignancy. In our study vide Fig. 2, among, eight patients who were assigned BIRADS R4b and R5 categories (i.e. >50% chance of malignancy), three cases of breast cancer were diagnosed i.e. 60% accuracy was found compared to 71.3% accuracy in the Italian study.

In a very well known study by Sickles et al. published in 1983 in *AJR* Vol. 1, involving 1,000 women to evaluate breast cancer detection by sonography and mammography, sonography was found to be inferior in detecting non-palpable abnormalities [25]. But, this study was done in 1980; with the advent of better sonographic techniques and equipments and BIRADS, newer studies show better results thereby emphasising the need to re-evaluate the effectiveness of BUS [26].

In a study in 2001, by Malur from Germany, sensitivity of mammography was 83.7% and for sonography was 89.1%, to detect non-palpable lesions, thus having comparable results. In our study we found no statistically

significant difference between mammography and sonography in detecting subclinical lesions in breast and predicting chance of cancer. Our study conforms to the current studies and BUS gives comparable results to mammography [27].

The mean size of lesion detected by our study was found to be similar to the study done by Rahusen et al. where mean size was 1.34 cm [28]. In estimating accuracy of US guided needle localisation no cases of failed excision were recorded in our study.

Our study reveals that of the 22 cases diagnosed and localised preoperatively by BUS 68.18% cases came out to be benign, 18.18% borderline and 13.67% malignant in final histopathological assessment, as in Table 2 and from the Fig. 2. As histopathological assessment is gold standard, of eight predicted malignant cases by US (BIRADS 4b and 5), three (36%) came out to be clearly malignant and four borderline in histology. Thus, in our series, USG predicted 36% malignancy as in Fig. 4. Among these 13.6% came out to be malignant and 18.18% borderline, both adding up to 31.7% in the final HPE. This conforms to a study Sim et al. which concludes that sonography and histopathological co-relation is significant, thus BUS predicts cancer effectively [29].

However our study differs on account that US was found to be over predicting lesions as borderline (BIRADS 4a and 3) which later came out to be benign in histology. This may be attributed to observer bias, since sonography is observer dependant to some extent. Thus, we found that BUS over diagnoses borderline lesions when sonographic prediction was compared to histopathological assessment. Similar studies conclude that US was useful in guiding needle biopsy/wire localisation in most lesions of breast even in fatty breasts. However it was of limited value in localising microcalcifications and we have excluded microcalcifications from our study after reviewing literature [17, 30].

The most accurate way of arriving at a tissue diagnosis remains the surgical removal of the suspected tissue. Hence, needle localised surgical breast biopsy is the most definite, as compared to image guided needle biopsy. The role of BUS in modern era is well established. Given its widespread availability and low cost as compared to mammography, in India its use in screening for breast cancer in women is a possibility. Interventions like needle localisation are comfortable, accurate under US guidance. Real time guidance, less radiation, more comfort and reproducibility are advantages of US guided needle localisation and biopsy.

Conclusion

The present study, US guided needle localisation for impalpable breast lesions followed by lumpectomy was based on 22 cases. After analysing the data we observed that:

1. Ultrasonography is an effective tool in detecting subclinical lesions of the breast
2. Ultrasonography, using high resolution probe and in real time guidance gives accurate results in localising such lesions in the breast
3. Sonography can be used as first investigation in younger age group patients (<35 years)
4. Sonographic, mammographic and histopathological association is strong in breast lesions
5. BIRADS US lexicon predicts malignancy in the breast and is applicable in our setup
6. Ultrasound guided needle localisation and lumpectomy is an accurate method to diagnose and treat early cases of breast cancer.

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