

MAMMOGRAPHIC – SONOGRAPHIC CO-RELATION IN THE DIAGNOSIS OF BREAST LUMP

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ABSTRACT

This study investigated the sensitivity of adding ultrasound (US) to mammography in the diagnosis of breast lumps. All women attending Radiology department Sir Ganga Ram Hospital, Lahore for mammography during a period of three months from June to August 2008 underwent bilateral mammography followed by whole-breast US and results were documented prospectively and preoperatively and verified by histopathology. Among the total 129 patients screened at our hospital in the three month period 73 patients came with the history of breast lump. US was positive in 69 (94%) and mammography in 67 (93%). But when both the imaging techniques were combined the number of breast lumps detected was 72(98%). So the ultrasound examination detected cancer in three additional women. Adding a screening ultrasound examination to routine mammography reveals more breast cancers were found than mammography alone. The combination of US and mammography is significantly better than either modality used alone, together resulting in 9% more breast cancers detected. High-quality breast ultrasound after mammography is of great value in diagnostic breast imaging and is being explored for supplemental screening of selected groups of women When ultrasound and mammography are properly correlated, abnormalities noted on screening mammography and even many palpable abnormalities can be dismissed as benign findings after complete work-up. For suspicious findings that can be seen sonographically, core biopsy under ultrasound guidance is desirable.

INTRODUCTION

Mammography has been the “gold standard” in breast cancer detection for >40 years. Limitations in its ability to detect both small and lobular breast cancers, poor resolution in dense breasts, and a lack of significant improvement in cancer detection, despite digital mammography and computer-aided diagnosis, has inevitably lead to a search for other modalities to improve the detection of breast cancer.

After its introduction in the 1950s and 1960s, physicians struggled for many years to find an application for US other than a minor adjunct role in the investigation of breast disease. The resolution of the original equipment resulted in diagnostic accuracy far less than the “gold standard” of mammography.^{1,2} Its primary use at introduction, therefore, was to distinguish between cystic and solid lesions, thus allowing the aspiration of the former and preventing unnecessary surgery. Increasing confidence with the needle and increasing resolution of US machines expanded the scope of US to more accurately guide diagnostic biopsies³ and measure tumors.⁴ Until recently, these supporting roles remained the principle use of US in breast disease.⁵

Further progress in machine resolution and software, the advent of the 6 to 13 MHz probe, and

ever-increasing operator skill has led during the last decade to the development of certain US-based diagnostic criteria that enable the distinction of benign from malignant lesions with improving accuracy.⁶⁻⁸ These results, combined with the complete lack of radiation and the maintenance of resolution even in dense breasts, has led to the latest recommendation by the American College of Radiologists that US be used as a first-line investigative tool for palpable masses in pregnant women and women <30 yrs old at high risk of breast cancer.⁹ The same guidelines state that US is not currently indicated as a screening tool for microcalcifications. Beyond this small patient population, several studies have now shown a diagnostic accuracy for US approaching or exceeding that of mammography.¹⁰⁻¹⁵

The advent of the 6 to 13 MHz dedicated breast probe, coupled with the specialty of breast medicine, has lead to the development of breast US as we know it today and as was practiced in our breast center throughout the study period. During this time, more than two thirds of our breast cancer patients were symptomatic at the time of referral. Used as a primary investigative tool in this group of patients, our study demonstrated that US is now significantly more sensitive than mammography.

METHODS

The majority of new patients attending Sir Ganga Ram Hospital have their initial consultation with a breast clinician. The breast clinician obtained a full history, performed a clinical breast examination, and then sent the patient for mammography to our radiology department. Standard views i.e CC and MLO views of both the breasts were obtained on a dedicated mammography unit (Siemens) which was subsequently seen by the radiologists specialising in breast imaging. This was followed by a whole breast ultrasound performed by an experienced radiologist doing ultrasound of breast for at least 5 years. Both breasts were scanned by commencing in the axilla and utilising a clockwise, sequential, overlapping radial approach.

Patients were termed "symptomatic" if their referral was driven by any breast symptom. This was a heterogeneous group and included both high and low risk patients. US was used for both groups of patients, not as a study tool, but as a fully operational diagnostic tool with clinical decisions made based on its findings in conjunction with CBE and mammography. US and mammography were scored on a 5-point system and prefixed with "U" or "M":^{11,17} 1 = no abnormality detected; 2 = benign changes; 3 = abnormal and probably benign; 4 = suspicious and probably malignant; and 5 = malignant.

Indeterminate US or mammography findings were recorded as "probably benign" or grade 3. Occasionally additional imaging downgraded these lesions to grade 2 or "benign"; otherwise all suspicious lesions grades 3 through 5 were further investigated, usually by core biopsy (18-g magnum biopsy system, Bard, Covington, Georgia) using US guidance or fine-needle aspiration cytology.

All US examinations were performed using a Toshiba Applio ultrasonography unit, with a 6 to

13 MHz linear probe with multifrequency capability and Doppler. The results of the clinical assessments, WBUS (U scores), mammography (M scores), and tissue biopsy, and surgical specimens were collected prospectively.

This study covered the 3-month period from June 2008-august 2008 inclusive and included those new patients who had a clinical examination by a breast physician and a mammogram followed by WBUS at their initial consultation before proceeding to any tissue biopsy. All data for the study were collected from the department's breast cancer database and cross-checked against the patients' notes, radiology results, or histopathology results as necessary. Ultrasonography or mammography was considered to be positive if the U or M score was 3, 4, or 5 and to be negative if the score was 1 or 2.

Among the 129 patients presenting to us for mammogram in this period 75 presented with the complaint of breast lump, and on whom the whole breast ultrasound was performed and subsequent histopathology done. Two of these could not be followed due to lack of histopathology reports leaving 73 patients suitable for analysis.

Statistical analyses were performed using a 2 × 2 contingency table and Fisher's Exact test (GraphPad InStat version 3.05, GraphPad Software, San Diego, California). $P < 0.05$ was considered significant.

RESULTS

Among the 75 patients with breast lump proceeding to Ultrasound and mammography and histopathology showed equal efficacy however, their combination was significantly better than either modality used alone ($P < 0.0001$, Table 1).

In the 73 symptomatic patients, US was positive in 68 (93%), and mammography was positive in 66 (90%) ($P = 0.0019$). Either US or mammography was positive in 71 (97%) patients, 4 more than US alone and 6 more than mammography alone ($P = 0.0301$ compared with US alone and $P < 0.0001$ compared with mammography alone), yielding a 10% diagnostic increase over mammography.

INVASIVE DISEASE

Of the 73 symptomatic patients who had a history of breast lump, US was positive in 68 (93%), and mammography was positive in 66(90%) ($P = 0.0002$). When combined US and mammography results were positive in 71 (97%) patients ($P < 0.0394$ compared with US alone and ($P < 0.0001$) or with mammography alone (Table 1).

Table 1: US and mammography positivity for patients with lump breast.

	Total	Symptomatic	Screening
		Benign	Malignant
No. of patients	73	39	34
US + VE (%)	68 (93)	36 (88)	32 (94)
M + VE (%)	66 (90)	36 (88)	30 (88)
US vs. M	P = NS	P = NS	P = NS
US or M + VE (%)	71 (97)	38 (97)	33 (98)
US or M vs. US	P < 0.0001	P = 0.0394	P = NS
US or M vs. M	P < 0.0001	P < 0.0001	P = NS

M = mammography; US = ultrasonography; NS = not significant.

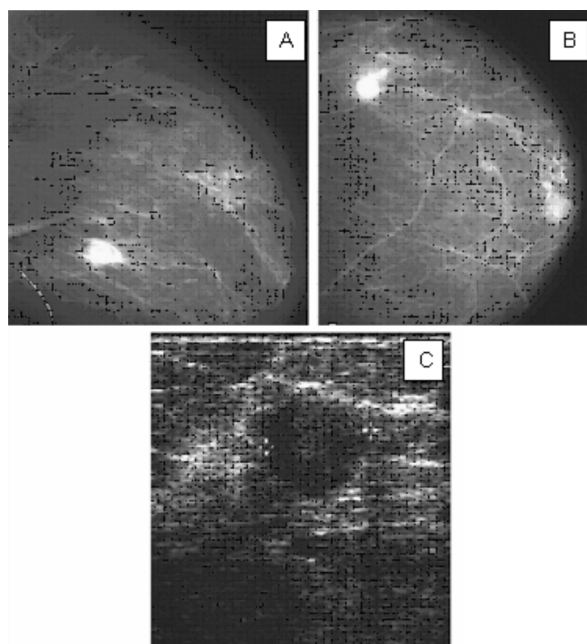


Fig. 1: Mammography: Right ML (A) and CC (B) views demonstrated a high-density round mass with indistinct margins. The high density and the margination are suspicious for carcinoma. Sonography (C) shows the mass to be solid, slightly irregular, and associated with posterior shadowing, all of which are suspicious features.

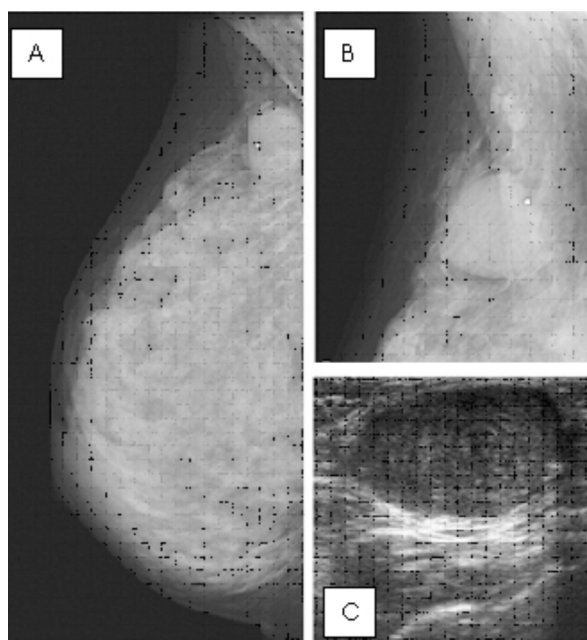


Fig. 2: History: A 37 year old female with breast lump.

For all the 73 patients 34 had invasive breast cancer, US was positive in 32 (94%), mammography

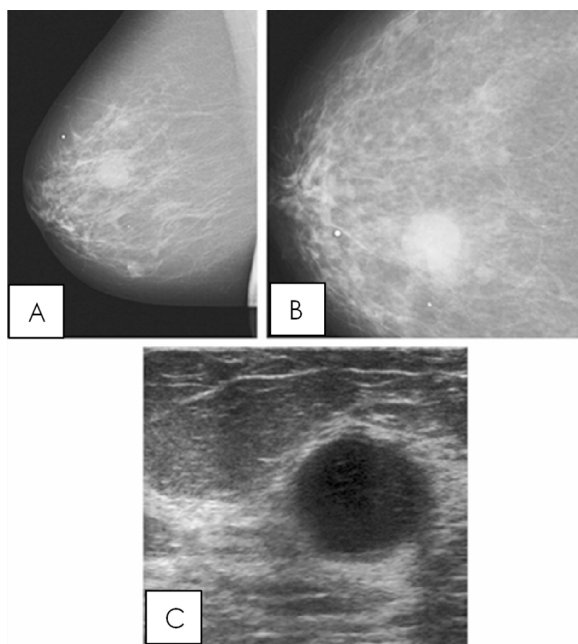


Fig. 3: History: A 56 year old woman with breast lump Mammography: shows a well defined mass Ultrasound: mass is well defined and anechoic, consistent with cyst. Histopathology: benign disease – simple cyst.

was positive in 30(88%; $P = 0.0178$), and either test was positive in 33 (98%) patients ($P < 0.0001$) compared with US or mammography alone were Mammographic and sonographic findings suspicious for carcinoma.

Thus, for symptomatic patients and overall for all patients, US was significantly more sensitive than mammography for the detection of invasive breast cancer. In addition, the combination of US and mammography was significantly better for the detection of invasive breast cancer than either modality used alone.

BENIGN DISEASE

Among the 39 symptomatic patients who had benign breast disease later on confirmed on histopathology, US was positive in 36 (97%), and mammography was positive in 36 (97%) ($P = NS$). Either US or mammography was positive in 36 (97%) ($P = NS$).

Mammography: Left (A) MLO view shows extremely dense breast tissue. A marker marks the palpable mass which is circumscribed, isodense lobular lesion. On the spot magnification view (B), the very well-defined margins are seen. On ultrasound (C) the mass is hypoechoic, well defined, and somewhat oval. Its histopathology was of fibroadenoma.

COMMENTS

We have demonstrated that US is significantly better than mammography in detecting invasive malignancy. Overall, US is now sufficiently superior to mammography for the vast proportion of patients in whom it must be considered a first-line diagnostic and screening partner, of mammography, in dedicated breast centers. It should be considered as an extension of the examining clinician's fingers and be a routine practice in all breast clinics, particularly "one-stop" breast clinics, where it allows for the immediate assessment and biopsy of any lesion of concern. The improving 3-dimensional assessment and computer-aided diagnosis, the sensitivity for US is likely to increase further.⁹

One of the most important findings of this study is that the combination of US and mammography is significantly more sensitive than either modality used alone. Its ease of use, relative low cost, lack of additional radiation, acceptability to the patient and, ability to tissue sample for diagnostic and therapeutic purposes, make this combination—not computed tomography or magnetic resonance imaging—the new "gold standard" in breast cancer imaging. Using both US and mammography results in 9% more breast cancers detected than using mammography alone. With 8 or 9 breast cancers missed in every 100 patients, "triple assessment" is no longer adequate for the investigation of breast disease.^{11,13,14} Best practice in breast cancer detection therefore dictates that US and mammography must be used together, as part of a "quadruple assessment," in all breast clinics. The increased diagnostic accuracy afforded by such a quadruple assessment benefits the patient by improving breast cancer detection and decreasing patient uncertainty and anxiety. In today's increasingly litigious society, the improved diagnostic accuracy of the quadruple assessment has an additional benefit. Undertaking the most accurate assessment available not only decreases the possibility of missed diagnoses, it also decreases any criticism associated with such rare missed diagnoses.

Limitations of this study included the inability to calculate the exact false-negative and false-positive rates for US without long-term longitudinal data. It has been generally accepted since the 1980s that the false-negative rate for mammography is relatively low, i.e., 5% to 15%, although it may actually be as high as 15% to 30%.^{8,10,11,13,14} Bilateral whole breast US detects a proportion of those tumors missed by mammogram. Our findings of a false-negative rate for US of 11% for all patients and 7.7% for symptomatic patients compares favourably with both our figures for mammography (11.5% for all patients and 13.4% for

symptomatic patients) and with the literature previously mentioned.

The addition of bilateral WBUS to mammography increases diagnostic sensitivity without increasing unnecessary biopsies when performed in a specialty breast center using state-of-the-art equipment and staff.¹²

In addition to studying the rate of false-positive results, we believe future studies should also address the nature of US false-positive results compared with mammography. A further concern could be that mammography-negative tumours detected by US might be large enough to be palpable, thus negating the benefit of US. The average size of tumours, in this study that were visible on both US and mammography was 19.3 mm. The size of US-negative but mammography-positive tumours was 16 mm, but the size of US-positive and mammography-negative tumours was 15.5 mm.

It is **concluded** that high-quality breast ultrasound after mammography is of great value in diagnostic breast imaging and is being explored for supplemental screening of selected groups of women. When ultrasound and mammography are properly correlated, abnormalities noted on screening mammography and even many palpable abnormalities can be dismissed as benign findings after complete work-up.

For suspicious findings that can be seen sonographically, core biopsy under ultrasound guidance is desirable. These patient-oriented benefits are also reflected in a medicolegal benefit attained by providing the most accurate assessment currently available, i.e., that of a clinical assessment, both US and mammography, and a histological study. This quadruple assessment is the new "gold standard" in the investigation of breast disease.

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