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Original Research

Comparative Analysis of Accuracy of Mammography and Ultrasound in Women with Breast Symptoms at a Tertiary Care Hospital

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Abstract

Background: Breast cancer remains the foremost cause of cancer-related fatalities among women globally. Although mammography has traditionally been regarded as the gold standard for screening and early detection, its implementation is often impractical in resource-constrained environments. This challenge arises from the substantial costs associated with acquiring and maintaining the necessary equipment, as well as the difficulties in training and retaining qualified technologists and radiologists for image interpretation. Hence, the present study was conducted for comparative analysis of accuracy of mammography and ultrasound in women with breast symptoms.

Materials & Methods: The study involving 100 women presenting with breast symptoms was conducted. Breast lesions were identified through clinical breast examination, mammography, and ultrasound imaging. All detected lesions underwent histological analysis. The histopathological findings indicated the presence of 42 cases of malignant and 58 benign lesions. A comprehensive medical history was obtained from each participant. The diagnostic protocol included clinical breast examination, ultrasound, mammography, and histopathological evaluation. The clinical breast examination was carried out on the entire breast and axillary regions while the patient was seated, with arms positioned both at rest and elevated. All the results were recorded and analyzed using SPSS software.

Results: A total of 100 subjects were evaluated. The mean age of the subjects was 35.3 years. Among these 100 subjects, malignant lesions were seen in 42 percent of the patients while the remaining 58 percent of the patients showed benign lesions. Ultrasound was superior to mammography in detection of both benign and malignant lesions.

Conclusion: Breast ultrasound is more accurate than mammography in symptomatic women.

Key words: Breast, Ultrasound, Mammography.

INTRODUCTION

Breast cancer remains the foremost cause of cancer-related fatalities among women globally. In 2018, there were 2.1 million newly diagnosed cases, and 626,679 deaths attributed to this disease. Effective access to breast cancer detection through imaging represents the initial step in the diagnostic process aimed at reducing mortality rates associated with this condition. Although mammography has traditionally been regarded as the goldstandard for screening and early detection, its implementation is often impractical in resource-constrained environments. This challenge arises from the substantial costs associated with acquiring and maintaining the necessary equipment, as well as the difficulties in training and retaining qualified technologists and radiologists for image interpretation. Data from 2014 indicate that in highly developed regions, there are between 40 to 600 mammography units available per 1 million women aged 50 to 69 years, in stark contrast to sub-Saharan Africa, where the

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average is between 0 to 12 units, and many developing regions in Asia, which have approximately 12 to 41 units. In the United States, where 70% of women participate in mammography screening, the latest estimates for the overall sensitivity and specificity of diagnostic digital mammography are 87.8% and 90.5%, respectively. In low- and middle-income countries (LMICs), the sensitivity of mammography is reported to range from 63% to 95%, with higher sensitivity observed in cases involving palpable lumps and lower sensitivity in instances of dense breast tissue.[1- 3] Breast ultrasound, commonly utilized in high-resource settings to complement mammography in specific clinical situations, presents a potentially effective alternative for the early detection of breast cancer in certain resource-limited contexts. Its advantages include portability, lower costs compared to mammography, and adaptability across a broader spectrum of clinical applications.[4,5]

Mammography is a specialised radiography of the breast using x-rays for generating images of the breast. Its purposes are first early detection of breast cancer before symptoms (screening mammography) and second diagnosis in patients with symptoms such as a palpable lump (diagnostic mammography, also named clinical mammography).[6] Hence; the present study was conducted for comparative analysis of accuracy of mammography and ultrasound in women with breast symptoms.

MATERIALS & METHODS

The present study was conducted in Department of Radiodiagnosis, LN Medical College & Research Center, Bhopal, Madhya Pradesh (India) for comparative analysis of accuracy of mammography and ultrasound in women with breast symptoms. A study involving 100 women presenting with breast symptoms was conducted from July 2023 to June 2024. Inclusion criteria for present study included female subjects within age range of 20 to 40 years and presenting with any breast lesion. Subjects with the presence of any other systemic illness and beyond the age range of more than 40 years were excluded. Breast lesions were identified through clinical breast examination, mammography, and ultrasound imaging. All detected lesions underwent histological analysis. The histopathological findings indicated the presence of 42 cases of malignant and 58 benign lesions. A comprehensive medical history was obtained from each participant. The diagnostic protocol included clinical breast examination, ultrasound, mammography and histopathological evaluation.

The mammography machine used in this study is Fujifilm Amulet Felicia. Both CC and MLO projections with compression were obtained. The factors used were fixed: (standard) Kv and (auto)mAs. The ultrasonographic machine used in this study was WiproGE Versana. Linear transducer Probe frequency - 6.5 to 12 MHz. The position of the patient was supine oblique, with the ipsilateral arm on the examined side lifted onto the head to spread the breast. Various scanning method proposed for the diagnostic imaging, including systemic scanning in the radial and antiradial planes were performed.

On Mammography lesions with round or oval masses having distinct borders were identified as benign lesions while malignant lesions were more likely to have irregular shapes, indistinct margins, or spiculated margins. Malignant lesions were typically denser than normal breast tissue. On Ultrasound, a benign breast lesion on an ultrasound typically appeared with the Oval, round, or gently lobulated having well-defined and circumscribed and were Hyperechoic, isoechoic, or mildly hypoechoic. Malignant lesions were irregular in shape or have uneven margins. Also, the lesion was markedly hypoechoic, meaning it has a low echo.

The clinical breast examination was carried out on the entire breast and axillary regions while the patient was seated, with arms positioned both at rest and elevated. All the results were recorded and analyzed using SPSS software.

Table 1: Mammography lexicon

Breast composition	A. entirely fatty B. scattered areas of fibroglandular density C. heterogeneously dense, which may obscure masses D. extremely dense, which lowers sensitivity		
Mass	Shape	Oval-round-irregular	
	Margin	Circumscribed-obscured-microlobulated-inndistinct-spiculated	
	Density	Fat-low-equal-high	
Asymmetry	Asymmetry-global-focal-developing		
Architectural Distortion	Distorted parenchyma with no visible mass		
Calcifications	Morphology	Typically benign	
		Suspicious	1. amorphous

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			2. coarseheterogeneous 3. fine pleiomorphic 4. fine linear or fine linear branching
	Distribution	Diffuse-regional-grouped-linear-segmental	
Associated Features	skin retraction - nipple retraction - skin thickening - trabecular thickening-axillary adenopathy - architectural distortion - calcifications		

Table 2: Ultrasound lexicon

Breast composition	a. homogeneous - fat b. homogeneous - fibroglandular c. heterogeneous	
Mass	Shape	oval - round - irregular
	Margin	Circumscribed or Not-circumscribed: Indistinct,Angular, microlobulated,spiculated
	Orientation	Parallel – not parallel
	Echo pattern	anechoic - hyperechoic - complex cystic/solid hypoechoic - isoechoic- heterogeneous
	Posterior features	no features - enhancement-shadowing - combined pattern
Calcifications	in mass - outside mass - intraductal	
Associated Features	architectural distortion - duct changes - skin thickening - skin retraction – edema - vascularity (absent, internal, rim) - elasticity	
Special Cases (cases with a unique diagnosis)	simple cyst - clustered microcysts - complicated cyst - mass in or on skin - foreign body (including implants) - intramammary lymph node - AVM - Mondor disease - postsurgical fluid collection - fat necrosis	

Table 3: Comparison of mammography and ultrasound for malignant lesions

Variables		**Ultrasound**		
		Positive	**Negative**	**Total**
Mammography	**Positive**	29	2	31
	Negative	9	2	11
	Total	38	4	42

Table 4: Comparison of mammography and ultrasound for benign lesions

Variables		**Ultrasound**		
		Positive	**Negative**	**Total**
Mammography	**Positive**	38	4	42
	Negative	10	6	16
	Total	48	10	58

RESULTS

A total of 100 subjects were evaluated. The mean age of the subjects was 35.3 years. Among these 100 subjects, malignant lesions were seen in 42 percent of the patients while the remaining 58 percent of the patients showed benign lesions. The accuracy of ultrasound and mammography in detecting malignant lesions was 82.3 percent and 69.7 percent respectively. The accuracy of ultrasound and mammography in detecting malignant lesions was 80.9 percent and 73.8 percent respectively. Ultrasound was superior to mammography in detection of both benign and malignant lesions.

DISCUSSION

Malignant tumours (cancers) and benign diseases are very common in the breast. Aside from clinical history (disorders in the family, previous breast diseases/surgery, hormone therapy, personal well-being and complaints), inspection (external viewing) and palpation, which compose the so-called clinical breast examination, imaging procedures and especially mammography are of crucial importance in the detection and diagnosis of breast cancer and also other breast diseases.[7-9] Hence; the present study was conducted for comparative analysis of accuracy of

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mammography and ultrasound in women with breast symptoms.

A total of 100 subjects were evaluated. The mean age of the subjects was 35.3 years. Among these 100 subjects, malignant lesions were seen in 42 percent of the patients while the remaining 58 percent of the patients showed benign lesions. The accuracy of ultrasound and mammography in detecting malignant lesions was 82.3 percent and 69.7 percent respectively. The accuracy of ultrasound and mammography in detecting malignant lesions was 80.9 percent and 73.8 percent respectively. Ultrasound was superior to mammography in detection of both benign and malignant lesions. Stavros AT et al. investigated the efficacy of sonography in differentiating benign solid breast nodules from those that are indeterminate or malignant. A total of 750 solid breast nodules were prospectively categorized into benign, indeterminate, or malignant classifications. The findings revealed that 625 lesions (83%) exhibited benign histological characteristics, while 125 lesions (17%) displayed malignant features. Among the benign lesions, 424 had been accurately classified as benign. However, two lesions initially classified as benign were subsequently identified as malignant upon biopsy. This classification approach demonstrated a negative predictive value of 99.5%. Out of the 125 malignant lesions, 123 were accurately identified as either indeterminate or malignant, resulting in a sensitivity of 98.4%. Therefore, sonography proved to be a valuable tool in the accurate classification of certain solid lesions as benign, facilitating imaging follow-up instead of invasive biopsy procedures.[10]

Moy L et al. investigated the incidence of breast cancer diagnoses in patients who presented with a clinically concerning area despite having negative mammographic and ultrasonographic (US) results. Out of 829 women studied, follow-up data were available for 374 individuals. Among these, 233 patients exhibited negative imaging results and were monitored for over two years. The remaining 141 women were considered cancer-free, as they were not recorded in the State Cancer Registry. Notably, six individuals (2.6%) from the group of 233 were diagnosed with breast cancer in the region of the palpable abnormality. All six cases were found in the subset of 156 women with radiographically dense breast tissue, while no cancers were detected among the 77 women with predominantly fatty breast tissue. This study indicates that although a negative mammogram and US finding of a palpable abnormality does not definitively rule out breast cancer, the probability of such a diagnosis remains low, estimated at approximately 2.6% to 2.7%.[11]Devolli-Disha E et al conducted a study involving 546 patients presenting with breast symptoms, utilizing clinical breast examinations, mammography, and ultrasound for assessment. Histopathological analyses were performed on a total of 546 breast lesions. The findings revealed that the sensitivity and specificity of ultrasound were statistically significantly superior to those of mammography in detecting both breast cancer and benign lesions, especially in cases involving dense breast tissue and younger women.[12]

CONCLUSION

Breast ultrasound is more accurate than mammography in symptomatic women.

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