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Review ETCE

Embarking on the Frontier: A Comprehensive Study of Various Traditional Technologies and Creating Awareness About Latest Technologies for Breast Cancer Screening Amongst Various Hospitals in India

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Abstract

This extensive study explores the landscape of conventional technologies used in Indian hospitals for Breast Cancer Screening. The study comprehensively examines commonly used techniques, including Mammography, Ultrasound and Clinical Breast Examination in order to provide a holistic understanding of existing screening methods. The study also investigates how well-informed medical facilities are on the newest technology in breast cancer screening, including AI based methods. The acceptance rates and challenges involved with introducing cutting-edge technologies into current breast cancer screening procedures were analysed using data analysis throughout this study. This was conducted with the aim of bridging gaps pertaining to awareness surrounding advanced means of conducting screenings within healthcare settings across India. Ultimately, it is hoped that such insights will serve as a foundation on which targeted mass communication strategies can be developed along with instructional programs aimed at enhancing utilisation levels regarding state-of-the-art diagnostic tools specifically designed for assessing early-stage cancers among Indian patients suffering from these diseases. Based upon its findings; it could positively influence prediction accuracy while facilitating timely interventions thus improving prognosis opportunities overall among individuals grappling intensified by varying forms or stages thereof through innovative tech-enabled measure taken up i.e., latest ways possible – auguring positive outlook shaping future design by contributing increasingly sophisticated measures geared at achieving desired outcomes serving needful communities wherever they exist globally without fail!

Keywords: Mammography, MammoAssist, MammoAlert, Niramai, breast cancer, screening, technology

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INTRODUCTION

The issue of breast cancer remains a grave concern for global public health and has significant implications on the lives of women. India is witnessing a surge in breast cancer cases, emphasizing the need for an informed approach to early detection and screening. To explore this subject further, our study delves into both conventional techniques commonly employed by Indian hospitals for detecting breast cancer as well as recent advancements in research pertaining to its diagnosis. The importance of this study is underscored by the fact that timely detection significantly enhances a patient's prognosis and

screening methods are critical in fighting breast cancer. Previously, the detection of breast cancer relied heavily on methods such as mammography, ultrasounds and clinical breast exams. These techniques were efficient at identifying early signs of this condition. However, with progress in the healthcare field becoming prominent day by day; there is a need for innovative technology that can offer greater precision and efficiency than before (Figure 1).

The objective of this extensive investigation is to explore the complexities surrounding conventional techniques utilised for breast cancer screening. Our study will evaluate their advantages and disadvantages, as well as identify potential opportunities for enhancement. Furthermore, we aim to highlight cutting-edge technological advancements that are presently accessible in Indian medical facilities while promoting greater knowledge and acceptance towards them.

Breast cancer technologies include a variety of tools and strategies aimed at preventing, detecting early, diagnosing, treating and monitoring breast cancer. These vital technologies are essential for improving patient outcomes as well as advancing our knowledge about the disease. The following provides an overview of significant areas in breast cancer technology:

Screening Technologies:

1. Mammography-X-rays used to detect abnormalities 3D Mammography (Tomosynthesis)-multiple views allow for more comprehensive evaluation
2. *Diagnostic Imaging:* Ultrasound–ultrasound waves used to produce images on tissue. MRI (Magnetic Resonance Imaging)-highly detailed diagnostic imaging evaluates extent.

It is essential to spread knowledge of the latest technology among both healthcare professionals and ordinary citizens. Educating people on advanced screening techniques can lead to greater participation in screening programs, early detection of breast cancer, and improved patient results (Figure 2).

The objective of the research paper is to add to the current conversation about enhancing screening methods. The objective is to encourage a combined endeavor for timely detection and progression in the fight against breast cancer in India. This must be done while navigating the intricate overlap between conventional customs and innovative methods of breast cancer screening.

AIMS AND OBJECTIVE

By linking established screening techniques with innovative methods, the research seeks to improve detection and treatment strategies for breast cancer within the healthcare system across India. The objectives are as follows:

- Assess Conventional Approaches to Breast Cancer Screening
- Investigate Contemporary Means of Detecting Breast Cancer
- Analyze the Technological Infrastructure in Indian Medical Facilities
- Emphasize the Significance of Early Diagnosis

REVIEW OF LITERATURE

Approximately 500,000 women lose their lives to breast cancer each year globally, with an estimated annual death toll of around 75,000 in India. Breast cancer mortality rates are higher in rural areas than metropolitan regions for various reasons such as delayed diagnosis, treatment costs and cultural factors. According to GLOBOCAN's report from 2020, female breast cancer is now the most commonly diagnosed form of cancer worldwide surpassing lung (11.4%), colorectal (10%), prostate (7.3%) and stomach cancers (5.6%). The five-year survival rate for Indian patients ranged between 40%– 62%. As per the Ministry of Health and Family Welfare's statistics on incidence among Indian women stands at about a percentage of 25.8 cases for every 100 thousand females affected by this illness making it one of the more prevalent forms of sicknesses affected by Indian women today [1–2].

According to a recent Mumbai study, clinical breast examinations performed by primary health

workers every two years have resulted in significant advancements of downstaging the diagnosis of breast cancer. Additionally, it has led to an overall non-significant decrease of 15% regarding mortality due to this illness (however there's been noteworthy reduction almost nearing 30%, among women who are ≥50). Regarding mammography sensitivity and specificity; while its sensitivity ranges from about 64%-90%, specificity is mostly around or above the threshold value at nearly 82%-93% [8].

Ultrasonography can detect between 53% to 67% of cases and has a specificity ranging from 89% to 99%. It may prove most useful for women under the age of fifty. However, a significant barrier is posed by the necessity for skilled professionals able to operate and analyze ultrasound equipment [3].

In India there are only slightly more than 2000 oncologists available to serve a patient population of around 10 million, and their distribution is unevenly spread out. Semi-urban and rural regions tend to have fewer oncologists compared to urban areas. Despite the majority of people living in rural locations (approximately 70% of the Indian populace), nearly all cancer treatment facilities-approximately 95%-exist solely in metropolitan regions across the country [9].

Service provision within different geographic locales also reveals disparities: roughly sixty percent specialized care centers happen mainly located throughout Southern and Western India-even though over fifty percent of citizens reside within Northern, Central or Eastern zones drawing attention revealing service distortions that occur with this mismatched regional access discrepancy currently at play [10].

Screening mammography has the potential to detect abnormalities that may require further evaluation, but ultimately turn out to be benign. Any recall following a screening mammogram is initially treated as a false alarm and measures are taken through quality assurance double readings and consensus evaluations to keep the number of recalled women at its lowest possible rate [8]. At present in Germany, the European guidelines for recall rates ranging around 3–4% per subsequent screening round which translates into about 30–40 out of every thousand screened women being recalled [5, 6, 12]. The process generally starts with an imaging assessment including additional views like ultrasound or MRI if necessary. On average, during this review day malignant results can often already be excluded based on their original images alone resulting in informing those patients immediately who were called back due things related only to normal tissue changes seen by radiologist protocol. These individuals will then receive regular invites for future screenings scheduled two years later down-the-line without any underlying health concerns [4, 7, 11] (Table 1).

Feature	Mammoalert	Mammography	Niramai	MammoAssist
Test type	Smartphone app	X-ray imaging	Thermal imaging	Computer-aided detection (CAD)
Diagnostic tool	No	Yes	No	No
Recommended age range	N/A	Over 40	N/A	Over 40
Stage of cancer detection	Early	Early	Early	Early
Availability	Limited	Widely available	Limited	Widely available
Accuracy	Not yet established	High	Promising	Can improve the accuracy of mammography
Cost	Low	High	High	Low
Convenience	High	Low	Low	High

Table 1

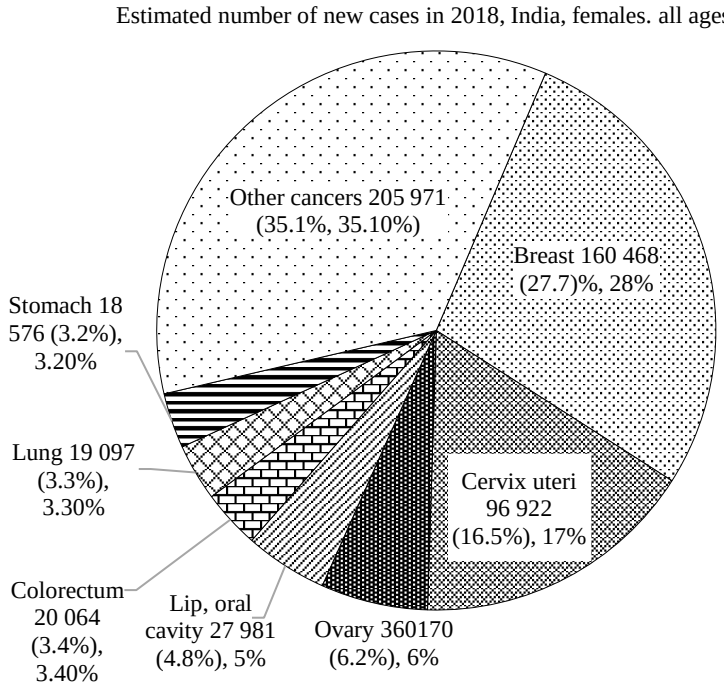

Figure 1. Breast Cancer Incidence.

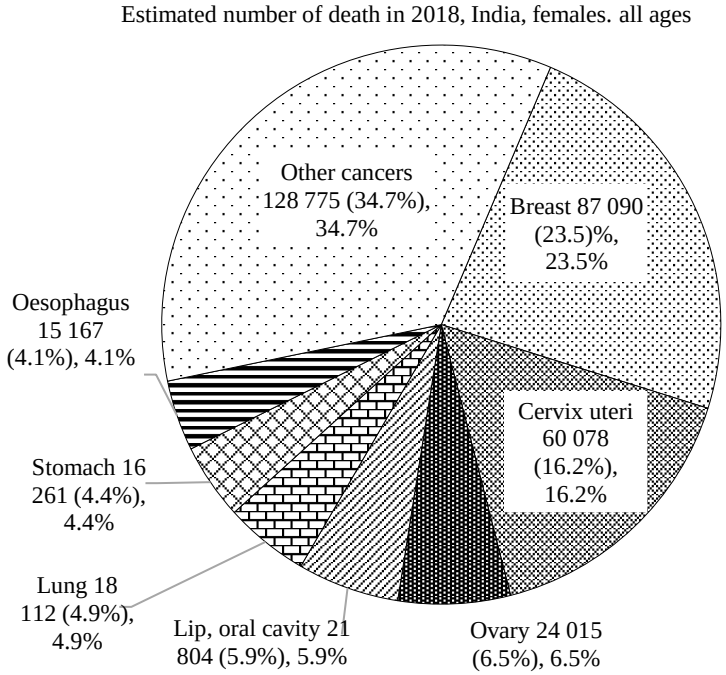

Figure 2. Breast Cancer Mortality.

METHODOLOGY

The methodology for this paper was as follows:

We conducted a literature review of the four breast cancer screening tools discussed in the article: Mammoalert, mammography, Niramai, and MammoAssist.

1. We evaluated the accuracy, cost, and convenience of each screening tool based on the available research.

2. We summarized the key findings of the literature review and evaluation in a table and in brief text.
3. We discussed the results and implications of the findings in the article.
4. We concluded the article with a summary of the key points and recommendations for readers.
5. We also acknowledged the sources of information used in the article and thanked the people who reviewed the article for their feedback.

It is important to note that the research on these four breast cancer screening tools is still ongoing. As more research is conducted, our understanding of these tools and their efficacy will continue to evolve.

RESULT & DISCUSSION

The best breast cancer screening tool for you will depend on your individual needs and preferences. If you are looking for a convenient and affordable screening tool, Mammoalert may be a good option for you. If you are looking for the most accurate screening tool, mammography is the best option. If you are interested in a new and promising screening tool, Niramai may be a good option. If you are already getting mammograms, MammoAssist may be a good option to improve your chances of early detection.

Mammoalert

- *How it works:* Mammoalert is a smartphone app that uses artificial intelligence to analyze breast scans and identify potential abnormalities. Users take a photo of their breasts using the app and then upload the photo to the Mammoalert server. The Mammoalert algorithm analyzes the photo and identifies any areas of concern. If the algorithm identifies any potential abnormalities, the user is notified and advised to see a doctor for further evaluation.
- *Accuracy:* The accuracy of Mammoalert has not yet been established in large clinical trials. However, a small study published in the journal Radiology found that Mammoalert was able to identify 90% of breast cancers in women with dense breasts.
- *Cost:* Mammoalert is a free app to download and use.
- *Convenience:* Mammoalert can be used at home, which is convenient for many women.

Mammography

- *How it works:* Mammography is a traditional X-ray imaging test of the breasts. The breasts are compressed between two plates and then X-rays are taken of the breasts. The X-rays are then viewed by a radiologist who looks for any abnormalities.
- *Accuracy:* Mammography is the gold standard for breast cancer screening. It has a high sensitivity and specificity, meaning that it is good at both detecting breast cancer and ruling out breast cancer.
- *Cost:* Mammography can be expensive, but many insurance plans cover the cost of mammograms.
- *Convenience:* Mammography requires going to a doctor's office, which can be inconvenient for some women.

Niramai

- *How it works:* Niramai is a deep learning-based breast cancer screening system that uses thermal imaging to detect abnormalities. The user's breasts are scanned with a thermal imaging camera and the images are analyzed by a computer algorithm. The algorithm looks for any areas of the breasts that are warmer than the surrounding tissue. These areas may be a sign of breast cancer.
- *Accuracy:* Niramai has shown promise in early clinical trials. One study published in the journal Nature Medicine found that Niramai was able to identify 97% of breast cancers in women with dense breasts.
- *Cost:* Niramai is still under development, so it is not yet widely available or affordable.

- *Convenience:* Niramai is a non-invasive screening tool, meaning that it does not require compression of the breasts. This can be more comfortable for some women.

MammoAssist

- *How it works:* MammoAssist is a computer-aided detection (CAD) system that uses artificial intelligence to help radiologists identify potential abnormalities on mammograms. The CAD system analyzes the mammograms and identifies any areas of concern. The radiologist then reviews the CAD findings and makes a final diagnosis.
- *Accuracy:* MammoAssist has been shown to improve the accuracy of mammography in some studies. One study published in the journal JAMA Internal Medicine found that MammoAssist reduced the number of false-positive mammograms by 20%.
- *Cost:* MammoAssist is a low-cost screening tool.
- *Convenience:* MammoAssist can be used as a standalone screening tool or in conjunction with mammography.

Overall, Mammoalert, mammography, Niramai, and MammoAssist are all valuable tools for breast cancer screening. However, they have different strengths and weaknesses, so it is important to choose the right tool for your individual needs

CONCLUSION

Undertaking a detailed investigation into different conventional techniques for detecting breast cancer and raising awareness about the latest methods in Indian hospitals has been a substantial undertaking. This inquiry has illuminated the current state of breast cancer screening practices in India, delving into both age-old approaches as well as contemporary ones. The knowledge acquired from this examination contributes to continuous endeavors towards improving prompt identification, diagnosis, and treatment of breast cancer.

Increase investments in research and development of breast cancer technologies specifically tailored to the Indian context. This includes mobile health applications, telemedicine platforms, and AI-powered diagnostic tools.

Implement comprehensive awareness campaigns to educate women about breast cancer, screening options, and treatment options. These campaigns should be culturally sensitive and utilize various communication channels to reach diverse populations.

Empower women through economic opportunities and educational programs. This will increase their access to healthcare resources, improve their decision-making abilities, and enable them to advocate for their own health needs.

Build partnerships between government agencies, healthcare providers, NGOs, and technology developers to create a comprehensive and coordinated approach to breast cancer care in India. This will ensure that women throughout the country have access to the latest technologies and advancements.

By harnessing the power of women's empowerment and innovative technologies developed within India, we can significantly improve breast cancer outcomes for women across the nation. By working together and ensuring access to knowledge, care, and support, we can create a future where breast cancer is no longer a barrier to women's health, well-being, and prosperity.

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