Clinical Studies

& Letters of Support

Indian J Gynecol Oncolog (2016)14:26
DOI 10.1007/s40944-016-0057-1

ORIGINAL PAPER

Noninvasive and Low-Cost Technique for Early Detection of Clinically Relevant Breast Lesions Using a Handheld Point-of-Care Medical Device (iBreastExam): Prospective Three-Arm Triple-Blinded Comparative Study

S. P. Somashekhar[1] · Ratna Vijay[1] · Rupa Ananthasivan[1] · Govindarajan Prasanna[1]

Received: 2 April 2016 / Revised: 11 April 2016 / Accepted: 12 April 2016

Abstract

Context With limited access to mechanisms of early detection, the vast majority of breast cancer cases present at late stages in developing countries.

Objective To determine the clinical efficacy of a handheld point-of-care medical device that could potentially assist allied healthcare workers to perform standardized Clinical Breast Examination in low-resource settings.

Design, Setting and Participants Nine hundred and eighty-nine healthy women visiting Manipal Hospital, Bangalore, for annual health check were recruited for bilateral breast examinations. Additionally, 20 women attending the hospital with breast-related symptoms were also recruited as part of the opportunistic screening program. Each woman was examined by three independent methods, each blinded to the other two: iBreastExam (iBE), Clinical Breast Examination (CBE) by an expert clinician and Breast Imaging (mammography or breast ultrasound).

Main Outcome Measures Sensitivity, Specificity, PPV, NPV for iBE and CBE were derived with Breast Imaging tests used as reference standard.

Results Out of 916 enrolled participants, 93 were confirmed by imaging to have at least one breast lesion. Clinical Breast Examination in comparison with imaging detected breast lesions with Sn = 65 %, Sp = 94 %, PPV = 52 %, NPV = 96 %, and iBreastExam reported Sn = 84 %, Sp = 94 %, PPV = 60 % and NPV = 98 %. In women below age 40 (314 participants), iBE detected breast lesions with Sn = 85 %, Sp = 93 %. All malignant lesions were identified by iBE, while one non-palpable malignant lesion was missed by clinician CBE.

Conclusion The point-of-care Breast Imaging device (iBreastExam) performed with significantly better sensitivity, by 19 %, than CBE to detect breast lesions while reporting high specificity (94 %) and NPV (98 %). In younger women population under the age of 40 years, where the prevalence of dense breast is high, iBreastExam demonstrated high-performance characteristics. iBreastExam detected all malignant lesions in this study, while the clinician's CBE missed to detect a non-palpable malignant lesion. iBreastExam can be a promising tool to provide clinically effective and standardized breast examinations in low-resource settings to detect breast lesions at early stages. The device can also be an effective screening tool for younger women with dense breasts.

Keywords iBreastExam · Breast cancer screening · India · Low-cost setting

Introduction

In 2012, 145,000 new cases of breast cancer (BC) and 70,000 deaths were reported in India. BC is the most common cancer in women worldwide, disproportionately affecting low- and middle-income countries (LMICs). 52.6 % of new BC cases occur in LMICs, and this is expected to grow to 70 % by year 2020 [1].

Five-year survival rate is poor 40–60 % in most LMICs as compared to 80–90 % in high-income countries (HICs). Lack of secondary prevention programs (population-based screening) and enhanced treatment are the two major differentiating factors for poorer BC outcomes in LMICs.

✉ S. P. Somashekhar
somashekhar.sp@manipalhospitals.com

[1] Manipal Comprehensive Cancer Center, Manipal Hospital, Bangalore, India

Published online: 22 April 2016

Broach et al. World Journal of Surgical Oncology (2016) 14:277
DOI 10.1186/s12957-016-1022-2

World Journal of Surgical Oncology

RESEARCH Open Access

A cost-effective handheld breast scanner for use in low-resource environments: a validation study

Robyn B. Broach[1], Rula Geha[1], Brian S. Englander[2], Lucy DeLaCruz[1], Holly Thrash[3] and Ari D. Brooks[4*]

Abstract

Background: With the incidence of breast cancer rising worldwide, we are evaluating the iBreastExam (iBE) (UE LifeSciences Inc.), a handheld breast scanning device that can be utilized by community health workers to screen for breast abnormalities. The purpose of this study is to determine the sensitivity of the iBE in a population undergoing diagnostic breast imaging.

Methods: Adult patients presenting to a breast imaging center for a diagnostic workup were eligible. Patients underwent an iBE exam performed by a trained ultrasound technician followed by their indicated imaging. Demographic, imaging, and biopsy data were recorded.

Results: Seventy-eight iBE exams were completed, 77 females and one male with a mean age of 42 (21–79). All patients were evaluated by ultrasound, 52 had diagnostic mammography and 39 had biopsies. Imaging and/or biopsy confirmed a mass (fibroadenoma, cyst, papilloma, myofibroblastoma, fat necrosis, DCIS, or cancer) in 60 patients. Twelve patients had a cancer diagnosed. In total, 342 quadrants were scanned, 77 quadrants had lesions confirmed on imaging, and iBE correctly identified 66 lesions for a sensitivity of 86 % and specificity of 89 %.

Conclusions: This validation study demonstrated excellent sensitivity of iBE for the identification of clinically significant lesions in patients presenting for diagnostic imaging.

Trial registration: A Cost-Effective Handheld Breast Scanner for Use in Low Resource Environments: A Validation Study: NCT02814292.

Background

The incidence of breast cancer is rising rapidly worldwide. Since 2008, the incidence of breast cancer has increased by more than 20 % worldwide [1]. Globally, breast cancer now represents one in four of all cancers among women. Early detection improves the survival rate, makes treatment less costly, and lowers the overall burden of the disease. The iBreastExam (iBE) device was developed as a pre-screening tool that could identify women in need of further breast imaging without requiring extensive breast screening infrastructure. This inexpensive handheld device uses piezoelectric palpation to enhance the clinical breast exam (CBE) for detection of breast masses that require further investigation.

The iBE device was built on the principle of the piezoelectric finger (PEF) detector. After their initial development, the PEF was proven in bench-top work on breast phantoms and subsequently in excised human tumors with excellent detection ability and size prediction [2]. A pilot in vivo clinical trial was then completed using a very basic array of four PEFs with excellent detection of breast lesions in women undergoing clinical evaluation [3]. Subsequently, the iBE device was developed as a 16 finger array with a rapid wireless mobile processor algorithm and durable battery powered handpiece. The device was developed to be operated by a technician or health care worker and does not require a radiologist for interpretation. This prospective study was designed specifically to validate the ability of the iBE device to detect breast abnormalities worthy of further diagnostic imaging.

* Correspondence: ari.brooks@uphs.upenn.edu
[4]Department of Surgery, University of Pennsylvania School of Medicine, 800 Walnut Street, 20th Floor, Philadelphia, PA 19107, USA
Full list of author information is available at the end of the article

Strictly confidential till release in Feb 2016
Submitted to 32nd Miami Breast Cancer Conference

Breast Examination in India Using a Portable Handheld Breast Palpation Device is as Effective as an Expert Clinical Breast Exam

Rula Geha, Robyn Broach PhD, Ari D. Brooks, MD, Matthew Campisi, Mihir Shah, Bhaumik Sanghvi, Ojus Wadhwa MSGS, Shekhar R. Kulkarni MSGS

Background:
In 2012, 145,000 new cases of breast cancer and 70,000 deaths were reported in India. The survival rate is poor; over 60% of cases present at advanced stage. Clinical breast exam (CBE) is the mainstay of screening, but is limited by lack of trained medical professionals. Routine mammography screening is virtually impossible due to limited resources. The iBreastExam (iBE) is a portable, handheld piezoelectric pressure sensor that electro-mechanically palpates the breast to differentiate variances in tissue elasticity. The goal of the iBE in India is to enable allied healthcare workers to perform breast exams in 190M women between ages 30-70 in order to find treatable cancers earlier.

Methods:
Thirteen-hundred women from Pune, India were recruited for bilateral breast examinations. A trained allied health care worker would scan each breast using the iBE in a clock-wise manner and then the patient would undergo CBE by a health care worker and then by a doctor. No further investigations were performed if iBE and the CBE were negative. If the iBE and/or the CBE was positive, the subject was asked to undergo a breast ultrasound. If the ultrasound was positive (including cyst, fibroadenoma or suspicious) then the subject was recommended to undergo fine needle aspiration (FNA).

Results:
Out of the 1300 patients, 158 returned with a positive finding by CBE only (22), iBE only (9), or both (127). Fifteen patients declined to obtain a follow-up USG breast exam. A bilateral ultrasound was completed on 143 patients resulting in 94 patients with positive sonographic findings, 17 of which were bilateral positive findings. Eight patients underwent FNA and 3 were found to be malignant. None of these were missed by iBE or physician CBE; one was missed by healthcare worker CBE. The sensitivity and specificity of the iBE when compared to physician CBE is Sn=77.66, Sp=98.96. However, CBE is not the gold standard to determine a true positive so ultrasound was used to determine the sensitivity and specificity of iBE and CBE. The sensitivity using the ultrasonography results for CBE (Sn=95.49 Sp=60.57) and for iBE (Sn=97.29, Sp=69.14) were superior to the sensitivity and specificity of the lay healthworker CBE.

	Ultrasound positive	Ultrasound negative	No U/S
Expert CBE positive	106	69	14
Expert CBE negative	5	106	1130
iBE positive	108	54	12
iBE negative	3	121	1122

Conclusion:
The iBE is a powerful tool that can be widely used to screen for breast pathology in women who do not have access to routine preventive health care or mammography. Laypeople can be trained on the device and provide access to pre-screening for women in rural and poor communities in developing nations. We have shown that the device is as effective as CBE done by an expert physician. Patients with positive findings can then be referred to medical centers for further evaluation. Since iBE may be more accurate than CBE, a study is currently ongoing to determine the sensitivity and specificity of iBE when mammography screening is used as the gold standard.

J Am Coll Surg. 2013 Jun;216(6):1168-73. doi: 10.1016/j.jamcollsurg.2013.02.022. Epub 2013 Apr 23.

Breast tumor detection using piezoelectric fingers: first clinical report.

Xu X, Gifford-Hollingsworth C, Sensenig R, Shih WH, Shih WY, Brooks AD.

School of Biomedical Engineering, Science, and Health Systems, Drexel University, Philadelphia, PA 19102, USA.

Abstract

BACKGROUND: Mammography is key to detection of breast cancer in high-risk populations. Currently, aside from palpation and risk-assessment questionnaires, there is no prescreening test that can improve the accuracy, safety, and cost effectiveness of screening low-risk populations. The piezoelectric finger (PEF) is a radiation-free, portable, and low-cost breast tumor detector we developed to be used as a prescreening tool.

STUDY DESIGN: Patients presenting with breast abnormalities detected by palpation or imaging were enrolled in this IRB-approved study. The PEF testing was performed with the patient in supine position before undergoing biopsy or surgical excision. The locations of the lesions detected by PEF were compared with those confirmed on imaging or pathology.

RESULTS: A total of 40 patients were enrolled and 46 lesions were confirmed by imaging or pathology. The PEF reported 55 lesions, with 9 false positives and 2 true positives not originally found on imaging or palpation. The overall sensitivity of the PEF test was 87% (40 of 46). In women 40 years old or younger, overall sensitivity was or 100% (19 of 19). In women who had a lesion visible on mammography, PEF had a sensitivity of 83% (24 of 29). Of these, in women aged 40 years or younger, PEF identified all 7 mammographically visible lesions, including 2 malignant lesions. When compared with ultrasound, PEF correctly identified 87% (34 of 39) in this group. Of these, in women aged 40 years or younger, PEF identified 100% (19 of 19) of all ultrasound-visible lesions.

CONCLUSIONS: The PEF identified abnormalities in all 39 patients who presented with breast abnormalities and did not demonstrate any false negatives that would prevent the patients from additional evaluation, which makes it a good prescreening tool. In addition, PEF demonstrated 100% sensitivity in women aged 40 years or younger, a traditionally low-risk population.

PMID: 23623223 [PubMed - indexed for MEDLINE]

Support Letters & Testimonials

THE ASSOCIATION OF BREAST SURGEONS OF INDIA

ABSI 2011

Dr.P.Raghu Ram
President, ABSI

Dr.Somashekhar S.P.
Hon.Secretary,ABSI

Date: August 16th, 2016

Subject: Noninvasive and Low-Cost Technique for Early Detection of Clinically Relevant Breast Lesions Using a Handheld Point-of-Care Medical Device (iBreastExam)

To Whom It May Concern:

The Association of Breast Surgeons of India (ABSI) represents General Surgeons, Surgical Oncologists and Plastic Surgeons who treat patients with breast disease. It is committed to improving the art & science of breast surgery by serving as an advocate for surgeons who seek excellence in the care of patients with breast disease. The Association provides a forum for the exchange of ideas by promoting education & research with similar associations across the world.

The Fifth Annual Congress of ABSI was organized @ ITC Gardenia from 1-3 July 2016 undermy leadership (Dr. Somashekhar, Honorary Secretary & Chairman Organising Committee) actively assisted by Dr. RajashekharJaka, Organising Secretary.

120 research papers were submitted and selected for presentation at the conference as poster from around the country. A 12-member evaluation jury panel was established composed of leading breast specialists from India to review these research papers. Criteria for evaluation were based on the excellence in research rigor, scientific merit, quality of execution and impact as well as benefit to the society. In a 3-tier selection process, each poster was evaluated and scored by each of the Jury panel members, leading up to a LIVE presentation by the top 10 posters at the ABSICON 2016 event. The winning paper was offered an Overseas Breast Fellowships in select Centers of excellence in the British Isles and would be badged by the Association of Breast Surgeons of UK.

I attest and confirm that research paper titled "Noninvasive and Low-Cost Technique for Early Detection of Clinically Relevant Breast Lesions Using a Handheld Point-of-Care Medical Device (iBreastExam): Prospective Three-Arm Triple-Blinded Comparative Study" was selected as the best research paper presentation at the ABSICON 2016 meeting.

Sincerely,

Somashekhar. SP

Prof.Dr.Somashekhar SP
MS,MCh(Onco),FRCS.Edinburgh
Hon. Secretary ABSI
Chairman & HOD Surgical Oncology, Manipal Health Enterprise
Consultant Surgical Oncologist,Manipal Comprehensive Cancer Center,
Board Member, Business Advisory Board of MHEPL
Editor-in-chief IJGO springer
E-mail:absisec@gmail.com;somusp@yahoo.com

ABSI 2011

DR. P. RAGHU RAM

MS, FRCS (Eng), FRCS (Edin), FRCS (Glasg), FRCS (Irel)

Director
KIMS-USHALAKSHMI Centre for Breast Diseases

Consultant Oncoplastic Breast Surgeon
Krishna Institute of Medical Sciences

Chief Executive Officer
USHALAKSHMI BREAST CANCER FOUNDATION

KIMS
The Future of Health

6 September 2016

Subject: Utility of iBreastExam Device

To Whom It May Concern

It is my pleasure to extend this letter of support for the clinical utility and usability of iBreast Exam device in the Indian context to enable early detection of breast cancer.

Breast cancer cases have doubled in the last twenty years in India (as well as in other emerging economies) and the trend continues to grow. It is now the leading cause of cancer related deaths in Indian women; most cases still present at late stages, diminishing the effectiveness of treatment and the chances of survival. Early detection of breast cancer is critical for better health outcomes.

The iBreastExam innovation, developed by Mihir Shah and his team at UE LifeSciences, is a hand-held device & has a potential to be used by community health workers to perform standardized breast examinations to identify early stage unsuspecting breast lesions. In clinical studies (performed in India), which included about 2000 patients, iBreastExam has demonstrated high clinical efficacy for breast lesion detection.

iBreastExam can complement Clinical Breast Examination (CBE) performed by Health Care Workers and can be tested on a larger scale to assess its efficacy. After having reviewed the literature and having used the device personally, I am satisfied with this innovation and support its use to assess its efficacy to compliment to CBE in India for large scale community based breast cancer screening programmes

Sincerely,

Dr. P. Raghu Ram

1-8-31/1, Minister Road, Secunderabad - 500 003. Andhra Pradesh, INDIA. **Off :** +91-(O)40 - 4488 5190, 4488 5191
E-mail : p.raghuram@hotmail.com **Website :** www.breastcancerindia.org

NICPR
NATIONAL INSTITUTE OF CANCER PREVENTION AND RESEARCH

NATIONAL INSTITUTE OF CANCER PREVENTION & RESEARCH
राष्ट्रीय कैंसर रोकथाम एंव अनुसंधान संस्थान
(INDIAN COUNCIL OF MEDICAL RESEARCH)
भारतीय आयुर्विज्ञान अनुसंधान परिशद
Department of Health Research
स्वास्थ्य अनुसंधान विभाग
Ministry of Health & Family Welfare, Govt. of India
स्वास्थ्य एंव परिवार कल्याण मंत्रालय, भारत सरकार

Prof. Ravi Mehrotra
MD, D.Phil. FRCPath, FAMS
Director, National Institute of Cancer Prevention & Research
&
WHO FCTC Smokeless Tobacco Global Knowledge Hub

August 4th, 2016

To,
Mihir Shah,
Founder & CEO
UE LifeSciences Inc.

Subject: NICPR support for implementation monitoring and evaluation of breast cancer diagnostic devices.

Dear Mr. Shah,

Considering the current scenario of breast, cervical and oral cancer in India, National Institute of Cancer Prevention and Research (ICMR) is interested in supporting innovations led initiatives that are bringing access to early detection of these cancers to the people of India. NICPR under ICMR is working with a mandate to "Undertake research for the development of preventive and therapeutic approaches for prevention/diagnosis of cancer in community settings" and "Community intervention studies for major cancers through health system research with emphasis on primary and secondary prevention".

It is my understanding that UE LifeSciences is looking to undertake various projects in public healthcare settings with the support of governmental and non-governmental agencies to implement an innovative breast cancer early detection device in several regions of India. In my view, such devices uniquely enables community health workers to provide standardized breast examinations to identify unsuspecting breast lesions at an early stage. The clinical protocol for using such a cancer device should be in line with the Lancet Review paper "Recommendations for screening and early detection of common cancers in India" authored by global thought leaders in cancer control including our team.

NICPR is supportive of implementation programs that bring this breast health examination device to underserved populations. NICPR is interested in providing support for implementation monitoring and evaluation of such programs. Our support will ensure that outcomes are documented, evaluated and reported to assist and advice future strategies to expand the use of such devices as well as in framing guidelines for secondary prevention of breast cancer at a national scale.

Sincerely,

Prof. Ravi Mehrotra
Director, NICPR

Plot No.1-7, Sector-39, Noida-201301 (UP) India
Tel.: PABX:(0120) - 2446900, Fax:(0120) - 2579473, Clinic:(0120) - 2446938
E-Mail:directoricpo@icmr.org.in, rmehrotra@icmr.org.in, directornicpr@icmr.org.in
Website: www.nicpr.res.in

ManipalHospitals
LIFE'S ON

Dr. Somashekhar S. P
MS, M.Ch (Oncosurgery), FRCS (Edinburgh)
Chairman - Surgical Oncology, MHEPL
HOD & Consultant Surgical Oncologist & Robotic Surgeon
Manipal Comprehensive Cancer Center
Adjunct Professor of Surgical Oncology (Manipal University)

Date: August 16th, 2016

Subject: Support Letter for the Use of iBreastExam in India

To Whom It May Concern:

I hereby provide this support letter for the use of iBreastExam device in India to aid in the early detection of breast cancer in women.

India now loses more women to breast cancer than anywhere else (70,000+ reported in 2012); a significantly large portion of these women are under 50 years of age. The vast majority of women get detected with breast cancer at late stages and poor prognosis. Based on the current trend and rising incidence, India will lose an estimated 800,000 lives in less than 10 years. Honorable PM Shri Narendra Modiji's recent request to expeditiously develop a comprehensive cancer screening program for breast, cervical and oral cancer, is a testament to the alarming concern over the increasing burden of cancer in India.

In the capacity of Principal Investigator, I have evaluated iBreastExam under an IRB approved clinical study of approximately 1,000 women. The point-of-care Breast Imaging device (iBreastExam) performed with significantly better sensitivity than CBE to detect breast lesions (19 % improvement), while reporting high specificity (94 %) and NPV (98 %). In younger women, under the age of 40 years, where the prevalence of dense breast is high, iBreastExam demonstrated high-performance characteristics. iBreastExam detected all malignant lesions in this study, while the clinician's CBE missed detecting a non-palpable malignant lesion. iBreastExam can be a promising tool to provide clinically effective and standardized breast examinations in low-resource settings to detect breast lesions at early stages. The device can also be an effective screening tool for younger women with dense breasts. Findings of this study are published in a peer reviewed paper titled "Noninvasive and Low-Cost Technique for Early Detection of Clinically Relevant Breast Lesions Using a Handheld Point-of-Care Medical Device (iBreastExam): Prospective Three-Arm Triple-Blinded Comparative Study" in the Indian Journal of Gynecologic Oncology in June 2016.

I fully support the implementation of iBreastExam device in India in public health programs that can bring better breast health to women both in urban and rural areas and I wish the very best to UE LifeSciences in their endeavors. If required, I am happy to discuss iBreastExam in further detail.

Sincerely,

Somashekhar S.P

Dr. Somashekhar SP

Dr. Somashekhar S.P.
M.S., M.Ch (Oncosurgery), FRCS (Edinburgh)
Chairman, Manipal Comprehensive Cancer Center
Manipal Health Enterprises
HOD, Department of Surgical Oncology
Adjunct Professor of Surgical Oncology (KMC)
Consultant Surgical Oncologist & Robotic Surgeon
KMC No. 40538

MANIPAL HOSPITAL * BANGALORE * 017

12 YEARS

Manipal Hospital HAL Airport Road
#98, HAL Airport Road, Bengaluru 560017 P +91 80 4011 9000. +91 80 2502 3344/4444 www.manipalhospitals.com

MARS Manipal Ambulance Response Service
Complete Medical Emergency Solutions
For any medical emergency
2222 1111

Registered Office
Manipal Health Enterprises Pvt Ltd
The Annexe, #98/2, Rustom Bagh Road, Off HAL Airport Road, Bengaluru 560 017 P +91 80 4936 03000 www.manipalhospitals.com
CIN: U85110KA2010PTC052540