The Professional Medical Journal
www.theprofesional.com

**DOI:** 10.17957/TPMJ/17.3182

ORIGINAL PROF-3182

# BREAST CANCER SCREENING;
## MAMMOGRAPHY VERSUS DYNAMIC MRI BREAST

**Dr. Hassan Bukhari[1], Dr. Asim Shaukat[2], Dr. Nosheen Ahmad[3]**

1. Senior Registrar
   Department of Radiology
   Allied Hospital, Faisalabad.
2. Professor
   Department of Radiology
   Allied Hospital, Faisalabad.
3. Senior Registrar
   Department of Radiology
   Allied Hospital, Faisalabad.

**Correspondence Address:**
Dr. Hassan Bukhari
Department of Radiology
Allied Hospital, Faisalabad.
drhassanbukhari@hotmail.com

**Article received on:**
13/01/2016
**Accepted for publication:**
21/10/2016
**Received after proof reading:**
18/01/2017

**ABSTRACT… Objectives:** To compare the efficacy of Magnetic resonance imaging and Mammography for Breast-Cancer Screening in high risk Women with a Familial or Genetic Predisposition. **Study Design:** Cross-sectional study. **Setting:** Department of Radiology Allied Hospital, Faisalabad. **Duration:** From January 2012 to December 2014, **Sample size:** 299. **Methods:** A total of 299 females at high risk of breast cancer were included in this study and they underwent screening rounds of Mammogram and contrast enhanced dynamic breast MRI once a year with independent readings. Both the imaging modalities were interpreted by experience radiologist and all the images were categorized using Breast Imaging Reporting and Data System. In each patient, histopathology results were considered the standard criteria for the calculation of the sensitivity, specificity for both Mammogram and Breast MRI lesions. **Results:** Mean age of the patients was 46.69±11.86 years. Mammography revealed 11 (3.68%) true positive breast lesions, 22 (7.36%) false positive lesion, 247 (82.61%) true negative and 19 (6.35%) false negative lesions yielding the sensitivity of 36.67% and diagnostic accuracy of 86.3%. Dynamic breast MRI revealed 28 (9.36%) true positive breast lesions with 5 (1.67%) false positive, 264 (88.29%) true negative and 2 (0.67%) false negative lesions yielding sensitivity of 93.3%,specificity of 98.14%,PPV=84.85%,NPV=99.25% and diagnostic accuracy of 97.66%. MRI breast was significantly more sensitive (93.3 vs. 36.67%) and accurate (97.66 vs. 86.3%) than mammography. **Conclusion:** MRI is more sensitive than mammography in detecting tumors in women with an inherited susceptibility to breast cancer.

**Key words:** Dynamic Breast MRI, Mammography, Breast cancer

**Article Citation:** Bukhari H, Shaukat A, Ahmad N. Breast cancer screening; mammography versus dynamic MRI breast. Professional Med J 2017;24(1):42-46.
**DOI:** 10.17957/TPMJ/17.3182

## INTRODUCTION

Pakistan has the uppermost prevalence of breast tissue mitotic disease in Asia bestowing to the RMC, Rawalpindi Medical College Principal. Among the various cancers in Pakistan the breast cancer sits on the top of the list as it attacks approximately 40,000 women annually and one in every eighth women in Pakistan becomes its victim during her life span.

Mitotic breast diseases are speedily increasing at an alarming rate and are affecting all age groups, such that even younger age groups are not spared by it. It is claimed that female population of under-developed countries like Pakistan have progressively increasing mortality rates as compared to the developed countries owing to the fact that the disease process is diagnosed at its terminal stage than at the early stage which are properly manageable.

According to a meta-analysis conducted in 2009, 5400 deaths were claimed amongst 22,700 diagnosed cases of malignant breast diseases in Canadian population.[1] Even though the number of breast cancers encountered in families with inherited mutations is expressively high however genetic tendency is relatively low among women with breast cancer.[2] Approximately half of breast cancers in high-risk families can be accredited to BRCA1 and BRCA2 gene mutations. Autosomal-dominant style with partial penetrance is the hallmark of both genes.[3]

Clinical breast examination (CBE), ultrasonography, mammography and MRI are the

modalities used for screening of breast cancer. Randomized trials show a reduction of upto 25% in death rates by timely mammographic screening of elderly population aged between 50 to 70 years.[4]

Among the newest, emerging and advancing methods of breast imaging Magnetic resonance imaging (MRI) has superceded all other modalities. It is not essentially influenced by breast density exhibiting and shows flexible specificity and sensitivity.[5] Among female population showing increase genetic or familial tendency to breast cancer, MR Imaging increase the compassion of screening which results in reduced incidence of breast cancer by early diagnosis of malignant breast lesions and their prophylactic mastectomy for enhancing patient survival.[6]

Our studies aim is to establish the efficacy of MRI versus Mammography whichever is best for sensitive screening for breast carcinoma in Pakistan amongst patients who already have genetic and familial predisposition, which will help in early detetion of breast cancer when it is at its possibly curable stage. Decrease in disease process and death rates can be embarked upon by early detection and treatment and it is possible only by considering the use of more sensitive imaging modality.

## MATERIALS AND METHODS

Between January 2012 and December 2014, we targeted the female population who were denial of the genetic testing inspite of having the strong family history and culprit genes or one of the many other familial risk factors, including early detection before 40 years of age with one or more affected first degree relatives with breast mitotic disease, and other factors like nulliparity, menarche and menopause age ,history of previous chest, mediastinal, axillary radiation exposure for any other chest pathology, hormone replacement therapy**.** According to gail model a five-year risk of 1.67 percent or higher are categorized “high-risk.”

The exclusion criteria consisted of females who were symptomatic of malignancy, patients who underwent mastectomy as prophylasis, if they were pregnant or lactating in past 6 months, or if they denied follow up, if they had contrast allergy or any other contraindications to MRI.

Contrast enhanced MRI and 1-3 yearly screening was done of all the study participants. At each screening round, each imaging study was interpreted by a different radiologist who were unaware of the results obtained from other imaging modalities. The results of mammography and MRI were categorized and scored in a standardized way, according to the Breast Imaging Reporting and Data System (BI-RADS) classification.

For mammography, Two standard views CC & MLO views were performed. Additional views like Spot compression, magnification, and others were obtained according to need.

Dynamic bilateral breast MRI was performed on a 1.5-Tesla whole body Philips MRI scanner with a four-channel dedicated surface coil. Bilateral axial acquisitions were obtained. Acquisition protocol consisted of a T2-weighted sequence (TR 4850/ TE 103.1 ms) and a three-dimensional gradient-echo T1-weighted dynamic sequence (TR 10/ TE 4.2 ms) before and after bolus injection of gadolenium 0.1 mmol/kg, with four repetitions after contrast. Parenchymal morphological distortion and enhancement pattern of the abnormal areas were both used for assessment by experienced consultant radiologist.

After the final surveillance round and considering the results of all imaging modalities that signals only benign findings falling in category of (BIRADS 1 and 2), cases were labelled as negative. In case of a probably benign finding (BIRADS category 3) or category 0 (“need additional imaging evaluation”), further investigation by ultrasonography with or without fine-needle aspiration was done, or mammography or MRI was repeated. The lesion was re-categorized according to the findings interpreted on imaging and the short-term follow-up of 3 months considered. Whenever a modality revealed a suspicious finding (BIRADS category

4 or 5), a cytologic or histologic evaluation of a biopsy specimen was performed. Histopathology was considered to be the gold standard for the diagnosis of malignant tumors.

After the diagnosis of clinically significant disease process the appropriate treatment was given to the patient according to standard clinical guidelines. Furthermore excision was recommended for any mitotic or atypical result.

Data was analyzed on SPSS version 17.Sensitivity and specificity estimates were calculated for both screening tests. The gold standard used for these calculations was pathology-proven cancer.

## RESULTS

Total 299 female Patients were included in our study.

Frequency of true positive, false positive, true negative, false negative patients with mammography and MRI pathology. Table I, II

Comparison of sensitivity, specificity, PPV, NPV and accuracy in detecting breast lesions by mammography and MRI showed that the sensitivity was significantly greater with MRI than with mammogram. Table-III

| Frequency Percentage (%) | | |
|---|---|---|
| True positive | 11 | 3.68 |
| False positive | 22 | 7.36 |
| True negative | 247 | 82.61 |
| False negative | 19 | 6.35 |
| Total | 299 | 100 |

**Table-I. Mammography-pathology correlation**

| Frequency Percentage (%) | | |
|---|---|---|
| True positive | 28 | 9.36 |
| False positive | 5 | 1.67 |
| True negative | 264 | 88.29 |
| False negative | 2 | 0.67 |
| Total | 299 | 100 |

**Table-II. MRI-pathology correlation**

| Mammography MRI | | |
|---|---|---|
| Sensitivity (%) | 36.67 | 93.3 |
| Specificity (%) | 91.82 | 98.14 |
| PPV (%) | 33.33 | 84.85 |
| NPV (%) | 92.86 | 99.25 |
| Diagnostic accuracy (%) | 86.3 | 97.66 |

**Table-III. Comparison of sensitivity, specificity, accuracy in detecting breast lesion among Mamogram and MRI**

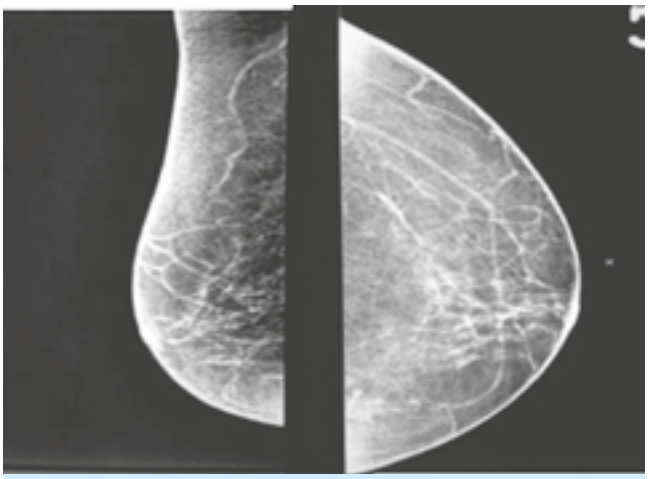

**Figure-1 (A). Mammogram of right breast with both MLO & CC views showing no obvious mass lesion and no region of other abnormality**

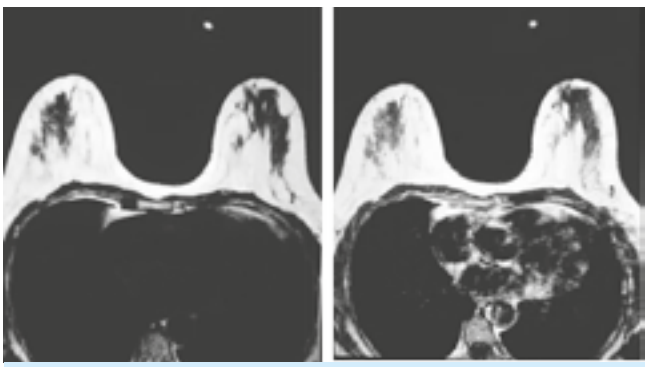

**Figure-1 (B). MRI images of the same patient with T1w & T1w post contrast images showing a well-defined small enhancing lesion along lateral aspect of right breast**

## DISCUSSION

The newest and most probable consistent standard for breast cancer screening rests with the Mammography. The Diagnostic precision of mammography is moderately high in general

public with sensitivity of 83%-95% and specificity of 94%-99% as reported by the meta–analysis of mammography screening.[7]

Though the mammography sensitivity is moderately low and fall in the range of 33%-56% in women having high risk of breast cancer owing to BRCA gene mutation.[8] This is thought to be associated with multiple factors like the younger age at screening, abnormal increase or decrese density of breast and numerous other imaging and pathologic characteristics of breast cancers in this population. Current studies show that breast magnetic resonance imaging (MRI) is the newest and emerging imaging modality with extreme sensitivity and can perceive breast cancers not grasped on mammography, mainly among females with increased risk and among those with moderately younger age groups.[9]

Annual screening using breast MRI as an evolving tool is now the recommendation of choice so as to decrese the lifelong increase risk of breast cancer in order to uplift their quality of life by early detection and appropriate treatment and management of breast lesions.[10] It was decided that the annual mammography, supplemented by breast MRI should be done in feasible circumstances as was decided by the (NHCTF) National Hereditary Cancer Task Force, considered as the current recommendations and it was published in Canada 2007.[11]

MRI excels than mammography in screening of breast cancer, (71% versus 40%), as reported by Kriege et al.[9] and specificity is somewhat lower than mammogram (90% versus 95%). The results of Kuhl et al.[12], Leach, et al.[13], Hagen et al.[14], Warner et al.[15] results also exposed that MRI superceeds the mammography regarding sensitivity.

In this study, sensitivity of 93.3% of MRI and 36.67% of mammogram were appreciated in breast lesion diagnosis. Our results are comparable with Kuhl et al.[12]

There are some drawbacks associated with the screening breast MRI as It proves aggressive when compared to mammography since before the procedure, a contrast agent is administered through intravenous course which is not suitable especially for patients with compromised renal functions. Furthermore, all centers don't have radiologists particularly who are trained and skilled enough to interpret MRI images. In addition, breast MRI is also costly than mammography (and is not always covered by insurance)

## CONCLUSION

MRI screening is a novel evolving technology and effective tool that is not only used for early breast cancer detection and diagnosis but also facilitate the development of risk-assessment centers in Pakistan to evaluate women at increased risk of breast cancer and to counsel them about optimal surveillance protocols.



## REFRENCES

1. Canadian Cancer Society 2009. [Available at: www.**cancer.ca/canadawide/about%20cancer/cancer%20statistics/stats%20at%20a%20glance/breast%20cancer.**aspx?sc_lang=en; cited June 9, 2009].

2. Marcus JN, Watson P, Page DL, et al. **BRCA2 hereditary breast carcinoma patho-phenotype.** Breast Cancer Res Treat. 1997; 44:275–7.

3. Ford D, Easton DF, Stratton M, et al. **Genetic heterogeneity and penetrance analysis of the BRCA1 andBRCA2 genes in breast cancer families.** The Breast Cancer Linkage Consortium. Am J Hum Genet.1998; 62:676–89.

4. Nystrom L, Andersson I, Bjurstam N, Frisell J, Nordenskjold B, Rutqvist LE. **Long-term effects of mammography screening: updated overview of the Swedish randomized trials.** Lancet 2002; 359:909-919[Erratum, Lancet 2002; 360:724.].

5. Boetes C, Stoutjesdijk M. **MR imaging in screening women at increased risk for breast cancer.** Magn Reson Imaging Clin N Am 2001; 9:357-372.

6. Meijers-Heijboer H, van Geel B, van Putten WLJ, et al. **Breast cancer after prophylactic bilateral mastectomy in women with a BRCA1 or BRCA2 mutation.** N Engl J Med2001; 345:159-164.

7. Mushlin AI, Kouides RW, Shapiro DE. **Estimating the accuracy of screening mammography: a**

**meta-analysis.** American Journal of Preventive Medicine. 1998; 14:143–153.

8. Komenaka IK, Ditkoff B, Joseph K, et al. **The development of interval breast malignancies in patients with BRCA mutations.** Cancer. 2004; 100:2079–2083.

9. Kriege M, Brekelmans CTM, Boetes C, et al. **For the Magnetic Resonance Imaging Screening Study Group. Efficacy of MRI and mammography for breast-cancer screening in women with a familial or genetic predisposition.** N Engl J Med. 351(5):427-37, 2004.

10. Saslow D, Boetes C, Burke W, et al. **On behalf of the American Cancer Society Breast Cancer Advisory Group American Cancer Society guidelines for breast screening with MRI as an adjunct to mammography.** CA Cancer J Clin. 2007; 57:75–89.

11. Horsman D, Wilson BJ, Avard D, et al. **On behalf of the National Hereditary Cancer Task Force Clinical management recommendations for surveillance and risk-reduction strategies for hereditary breast and ovarian cancer among individuals carrying a deleterious BRCA1 or BRCA2 mutation.** J Obstet Gynaecol Can.2007; 29:45–60.

12. Kuhl CK, Schrading S, Leutner CC, et al. **Mammography, breast ultrasound, and magnetic resonance imaging for surveillance of women at high familial risk for breast cancer.** J Clin Oncol. 23(33):8469-76, 2005.

13. Leach MO, Boggis CR, Dixon AK, et al. for the MARIBS Study Group. **Screening with magnetic resonance imaging and mammography of a UK population at high familial risk of breast cancer: a prospective multicentre cohort study (MARIBS).** Lancet. 365(9473):1769-78, 2005.

14. Hagen AI, Kvistad KA, Maehle L, et al. **Sensitivity of MRI versus conventional screening in the diagnosis of BRCA-associated breast cancer in a national prospective series.** Breast. 16(4):367-74, 2007.

15. Warner E, Plewes DB, Hill KA, et al. **Surveillance of BRCA1 and BRCA2 mutation carriers with magnetic resonance imaging, ultrasound, mammography, and clinical breast examination.** JAMA. 292(11):1317-25, 2004.

## CORRECTION

The amendment of the Professional Vol: 23, No.10 (Prof-3489) titled: “Pregnancy induced hypertension; To compare efficacy of methyldopa and labetalol in management” on page 1187 is as under;

**INCORRECT**

AUTHOR’S NAME:
Dr. Nadia Sharif[1], Dr. Irum Usman[2], Dr. Tasneem Azhar[3]

**CORRECT**

Dr. Nadia Sharif[1], Dr. Iram Aslam[2], Dr. Tasneem Azhar[3]

## AUTHORSHIP AND CONTRIBUTION DECLARATION

| Sr. # | Author-s Full Name | Contribution to the paper | Author=s Signature |
|---|---|---|---|
| 1 | Dr. Hassan Bukhari | 1st Author | |
| 2 | Dr. Asim Shaukat | 2nd Author | |
| 3 | Dr. Nosheen Ahmad | 3rd Author | |