ORIGINAL ARTICLE

Role of bone scan for investigation of breast cancer and its applicability in future management.

Jagdeesh[1], Abdul Sami Mirani[2], Suresh Kumar[3], Bushra Shaikh[4], Parkash Lal[5], Azhar Ali Shah[6]

ABSTRACT… Objective: To find out the usefulness of bone scan in all stages of breast cancer. **Study Design:** Prospective Observation Study. **Setting:** Surgical Unit I & III Ghulam Muhammad Mahar Medical College Hospital, Sukkur. **Period:** October 2020 till September 2022. **Methods:** A total of 300 patients were selected who were newly diagnosed with breast cancer (Biopsy Proven). Data was collected for all these patients which included age, risk factors for breast cancer, findings on local examination, histopathology findings, stage of the cancer and result of the bone scan. **Results:** In our study, 78% patients were in 4th and 5th decade of life with mean age of 53.46±7.66 years. 'Age above 40' was the commonest risk factor for breast cancer followed by positive family history for breast cancer. Tumor size ranged from 2 to 13.2 cm with mean size of 6.06±1.92 cm. In our study, most common type of carcinoma was invasive ductal carcinoma (71.3%) followed by invasive lobar carcinoma (50%). Only 32 (10.67%) out of 300 patients had positive bone scan. Majority of the bone scan positive cases belonged to the Stage IIIB, IIIC and IV. **Conclusion:** It is concluded in our study that routine use of bone scan in cases of stage 1 and 2 breast cancer is not recommended; only stage 3A or advances cases should undergo bone scan.

Key words: Breast Cancer, Breast Carcinoma, Bone Scan, CA Breast, Metastasis.

INTRODUCTION

Cancer is characterised by disorganized division, growth and spread of abnormal cells.[1] According to World Health Organization it is one of the leading cause of death all over the world.[2] Breast cancer is one commonest cancers and is the 5th leading cause of cancer deaths worldwide.[3] Breast cancer is one of the commonest malignancies affecting women in Pakistan. According to Pakistan National Statistics, it constituted 38.8% of all cancers affecting female reported during the period from 2015 till 2019.[4] Risk factors for breast cancer include advanced age, smoking, obesity, late first full term pregnancy, use of hormonal therapy for menopause, family history of breast cancer, physical inactivity and short breastfeeding period.[5-6]

Signs and symptoms of breast cancer include new growth in the breast of the armpit, swelling of the breast, dimpling of the breast skin, flaky or redness of the breast skin and nipple depression or pain in the nipple.[7] Breast cancer is one of the deadliest cancers and its aggressiveness is associated with early metastasis, high chances of relapse and mortality. The aggressive nature of CA breast can vary widely and is dependent on gene expression, glucose metabolism and hormone receptors. It aggressive nature warrants a timely diagnosis and management to reduce the morbidity and mortality.

There are various diagnostic modalities used for the diagnosis of breast cancer. The screening tool that is considered gold standard is mammogram. Other include tissue biopsy either thought fine needle, open or excision. Magnetic resonance imaging and biomarkers like plasminogen activator inhibitor-1 (PAI-1) and tissue plasminogen activator antigen (t-PA) are of some value.[8] Bone scan can also be utilized to detect the metastasis to the skeleton. This

1. MBBS, MS (General Surgery), Lecturer Anatomy, Ghulam Muhammad Mahar Medical College, Sukkur.
2. MBBS, FCPS, Assistant Professor Surgical Unit-I, Ghulam Muhammad Mahar Medical College, Sukkur.
3. MBBS, FCPS, Consultant Orthopedic Surgeon, Lyari General Hospital, Karachi.
4. MBBS, FCPS, Assistant Professor Surgical Unit-I, Ghulam Muhammad Mahar Medical College, Sukkur.
5. MBBS, FCPS, Consultant Surgeon Surgical Unit-I, Ghulam Muhammad Mahar Medical College, Sukkur.
6. MBBS, FCPS, Assistant Professor Surgical Unit-I, Ghulam Muhammad Mahar Medical College, Sukkur.

Correspondence Address:
Dr. Jagdeesh
Department of Anatomy
Ghulam Muhammad Mahar Medical College, Sukkur.
dr.aries@yahoo.com

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nuclear imaging technique uses small amount of technetium 99m and is the mainstay of diagnosis any metastasis to the bones.

Since bone is the most commonly affected tissue for distant metastasis of breast cancer, bone scan may help detect the early metastasis of the breast cancer.[9-10] Tough this modality is used only in advanced and selected cases of breast cancer, we designed this prospective study to find out the rationale of using this modality in all biopsy proven breast cancer cases. Results of this study will help us with more effective use of bone scan in the cases of breast cancer.

METHODS

We carried out this prospective study in Department of General Surgery, Ghulam Muhammad Mahar Medical College Sukkur in collaboration with Larkana Institute of Nuclear Medicine and Radiotherapy. Duration of this study was from October 2020 till September 2022. Institutional Ethical Review Board's approval (GMMMC/Suk/Est: Branch/213) was sought before beginning this study. Detailed history and local examination was done in all cases of lump breast reporting in Outdoor Department. Work up was done in cases of suspected cases. Diagnosis of breast cancer was made on the basis of Fine needle aspiration biopsy and/or Tru-cut biopsy. A total of 300 patients were selected who were newly diagnosed with breast cancer (Biopsy Proven). Patients with relapse of the disease, history of radiotherapy and chemotherapy or patients unwilling to participate in the study were excluded. Patients underwent the baseline investigations and the investigations required for diagnosis and staging of the disease which included mammography, biopsy for histopathology, CT scan chest and ultrasound abdomen. We used the TNM system for staging the cancer as show in the Table-I below.[11]

We collected the data of these patients which included age, risk factors of the disease (Age > 40 years family history of breast cancer, use of contraceptives, early menarche, nulliparity), findings on the local examination (consistency, size, skin tethering, Peu'd orange, nipple retraction/defacement, and chest wall fixation), stage of the cancer and result of the bone scan. Collected data was computed with the help of SPSS 26. We presented the quantitative variables like age and size of the breast lump as mean and standard deviation. We presented the qualitative variables like age above 40 years, family history of breast cancer, early menarche, use of contraceptives, nulliparity, stage of the breast cancer and result of the bone scan as frequency and percentage.

RESULTS

In our study, we observed a wide range of age which was from 36 to 74 years. Mean age of the patients was 53.46±7.66 years. Details of age distribution are shown in Table-II below.

In our study, we found 'age above 40' the commonest risk factor for breast cancer followed by positive family history for breast cancer. Details are shown in Table-III below.

In our study, the tumor size ranged from 2 to 13.2 cm with mean size of 6.06±1.92 cm. On examination irregularity in size and shape was observed in 187 (62.67%) patients. Regarding the consistency on examination, 217 (72.33%) patients had hard, 83 (27.67%) had firm consistency. Skin tethering was observed in 213

Tumor Size		Nodes		Metastasis	
T0	No primary tumor	**N0**	No lymph nodes involved	**M0**	No Metastasis
Tis	In Situ	**N1**	1-3 axillary lymph nodes involved	**M1**	Metastasis found
T1	Tumor size ≤ 2 cm	**N2**	4-9 axillary lymph nodes involved		
T2	Size >2 - ≤5 cm	**N3**	≥ 10 axillary or involvement of infra or supraclavicular lymph nodes		
T3	> 5 cm				
T4	Tumor extending to skin/ chest wall irrespective of its size				
Table-I. TNM staging for breast cancer					

(71%) patients. Pleu'd orange was seen in 137 (45.67%) patients. Nipple retraction/defacement was seen in 121 (40.33%). Chest wall fixation was seen in 71 cases (23.66%). Axillary lymph nodes were palpable in 188 patients (62.67%).

In our study, most common type of carcinoma was invasive ductal carcinoma (71.3%) followed by invasive lobar carcinoma (50%). Further details are shown in the Table-IV below.

Age Range (Years)	Frequency (%) (n=300)
31-40	19 (6.33)
41-50	90 (30)
51-60	144 (48)
61-70	42 (14)
71-80	5 (1.67)
Table-II. Age distribution	

Risk Factor	Frequency (%) (n=300)
Age > 40	281 (93.67)
Use of Contraceptives	84 (28)
Positive Family History	55 (18.33)
Nulliparity	37 (12.33)
Early Menarche	33 (11)
Table-III. Risk factors for breast cancer	

Cancer Type	Frequency (%) (n=300)
Invasive Ductal Carcinoma	214 (71.33)
Invasive lobar Carcinoma	50 (16.67)
Medullary Carcinoma	17 (5.67)
Mucinous Carcinoma	9 (3)
Tubular Carcinoma	6 (2)
Papillary Carcinoma	3 (1)
Phyllodes Tumor	1 (0.33)
Table-IV. Frequency of cancer type on the basis of histopathology	

In our study we performed the bone scan in all 300 hundred patients. Only 32 (10.67%) out of 300 patients had positive bone scan. Majority of the bone scan positive cases belonged to the Stage IIIB, IIIC and IV. Further details are shown in Table-V below.

DISCUSSION

As the breast carcinoma is one of the most frequent malignancies in females and one of the leading cause of deaths caused by cancer. This warrants a prompt diagnosis and treatment to reduce its morbidity and mortality.[12-13] Since the bone is the commonest site for metastases in breast cancer, we used bone scan in all diagnosed cases of breast cancer to detect the early metastasis and treat the patient according to reduce the morbidity and mortality of the disease.[14-15]

In our study, 78% patients affected by this disease were in 4th and 5th decade of life with mean age of 53.46±7.66 years. In a Korean study done by Kang SY et al. observed that the age group of 40-49 was most commonly affected [16]. In a Pakistani study conducted at PIMS, Islamabad by Majeed AI et al. the median age of the patients with breast cancer was 46 years with majority of the patients between 36 to 45 years.[17]

In our study, we observed that the "Age above 40" was the commonest risk factor. More than 93% of our patients were above 40. Use of contraceptive (28%) and positive family history for breast cancer (18.33%) were 2nd and 3rd common risk factors. Łukasiewicz S et al. observed in their study that 80% of the patients affected by breast carcinoma are above 50 years.

Cancer Stage		Frequency (%) (n=300)	
		Negative	**Positive**
Stage 1	T1,N0,M0	54 (18)	0 (0)
Stage 2A	T0,N1,M0; T1,N1,M0; T2,N1,M0	58 (19.33)	0 (0)
Stage 2B	T2,N1,N0; T3,N0,M0	39 (13)	1 (0.33)
Stage 3A	T0,N2,M0; T1,N2,M0; T3,N1,M0; T3,N2,M0	44 (14.66)	4 (1.33)
Stage 3B	T4,N0,M0; T4,N1,M0; T4,N2,M0	25 (8.33)	6 (2)
Stage 3C	Any T,N3,M0	22 (7.33)	8 (2.67)
Stage 4	Any T, any N, M	26 (8.67)	13 (4.33)
Total		268 (89.33)	32 (10.67)
Table-V. Positive bone scan seen in different breast cancers			

Unlike our study the second most common risk factor in their patients was positive family history.[18]

We observed in our study that invasive ductal carcinoma (71.33%) was the commonest type of breast cancer in our patients followed by invasive lobar Carcinoma (16.67%) and Medullary Carcinoma (5.67%). Siddiqui MS et al. did histopathology analysis of 3279 breast specimen during the period from 1993 till 1996 at Agha Khan Hospital Karachi. They found out that infiltrating ductal carcinoma was the most common breast cancer, but the percentage of this cancer was only 37% as compared to 71.33% in our results.[19]

In our study, only 10.67% patients had positive finding on bone scan and almost 97% of these patients had stage IIIA or advanced breast cancer. In a similar study conducted in Pakistan.[20] observed that around 12% patients had positive skeletal involvement detected on bone scan and like our results most of these cases had advanced stage breast cancer. We can easily deduce with our results that doing a bone scan in stage 1, 2A and 2B will be waste of resources in a poor country like Pakistan and results will not have any positive impact on patients' course of treatment.

CONCLUSION
It is concluded in our study that routine use of bone scan in cases of stage 1 and 2 breast cancer is not recommended; only stage 3A or advances cases should undergo bone scan.

CONFLICT OF INTEREST
The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Jagdeesh	Concept, design, analysis, interpretation of data, drafting.	
2	Abdul Sami Mirani	Concept, design, data collection, analysis, drafting.	
3	Suresh Kumar	Design, analysis, interpretation of data, drafting.	
4	Bushra Shaikh	Data collection, interpretation analysis of data.	
5	Parkash Lal	Data collection, Analysis, interpretation of data, drafting.	
6	Azhar Ali Shah	Analysis and interpretation of data.	