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Research Article

CORRELATION OF CA 15.3 LEVELS WITH METASTASIS IN BREAST CANCER

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ABSTRACT

Objectives: The objective is to measure the serum levels of Cancer Antigen CA 15.3 in breast cancer patients with metastasis and without metastasis and compare the mean values between them. The study investigated the correlation between CA 15.3 levels and metastasis in breast cancer.

Methods: The study was conducted with 45 female patients in a tertiary care center in India, and metastatic evaluation was done using positron emission tomography–computed tomography.

Results: The results indicated that CA 15.3 levels were significantly higher in the metastatic group compared to the non-metastatic group.

Conclusion: CA 15.3 has the potential as a diagnostic tool for early detection of metastases in breast cancer patients.

Keywords: Breast cancer, Tumor markers, Cancer antigen CA 15.3, Metastasis, Cancer Diagnosis.

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INTRODUCTION

Breast carcinoma poses a significant global health challenge, with 900,000 new cases and 376,000 deaths annually worldwide. This cancer accounts for 26.8% of all cancers in women [1,2]. While previously more common in women above 50 years, the increased awareness and use of screening mammography has led to a paradoxical increase in diagnoses. However, early detection and multimodality treatment have also led to reduced mortality. In India, there is a need for cost-effective early diagnosis, appropriate therapy, and follow-up care for breast cancer patients [2]. 5-year survival in metastatic cancer antigen (CA) breast is <30% and early detection of possible metastasis may help target the disease early and provide significant lead time.

Mucins are large glycoproteins with high carbohydrate content which are normally expressed at the apical surface of polarized epithelial cells of normal mammary glands. In malignancy, the transformation and disruption of polarity leads to their release into the bloodstream of patients. CA 15-3, is a soluble form of the transmembrane protein Mucin-1 (MUC-1) with a molecular weight of 290 kilodalton (kDa) that is shed from the tumor cells into the bloodstream. It is overexpressed in more than 90% of breast carcinomas and is used in the diagnosis, treatment, and clinical management of the disease. It is a useful marker in evaluating the recurrence of the disease as well as response to the treatment. CA 15-3 is particularly valuable for treatment monitoring in patients who have disease that cannot be evaluated using existing radiological procedures [2]. CA 15.3 also shows promise as a biomarker in predicting prognosis in breast cancer patients. Several studies have explored the use of CA 15.3 as a prognostic biomarker in breast carcinoma, but have been limited by the sample size and their retrospective study design [3,4].

METHODS

We conducted a prospective observational study in a tertiary care center in southern India. Female patients presenting to our clinic with biopsy-confirmed breast mass over 1 year duration were counseled about the study. After ethical committee clearance patient accrual was initiated. Consenting patients were included in the study population. Demographic data was recorded. Metastatic evaluation was performed using positron emission tomography–computed tomography reported by a single operator. The patients were divided into two groups based on their metastatic status and underwent venous sampling to assess CA 15.3 levels in a single laboratory using sandwich enzyme-linked immune sorbent assay.

Descriptive data were tabulated into Microsoft Excel. Statistical tests such as the Student's *t*-test and the Spearman's correlation coefficient were calculated using SPSS software version 20.

Table 1: Age-wise distribution of patients having non-metastatic and metastatic breast cancer

Age group (in completed years)	Frequency	Total percentage
18–30	1	2.2
30–40	11	24.4
40–50	10	22.2
50–60	10	22.2
60–70	11	24.4
>70	2	4.4
Total	45	100

Table 2: Correlation between nodal status and mean CA 15.3 level

Nodal status in M1	Mean CA 15.3
N1	87.6 (IU/ML)
N2	173.12 (IU/ML)
N3	136.29 (IU/ML)

Table 3: t-test

TNM stage	N	Mean	Standard deviation
CA 15.3			
M0	23	20.947391	7.0626078
M1	22	144.18454 5	76.3256517

Table 4: Independent samples test

Variances	Levene's test for equality of variances		t-test for equality of means		p value	Confidence Interval
	F	Sig.	t	df		
CA 15.3						
Equal variances assumed	29.87	<0.001	−7.71	43		
Equal variances not assumed			−7.54	21.344	<0.001	(−157.18, −89.29)

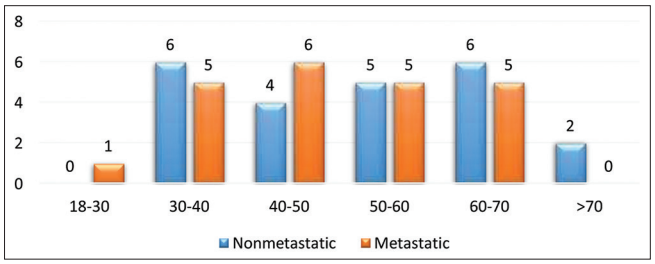

Fig. 1: Age-wise distribution of patients having nonmetastatic and metastatic breast cancer

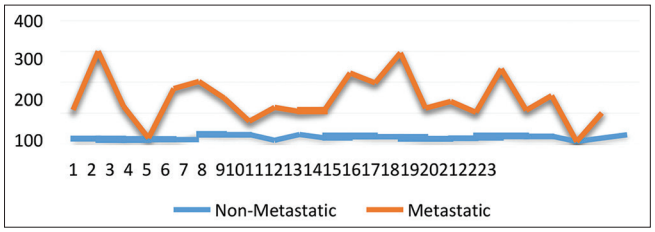

Fig. 2: Variation in the levels of CA 15.3 in non-metastatic and metastatic breast cancer

RESULTS

Forty-five patients, aged between 25 and 74 years were recruited for this study. The mean age of the study population was 50.2 with the oldest patient being 74 years old and the youngest being 25 years old (Table 1 and Fig. 1).

In the non-metastatic group, the highest level of CA 15.3 was 32.93 IU/ml and the lowest value was 7.54 IU/ml with a mean of 20.9 IU/ml. In the metastatic group, the highest level of CA 15.3 was 300 IU/ml and the lowest value was 6.78 IU/ml with a mean of 144.18 IU/ml (Fig. 2).

In the metastatic study group, 21 patients were node-positive (N1=4, N2=10, N3=7). There was no intra-group correlation of nodal status to degree of elevation of CA 15.3 was statistically insignificant (Table 2).

Using the Student's *t*-test (Table 3) to compare the serum CA 15.3 levels in non-metastatic and metastatic breast carcinoma patients, our hypothesis shows a significant p<0.001 (Table 4), implying that patients with metastatic carcinoma breast disease will have an elevated level of CA 15.3. Hence, CA 15.3 can be used as a tumor marker for metastatic carcinoma breast disease.

DISCUSSION

Metastasis is the most important determinant of prognosis in oncology. Evaluation directed at early detection of metastasis is the crucial to the improvement of survival. Radiological investigations have been the cornerstone in the detection of metastasis in breast cancer; however, they are limited by their scope. As a result, serum tumor markers have been the focal point of investigators for early detection of metastasis. CA 15.3, Carcinoembryonic antigen, and CA 27.29 have been at the forefront of research in breast cancer.

CA 15.3 has been studied for its role in diagnosis, treatment, and clinical management of breast carcinoma. Its usefulness as a marker in evaluating recurrence of the disease as well as response to the treatment has also been studied and is considered to be the most sensitive test in detecting metastatic breast cancer. The potential uses of CA 15-3 in clinical practice could lead to improved diagnosis and cost-effective tools for metastatic disease. Duffy *et al.* [2] studied the role of CA 15-3 in the postoperative surveillance of asymptomatic women following radical surgery and concluded that serial determination can provide median lead times of 5–6 months in the early detection of recurrent/ metastatic breast cancer [3].

The results of the present study are complementary to the research done in the past. CA 15.3 was elevated in 90.9% of patients in the metastatic group, with no patients showing elevation in the non-metastatic group. The difference was statistically significant and concurred with the findings of Moazzezy *et al.* and Gonssaud *et al.* [5,6]. The nodal status did not correlate with the level of elevation, and cut off for the presence of visceral metastasis requires further research.

The present study is limited by the single-center nature and sample size. Further, the absence of elevation of CA 15.3 in two patients with metastasis could not be found, pointing to the presence of other factors for elevation.

CONCLUSION

CA 15.3 is a biological marker for metastasis in breast cancer patients and may be useful as a diagnostic tool to aid early detection of metastases.

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AUTHORS CONTRIBUTION

Aswin Karthik Periasamy -Concept, Data Collection, Analysis. Karthikhaeyan TR, Ankit Kumar Sharma – Data Compilation, Analysis, Manuscript

CONFLICTS OF INTERESTS

Nil.

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