

THE EXPRESSION OF BASAL CYTOKERATINS IN BREAST CANCERS

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**Abstract-**

**Introduction:** Treatment for breast cancer is based on the expression of the immunomarkers such as ER, PR, and HER2/neu. Cases which are negative to all the three immunomarkers are called Triple Negative Breast Cancers (TNBC) and they have a poor prognosis. Recent studies have shown that some of the TNBCs express cytokeratins CK 5/6 (subcategorizing them as basal-like breast cancers) and these respond well to anthracycline-based chemotherapy.

**Aim and Objectives:** To study the expression of basal cytokeratins CK 5/6 in breast carcinomas reported in our center and to correlate with histological type, grade, size, clinical features and ER, PR and HER2/neu status.

**Methods:** Tissues of 44 cases of breast carcinoma diagnosed between June 2009 and May 2014 were retrieved. Immunohistochemical staining for CK 5/6 was done and it was correlated with parameters such as histopathological type, grade, size, invasion and ER, PR and HER2/neu status.

**Results:** Eight of the breast carcinomas (18%) were categorized as Triple Negative Breast Cancers (TNBC) as they were negative for ER, PR, and HER2/neu. Four of the TNBCs (50%), were positive for CK 5/6. The significant statistical correlation was observed between the size of a tumor and positive CK 5/6 expression. All CK 5/6 positive cases were of high grade.

**Conclusion:** The routine use of CK 5/6 is recommended in all cases of TNBCs, as 50% of them are positive for these markers. Patients in this subcategory could benefit from anthracycline-based chemotherapy.

**Keywords-** Triple Negative Breast Cancers, Cytokeratin 5/6, basal-like breast carcinoma

**Introduction**

Breast cancers are a diverse group of diseases that vary remarkably in terms of

clinical presentation, histology, behavior and genetic characteristics [1]. There has been a steady increase in the incidence of breast

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cancers worldwide and especially in the developing countries, mainly attributable to globalization causing adaptation of western lifestyle and improved access to diagnostic modalities. As per the International agency for research on cancer, the number of new cases of female breast cancers in India in the year 2012 was 144,937. [2] The mortality rate in the Indian cohort was 50% compared to that in the USA, where only one woman out 5-6 patients die of breast cancer.

Breast cancers that express Estrogen and Progesterone receptors can be treated by hormonal manipulation [3]. Targeted therapy towards HER2 neu has great success and Trastuzumab has been introduced as an adjuvant drug in those showing overexpression of Her 2 neu [4]. A subset of breast cancers has been found to show no expression of any of the above-mentioned markers. These have been labeled as Triple Negative Breast Cancers (TNBCs). Though hormonal manipulation is of no use in this subset, they have found to show expression of other markers such as basal Cytokeratins and EGFR. They have greater sensitivity to anthracycline-based chemotherapy despite poor pathologic complete response [5].

This study focuses on identifying the cases of breast cancer at our center, performing immunohistochemical studies of the basal Cytokeratin CK5/6 in them and studying their expression and correlation with various clinicopathological parameters.

#### Materials and Methods

Cases of breast carcinomas diagnosed between the years 2009 and 2014 were included in our study. The study was performed after getting approved by the Institutional Human Ethics Committee (IHEC). A few of the cases were rejected

owing to the absence of sufficient clinical information, ER/PR studies or if blocks were unavailable. The requisition form sent by the operating surgeon was used for deriving information such as age, size, nodal status, and other gross findings. Hematoxylin and eosin stained slides from representative sections of the breast tumors were used for grading and assessing the histological type of a tumor, evidence of lymphovascular invasion, perineural invasion and skin involvement. Immunohistochemical staining for Estrogen Receptor, Progesterone Receptor, Her2neu and CK5/6 was performed on these sections after antigen retrieval in pressure cooker followed by EDTA buffer at an alkaline pH (pH of 9).

The antibody reagent clones were Clone EP1 by DAKO, Clone PgR 636 by DAKO, Anti-v-erbB-2 Clone CB11 by Biogenix and FLEX Monoclonal Mouse Anti-human Cytokeratin5/6 (Clone D5/16B4) for ER, PR, Her2neu and CK5/6 respectively. A two-stage process involving binding of the primary antibody to the targeted epitope; second step by identifying a secondary antibody bound to a dextran polymer with the help of horseradish peroxidase enzyme attached to a chromogen.

The various parameters analyzed were age, histological type, size of a tumor, grade, skin, lymphovascular and perineural invasions, number of axillary lymph nodes showing metastasis and staining properties of ER, PR, Her2neu, and CK5/6.

Based on studies conducted by Rakha et al [1], Laakso et al [6] an arbitrary scoring system was drawn up for quantifying the expression of CK5/6. (Table: 1)

Score	Description
0	Less than 1 % positivity
1 +	1-10% tumour cells are positive

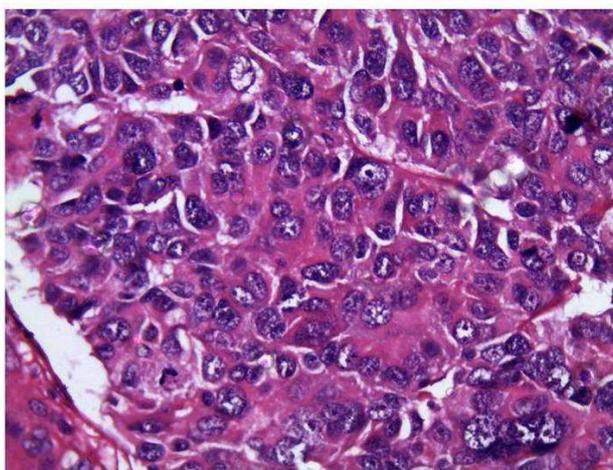
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2 +	10-50% tumour cells are positive
3 +	More than 50% of tumor cells are positive

### Results

44 cases of female breast cancer were under study. The ages ranged between 33 and 67 years. The age group that had the

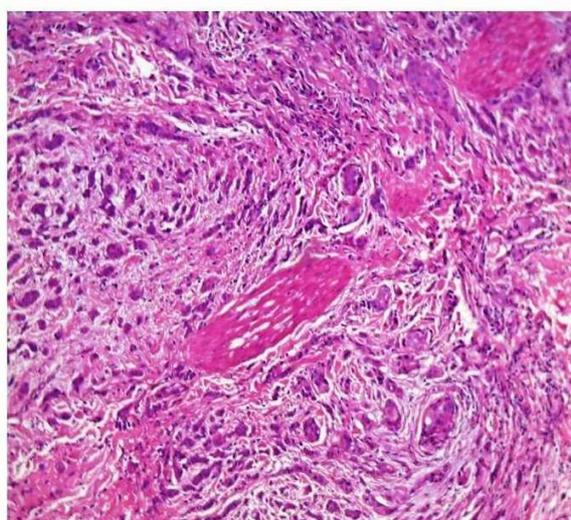
most number of cases was 41 to 50 years. The commonest histological grade in our study was Grade 2, with 24 cases and 9 cases were grade 3 (Fig:1).



**Fig 1** - Invasive ductal carcinoma NOS, H&E 400x

88% of the tumors were of the infiltrating ductal carcinoma, not otherwise specified (NOS). Two cases of micropapillary carcinoma, a case of metaplastic carcinoma and papillary carcinoma were included.

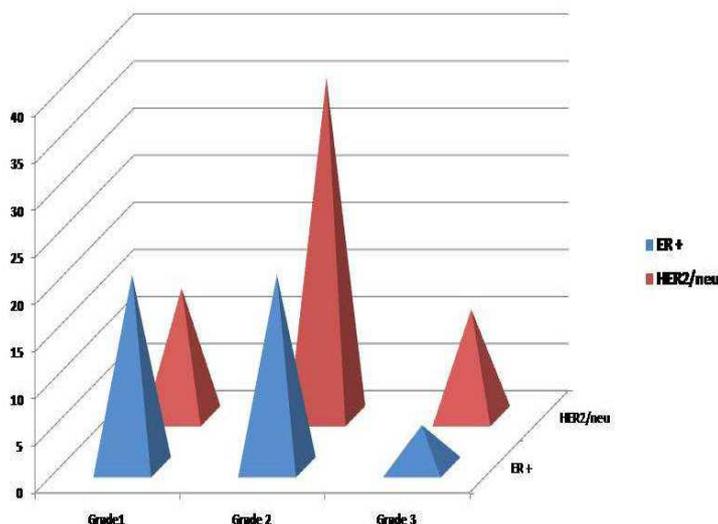
Most cases (22) were of sizes between 2cm-5 cm. Lymphovascular invasion was seen in 20 out of 44 cases, with most cases belonging to Grade 2. Perineural invasion (Fig: 2) was seen in only two cases.



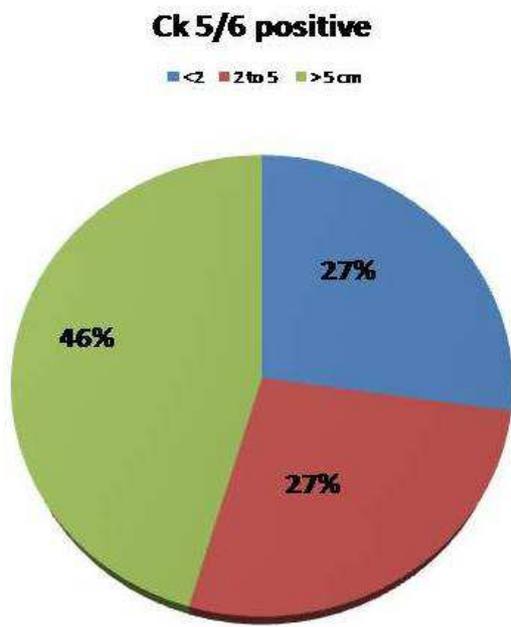
**Fig 2** - Invasive ductal carcinoma with perineural invasion, 400x

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Estrogen receptor expression was seen in around 45% of cases and 52% of the cases showed Her 2 neu overexpression. (Fig 3)

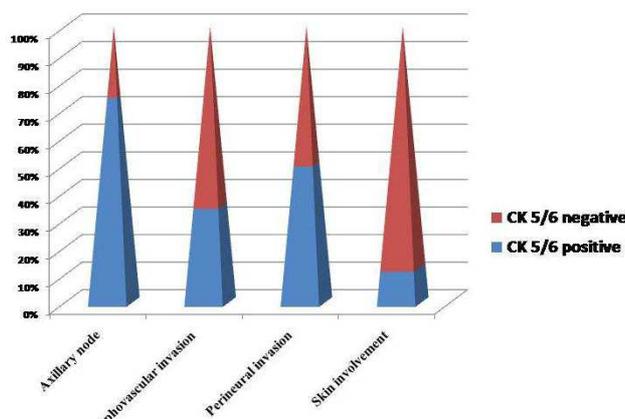


**Fig 3** - Histogram showing the distribution of ER/Her 2 neu & grade K 5/6 positivity. Larger tumors had a greater incidence of CK 5/6 positivity with the largest t Size of a tumor statistically correlated with C a tumour being 13.5 cm in size. (Fig 4)



**Fig 4** – Pie chart showing CK5/6 positive cases and size of tumors  
Correlation between CK 5/6 with invasive and prognostic features was performed and we observed that the tumors with higher grade, lymphovascular, perineural invasion, and extensive lymph node metastases showed greater CK5/6 expression than their respective counterparts. (Fig 5).

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**Fig 5** - Histogram showing prognostic parameters vs CK5/6 positivity

## Discussion

Breast carcinomas have emerged as the most common malignancy in Indian women. Not only is their incidence high, but the fatality rate of these cases exceeds those of the western population [6]. The cure rates, quality, and length of life have improved in these women after the development of targeted therapy. Glass et al [7] observed quantitative and qualitative trends in breast cancer incidence. There has been a tremendous increase, particularly in ER-positive tumors. The reason for the exponential rise has been attributed to the use of post-menopausal hormone replacement therapy and widespread utilization of mammography.

Breast cancers have been subclassified into 4 molecular subtypes.

1. **Luminal A** – a high expression of luminal cytoke­ratins and hormone receptors. ER/PR-positive.HER2/neu- negative.
2. **Luminal B** - Expression of luminal cytoke­ratins are seen. ER/PR-positive.HER2/neu expression-variably positive. Higher grade and proliferation than Luminal A
3. **HER2/neu** - a Low expression of ER. High expression of HER2/neu and 17q12. ER/PR negative. HER2/neu positive. High grade,

TP53 mutations present and a higher likelihood of nodal metastasis

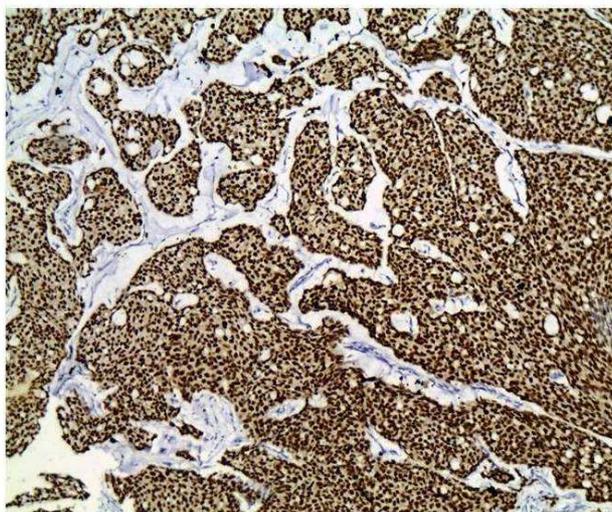
4. **Basal-like** - A High expression of basal cytoke­ratins and epithelial genes. Low expression of hormone receptors. Triple-negative (ER, PR, HER2/neu). TP53, BRCA1 mutations seen.

Treatment response to endocrine therapy is good in ‘Luminal type A tumors. The response in ‘Luminal B’ tumors is not as satisfactory as in Luminal A tumors. Her 2 neu class of tumors responds to Trastuzumab. The basal-like tumors do not respond to endocrine therapy or Trastuzumab

The subsets of breast carcinoma which are not susceptible to conventional therapy, have a paradigm shift in molecular genetics and immunohistochemical expression. These are the Basal-like breast carcinomas and the Triple Negative Breast Cancers.

The overall percentage of ER-positive cases in our study was 45%, lesser when compared with western literature. (Fig 6). This is consistent with findings in a study conducted by Ambroise et al [8], which concluded by saying that hormonal expression is lesser in the south Indian population. We noted that 54% of ER-positive tumors were node positive and most ER positive neoplasms [9] were less than 2 cm in size.

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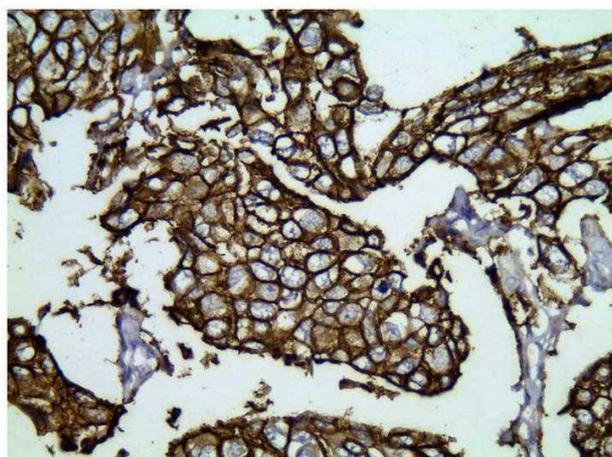


**Fig 6** - 100% cells showing strong nuclear staining for Estrogen Receptor

We inferred that due to the large size of the tumors in our study, there was increased nodal metastasis. Almost all the women with ER-positive cases belonged to the 35 to 65 year age group.

Normalization technique was introduced for standardization of results and to avoid discordance between immunohistochemistry and FISH results.

There is improved accuracy of HER2 studies using a subtraction scoring system in which a signal score of non-neoplastic breast epithelium is subtracted from that of a tumor [10]. Using this system, the proportion of HER2 positive tumors in our study is 63%. (Fig 7). This stresses the need to look into other markers and their routine use in South Indian cohorts.



**Fig 7** - Cells showing strong and complete membrane staining for Her2neu

Dolle et al [11] inferred that Triple Negative Breast Cancers (TNBCs) are breast cancer subtypes associated with high mortality rate and resistance to hormonal manipulation and Herceptin. Since these

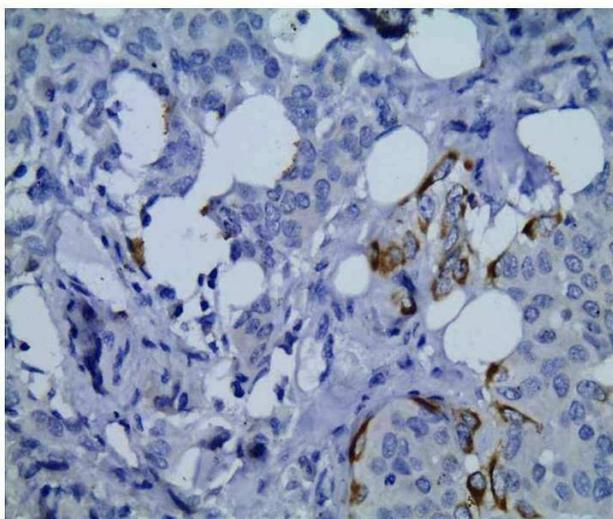
tumors are negative for ER, PR, and HER2, newer markers are to be identified for this subtype. These tumors have been seen with increased incidence in younger women (aged 45 years or younger). Our study

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showed close correlation, with the mean age of women with TNBCs being 46 years and nearly a third of the women were 40 or younger.

The purpose of our study was to identify a newer basal marker and observe the expression and clinic-pathological in cases of breast cancer at our center. The basal marker that we selected for our study was CK 5/6[12]. Clark et al suggested that CK5

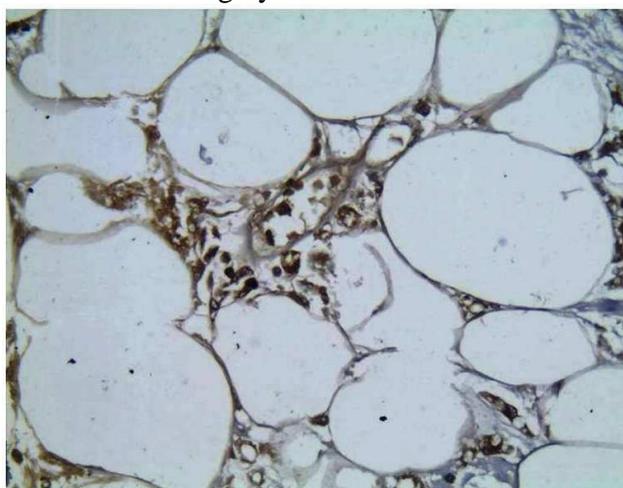
is positive in breast progenitor cells, which are believed to be the cell of origin in basal-like breast cancers (Rakha) [1]. In our study, 25% of the cases were basal-like, with all of these tumors falling into either Grade 2 or Grade 3. Thus CK 5/6 was positive in 50 % of TNBCs (Fig: 8). The only case of the metaplastic tumor was negative for basal markers.



**Fig 8** - < 10% cells showing staining with CK5/6 IHC marker, IHC 100 x

Nodal positivity in basal Cytokeratin positive cases in our study was nearly 80%. Vascular emboli were also prominent in these tumors, consistent with their highly

invasive nature (Fig: 9). These malignancies are associated with poor prognosis and have a distinctive response to chemotherapy.



**Fig 9** - > 50% cells showing staining with CK5/6 IHC marker, IHC 100 x

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Nielson et al [13] observed that a panel consisting of ER, HER2 and CK 5/6 to identify the basal-like subset was useful as this immunohistochemical combination had a 76% sensitivity and 100% specificity rate when compared with genetic microarray analysis.

The conclusions drawn from our study is that CK5/6 positivity was seen in tumors of larger size and higher grades.

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