**Impact of Breast Cancer Molecular Subtypes on the Incidence of Axilllarylymhp Nodes Metastases**

Emad Sadaka1 and Walid Almorsy2

1Clinical Oncology Department, Faculty of Medicine, Kafer Elsheikh University, Egypt

2Clinical Oncology Department, Faculty of Medicine, Tanta University, Egypt

[e\_sadaka@hotmail.com](mailto:e_sadaka@hotmail.com)

**Abstract: Purpose:** Breast cancer has at least four molecular subtypes with significant differences in prognosis and ALN involvement. This study aimed to investigate the impact of breast cancer molecular subtypes on the incidence of axillarylymph nodes metastases Methods: Three hundred and twenty-nine female patients with invasive breast cancer were included in this study. Age at diagnosis, menopausal status, tumor size, type and grade, lymph node status and molecular subtypes were recorded. Four major molecular subtypes were classified, Luminal A; Luminal B, HER2+ and triple negative. Results*:* The mean age was 51.34 years old. Most of patients (86.9%) have Invasive ductal carcinoma. One hundred sixty four (49.5%) patients had node negative disease while 166 (50.5%) had node positive disease. Luminal A molecular subtype was recorded in 87 patients (26.4%), luminal B 163 patients (49.5%), HER-2+ 35 patients (10.6%) and TNBC 44 patients (13.5%). There are differences in ALN positivity by molecular subtypes, node positive disease was (11.5%) among luminal A patients, luminal B patients (66.9%), HER2+ (91.4%) and TNBC (34.1%). There were significant correlation between molecular subtypes and nodal status (p=0.03 for luminal B and <0.001 for luminal A, HER 2 positive and triple negative). Conclusion: luminal B and HER2+ve breast cancer subtypes were more likely to be associated with ALNM. Also, tumor size and a grade, LVI and ki67 were correlated with lymph node status. Further confirmatory studies are necessary to define factors that predict ALN metastases.

**[**Emad Sadakaand Walid Almorsy. **Impact of Breast Cancer Molecular Subtypes on the Incidence of Axilllarylymhp Nodes Metastases.** *Cancer Biology* 2018;8(3):42-46]. ISSN: 2150-1041 (print); ISSN: 2150-105X (online). <http://www.cancerbio.net>. 8. doi:[10.7537/marscbj080318.08](http://www.dx.doi.org/10.7537/marscbj080318.08).

**Keywords:** Breast cancer, molecularsubtypes, axillary lymph nodes metastases.

**1. Introduction**

Breast cancer has been found to be the most common malignant tumor among females. It has many molecular, and pathological with different prognossis and therapy implications [1]. Hormonal receptors have an independent for prognosis of case. ER expression was in average 80-90% of breast cancer, while PR expression was 70-80%]. H.E.R-2/neuwas15-20% of breast cancer cases **[3, 4].**

Breast cancer is better represented by its combined receptor expression than by a single one us alone **[5, 6].** Axillary lymph nodal (ALN) infiltration are correlated to overall survival and have association with staging, prognosis, and treatment of invasive breast cancer **[7-9].** Breast cancer has main4main subtypes, Luminal A, Luminal B, Her-2 positive and triple negative breast cancer. Molecular subtype (MST) has significant differences in prognosis **[10-11].**

Triple negative breast cancer (TNBC) has aggressive clinical impact, with high metastatic rate compared to other subtypes, and characterized by a poor prognosis specially in case of decreased sensitivity tone adjuvant chemotherapy [11-13]. Some studies evaluated incidence of axillary node metastases in TNBC and they found thatitis less frequent in this subtype. **[14, 15].**

Many studies have been investigated patients unlikely to benefit from ALN dissection, thus, the use of sentinel lymph node biopsy reduce the need of ALN dissection of missed metastasis. There are controversies about the relation between ALN status and molecular subtypes and role of LN involvement as an intrinsic characteristic**. [6, 16]**Aim of present study is to evaluate the association between ALN status and molecular subtype.

**2. Patients and Methods:**

Three hundred and twenty nine (329) breast cancer patients were included in this study. The study was conducted at Tanta University Hospital, clinical oncology department between January 2011 and January 2015. The clinical and pathological features, including age at diagnosis, menopausal status, tumor site, tumor size, histological type and grade, lymph node status and molecular subtypes were constructed.

Four molecular types were determined **[11].**Patients were classified as follows: Luminal A (ER+/PR+, HER2-, Ki67 < 14%); Luminal B (ER+/PR+, HER2+); HER2+ (ER-, PR-, HER2+); TNBC (ER-, PR-, HER2-). HER2 FISH+ or IHC 3+ was considered to be positive.

**Statistical analysis:**

All data were statistically analyzed using the Statistical version 21.0 (SPSS Inc., USA). Chi-square test was used for the correlation between clinical, pathological features and axillary lymph node status. Univariate and multivariate analyses was done using the logistic regression model with P value of less than 0.05 was considered to be statistically significant.

**3. Results**

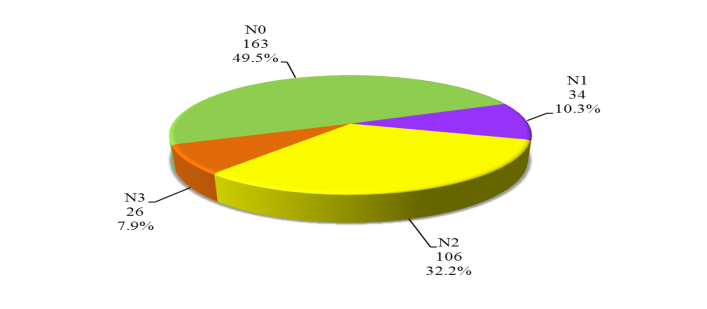
A total of 329 patients with invasive breast carcinoma were included. The mean age is (50.43) years old. Invasive ductal carcinoma (86.9%) constitute majority of patients. Luminal A molecular subtype was recorded in 87 patients (26.4%), while luminal B, HER-2+ and TNBC were recorded in 163 patients (49.5%), 35 patients (10.6%) and 44 patients (13.5%) respectively.

One hundred thirty nine patients were pre-menopausal (42.2%), 190 patients were post-menopausal (57.8%). Regarding tumor, T1was represented in18.2%, while T2and T3 were recorded in 53.2% and28.6% respectively. Grade I & II, representing 71.1% while grade III occurred in 28.9%.

Table 1, (Fig. 1) showed that 163 (49.5%) patients had node negative disease while 166 (50.5%) had node positive disease. Nodal stage 2 was the most frequent (106 patients) followed by N1 (34 patients) and26 patients had N3 stage.

**Table (1): Distribution of the patients according to N stage (n = 329)**

|  |  |  |
| --- | --- | --- |
| **Stage N** | **No.** | **%** |
| N0 | 163 | 49.5 |
| N1 | 34 | 10.3 |
| N2 | 106 | 32.2 |
| N3 | 26 | 7.9 |
|  |  |  |
| N1 + N2 + N3 | 166 | 50.5 |



**(Fig. 1)** Distribution of the patients according to N stage (n = 329)

**Table (2): Relation between N stage and different parameters (n = 329)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Total**  **(n = 329)** | **N Stage** | | **p** |
| **N0 (n = 163)** | **(N1 + N2 +N3 (n = 166)** |
| **Age** |  |  |  |  |
| ≤50 | 144(43.8%) | 50 (34.7%) | 94 (65.3%) | <0.001\* |
| >50 | 185(56.2%) | 113(61.1%) | 72 (38.9%) |
| **Sup type** |  |  |  |  |
| Luminal A | 87(26.4%) | 77(88.5%) | 10 (11.5%) | <0.001\* |
| Luminal B | 163(49.5%) | 54(33.1%) | 109(66.9%) | 0.03\* |
| HER.2+ | 35(10.6%) | 3(8.6%) | 32(91.4%) | <0.001\* |
| Triple - | 44(13.5%) | 29(65.9%) | 15(34.1%) | <0.001\* |
| **Pathology** |  |  |  |  |
| Ductal | 286(86.9%) | 142(49.7%) | 144(50.3%) | 0.921 |
| Lobular | 43(13.1%) | 21(48.8%) | 22(51.2%) |
| **Menopause** |  |  |  |  |
| Pre | 139(42.2%) | 52(37.4%) | 87 (62.6%) | <0.001\* |
| Post | 190(57.8%) | 111(58.4%) | 79 (41.6%) |
| **T**size |  |  |  |  |
| ≤2 | 60 (18.2%) | 47(78.3%) | 13(21.7%) | <0.001\* |
| >2- ≤5 | 175(53.2%) | 103(58.9%) | 72(41.1%) |
| >5 | 94(28.6%) | 13(13.8%) | 81(86.2%) |
| **Grade** |  |  |  |  |
| G1 & 2 | 234(71.1%) | 143(61.1%) | 91(38.9%) | <0.001\* |
| G3 | 95(28.9%) | 20 (21.1%) | 75(78.9%) |
| **LVI** |  |  |  |  |
| Non | 206(62.6%) | 142(68.9%) | 64(31.1%) | <0.001\* |
| Yes | 123(37.4%) | 21(17.1%) | 102(82.9%) |
| **Ki67** |  |  |  |  |
| Low | 103(31.3%) | 92(89.3%) | 11(10.7%) | <0.001\* |
| High | 226(68.7%) | 71(31.4%) | 155(68.6%) |

**Table (3): Univariate analysis logistic regression for factor affecting stage.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Sig. | Exp (B) | 95% Confidence Interval for Exp (B) | |
| Lower Bound | Upper Bound |
| age | .642 | 1.176 | .593 | 2.331 |
| menaupaus | .268 | 1.473 | .742 | 2.925 |
| Tumor size | .027 | .534 | .305 | .932 |
| LVI | <.001 | .140 | .061 | .322 |
| ki67 | .067 | .155 | .018 | 1.312 |
| pathology | .457 | .713 | .293 | 1.737 |
| grade | .389 | .718 | .338 | 1.525 |
| Luminal A | .957 | .939 | .098 | 8.977 |
| Luminal B | .032 | .376 | .154 | .918 |
| HER-2 | .038 | 5.304 | 1.202 | 23.406 |
| Triple -ve | .157 | .326 | .069 | 1.539 |

**Table (4): Multivariate analysis logistic regression for factors affecting stage.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Sig. | HR | 95% C.I. for EXP (B) | | |
| Lower | Upper | |
| suptype (1) | .905 | 1.146 | .122 | 10.814 |
| suptype (2) | .030 | 2.690 | 1.103 | 6.561 |
| suptype (3) | .015 | 2.081 | 1.245 | 3.479 |
| suptype (4) | .144 | 3.154 | .676 | 14.708 |
| T | .033 | 1.824 | 1.051 | 3.167 |
| LVI | <.001 | 6.998 | 3.050 | 16.052 |

Table 2 showed that there are differences in LN positivity by molecular subtypes, (11.5%) of luminal A patients had N positive disease, (66.9%) of luminal B patients, HER2+ (91.4%) and TNBC (34.1%). There were significant correlation between molecular subtypes and nodal status (p=0.03 for luminal B and <0.001 for HER 2 in favors of node positivity and <0.001 for both luminal A and triple negative disease in favors of node negativity).

In the same context, higher tumor grade is significantly associated with ALN metastases, (p<0.001), 34.9% of grade I & II tumors had ALN deposits compared to 78.9% of grade III tumors. There is a significant higher rate of ALN involvement among young age patients (p<0.001), (65.3%) of patients who had ALN metastases were younger than 50 years old compared with (38.9%) in patients older than 50 years old (Table 2).

Correlation between LVI and ALN involvement showed significant relation (p<0.001), (82.9%) of patients with LVI had ALN involvement compared to (31.1%) in patients without LVI. Also there is a significant higher rate of ALN involvement among patients with high ki67 (p<0.001), (68.6%) of patients with high ki67 expression had ALN metastases (Table 2). There was no association between lymph node metastases and tumor pathology.

Table (3) showed univariate logistic regres­sion models. Tumor size, molecular subtypes and LVI showed a significant correlation with the ALN status. In multivariate logistic regres­sion analysis, tumor size (P=0.03), luminal B subtype (P=0.03), HER-2+ subtype (P=0.02) and LVI (P<0.001) were independent factors in correlation with the ALN status. Table (4)

**4. Discussion**

Breast cancer is a complex, heterogeneous disease at the molecular level **[17].** The immunohistochemistry (IHC) using gene expression microarrays: the strongest factors correlated to overall survival in breast cancer patients, and as such, it has been a major determinant in therapeutic decision making. **[**[**20**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R25)**]**

This study evaluated 329 patients with invasive breast carcinoma, mean age (50.43) years old. The most histological type is invasive ductal carcinoma (86.9%). Luminal A in87 patients (26.4%), Luminal B in 163 (49.5%), HER-2+ in35 (10.6%), and TNBC in 44 (13.4%) patients.

This study showed that, 163 (49.5%) patients had node negative disease while 166 (50.5%) patients had node positive disease. Nodal stage N2 was the most frequent (106 patients) followed by N1 (34 patients) and 26 patients had N3 stage. The tumor size, grade, menopausal status, LVI, and Ki67 expression were significantly correlated the LN positivity. There are differences in LN positivity by molecular subtypes, 10/87 luminal A patients had N positive disease (11.5%), luminal B 109/163 patients (66.9%), HER2+ 32/35 (91.4%) and TNBC 15/44 (34.1%). There were significant correlation between molecular subtypes and nodal status (p=0.03 for luminal B and <0.001 for luminal A, HER 2 and triple negative).

In our study there was a lower risk of axillary lymph nodal (ALN) involvement in luminal A breast and triple negative cancer patients and increased frequency of LN metastasis in luminal B and HER2+breast cancer patients. Dent et al **[**[**20**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]** showed that patients with Triple negative breast cancer has less lymph node metastasis but is more aggressively. It maybe due to hematogenous spread or lack of targetable treatment.

Chengshuai Si et al **[**[**21**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]**study showed that tumor size and tumor subtype show statistical significance with LN involvement. Luminal B type showed significant higher probability of LN involvement, Triple positive and triple negative breast cancer ac­counts the most and least possibility of LN involvement.

Emi Yoshihara et al **[**[**22**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]** study the incidence of ALNM with the presence of LVI (P<0.001), larger tum0ur size (P < 0.001), higher hist0lgic grade (P < 0.0001) and no0effect of age. Elsayed M Ali1 et al **[**[**23**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]**study evaluated 258 patients with invasive breast carcinomas, ER and PR expression were dem0nstrated in 78.7% and 76.4%, respectively and over-expression of HER-2/neu was detected in 13.2% of cases. There was a strong c0rrelation between tumor size and tumor grade with lymph node involvement (p= 0.0001 and 0.024, respectively). Triple positive breast cancer is m0re likely to have axillary lymph node metastasis and ER+/PR+/HER-2- (PPN) is the m0st pr0tected group (p<=0.001).

Patani NR, et al **[**[**24**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]**study evaluated 590 patients with mean age 52 years. P0sitive ALNs were found in 302 patients (51%). Five factors were significantly associated with ALN metastasis; y0unger age, lower mamm0graphic density, higher BI-RA0DS categ0ry, larger tumor size, and presence of lymph0vascular invasion. [Tufale](https://www.ncbi.nlm.nih.gov/pubmed/?term=Dass%20TA%5BAuthor%5D&cauthor=true&cauthor_uid=27065659) et al **[**[**25**](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5589678/#R3)**]** evaluated the correlation of various clinicopathological variables with axillary nodal involvement in T1 breast cancer. tumor size, L0VI, histological grade, tumor palpability & ER/P0R/Her2 receptor profile were found to be significantly associated with axillary lymph node involvement (AL0NI) and also found that age of the patient, family history and histological type of tumor were not significantly correlated with AL0NI.

**Conclusion:**

Analysis of breast cancer subtypes is Important, because it provides valuable prognostic and predictive information's. our results showed that, luminal B, HER2/neu positive, tumor size and LVI are independent prognostic factors for ALN metostases. Further confirmatory studies are necessary to define factors that predict ALN metastases.

**References:**

1. Carey L A, Perou C M, Livasy C A, et al. Race, breast cancer subtypes and survival in the Carolina breast cancer study. JAMA, 295: 2492- 502, 2006.
2. Grann VR, Troxel AB, Zojwalla NJet al. Hormone receptor status and survival in a population- based cohort of patients with breast carcinoma. Cancer, 103(11): 2241- 51, 2005.
3. Esteva FJ, Hortobagyi GN. Prognostic molecular markers in early breast cancer. Breast Cancer Res. 2004; 6: 109- 18, 2004.
4. Ross JS, Fletcher JA, Linette GP. The HER-2 gene and protein in breast cancer: biomarker and target of therapy. Rev Oncologist, 8: 307- 25, 2003.
5. Sorlie T, Perou CM, Tibshirani R, et al. Gene expression patterns of breast cancers distinguish tumor subclasses with clinical implications. Proc Natl Acad Sci USA, 98(19): 10869- 74, 2001.
6. Yao ZX, Lu LJ, Wang RJ, et al. Discordance and clinical significance of ER, PR and HER2 status between primary breast cancer and synchronous axillary lymph node metastasis. Med Oncol, 31(1): 798, 2010.
7. Yoshihara E, Smeets A, Laenen A, et al. Predictors of axillary lymph node metastases in early breast cancer and their applicability in clinical practice. Breast.2013; 22:357–61. https://doi. org/10.1016/j.breast.2012.09.003
8. Viale G, Zurrida S, Maiorano E, et al. Predicting the status of axillary sentinel lymph nodes in 4351 patients with invasive breast carcinoma treated in a single institution. Cancer.2005; 103:492–500. https://doi.org/10.1002/ cncr.20809
9. Crabb SJ, Cheang MC, Leung S, et al. Basal breast cancer molecular subtype predicts for lower incidence of axillary lymph node metastases in primary breast cancer. Clin Breast Cancer.2008; 8:249–56. https://doi.org/10.3816/ CBC.2008.n.028
10. Perou CM, Sørlie T, Eisen MB, et al. Molecular portraits of human breast tumours. Nature.2000; 406:747– 52. https://doi.org/10.1038/35021093
11. Wiechmann L, Sampson M, Stempel M, et al. Presenting features of breast cancer differ by molecular subtype. Ann Surg Oncol. 2009; 16:2705–10.https://doi.org/10.1245/s10434-009-0606-2
12. Banz-Jansen C, Heinrichs A, Hedderich M, et al. Are there changes in characteristics and therapy of young patients with early-onset breast cancer in Germany over the last decade? Arch Gynecol Obstet. 2013; 288:379–83. https://doi.org/10.1007/s00404-013-2738-7
13. Gluz O, Liedtke C, Gottschalk N, et al. Triple-negative breast cancer—current status and future directions. Ann Oncol. 2009; 20:1913–27. https://doi.org/10.1093/annonc/mdp492
14. Liedtke C, Mazouni C, Hess KR, et al. Response to neoadjuvant therapy and long-term survival in patients with triple-negative breast cancer. J Clin Oncol.2008; 26:1275–81. https://doi.org/10.1200/ JCO.2007.14.4147
15. Gagdos C, Tartter P I, Bleiweiss I J. Lymphatic invasion, tumor size, and age are independent predictors of axillary lymph node metastasis in women with T1 breast cancers. Ann Surg, 230 (5): 692, 1999.
16. Won K, Sang W, Hye K, et al. Prediction of Advanced Axillary Lymph Node Metastases (ypN2-3) Using Breast MR imaging and PET/CT after Neoadjuvant Chemotherapy in Invasive Ductal Carcinoma Patients: Scientific Reportsvolume 8, Article number: 3181(2018) doi:10.1038/s41598-018-21554-z
17. Jagsi R, Pierce L. Postmastectomy radiation therapy for patients with locally advanced breast cancer. Semin Radiat Oncol. 2009;19:236–43.
18. Carey LA, Dees EC, Sawyer L, et al. The triple negative paradox: primary tumor chemosensitivity of breast cancer subtypes. Clin Cancer Res. 2007;13:2329–34.
19. Gangi A, Mirocha J, Leong T, et al. Triple-negative breast cancer is not associated with increased likelihood of nodal metastases. Ann Surg Oncol. 2014;21:4098–103.
20. Dent R, Hanna WM, Trudeau M, et al. Pattern of metastatic spread in triple-negative breast cancer. Breast Cancer Res Treat. 2009;115:423–28.
21. Chengshuai Si, Yiting Jin, Hongying Wang, et al. Association between molecular subtypes and lymph node status in invasive breast cancer, Int J Clin Exp Pathol. 2014; 7(10): 6800–6806.
22. Emi Y, Ann S, Annouchka Bet al. Predictors of axillary lymph node metastases in early breast cancer and their applicability in clinical practice, The Breast 22 (2013) 357e361.
23. Elsayed M, Ahmed R., Ayman M. et al. Correlation of Breast Cancer Subtypes Based on ER, PR and HER2 Expression with Axillary Lymph Node Status, Cancer and Oncology Research 2(4): 51-57, 2014.
24. Patani NR, Dwek MV and Douek M. Predictors of axillary lymph node metastasis in breast cancer: a systematic review. Eur J Surg Oncol 2007; 33: 409-19.
25. Tufale A, Sharma K., Patil Pet al. Correlation of Various Biomarkers with Axillary Nodal Metastases: Can a Panel of Such Biomarkers Guide Selective Use of Axillary Surgery in T1 Breast Cancer Indian J Surg Oncol. 2015 Dec; 6(4): 346–351.

8/14/2018