

Risk Factors for Locoregional Recurrence Following Mastectomy for Localized Breast Cancer in a Nigerian Teaching Hospital

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Abstract

Background: Mastectomy is an integral part of the management of breast cancer, especially in resource-limited centers. This study aimed to describe the outcomes in terms of locoregional recurrence (LRR) and distant metastasis (DM) after modified radical mastectomy (MRM) for breast cancer and factors associated with them.

Methods: This was a retrospective study of patients who underwent mastectomy between October 2012 and September 2017. Data generated were analyzed using SPSS version 23.0. The results were presented using descriptive statistics. Inferential statistics was done using the chi-square test with statistical significance set at $p < 0.05$. **Results:** Sixty-three (88.7%) of 71 patients who had MRM over the study period were eligible. Their ages ranged from 24-80 years with a median of 49 years (IQR, 43-59 years). Lump size ranged from 2-18 cm (mean, 7.8 ± 3.5 cm) and the lump duration was 1-48 months (median 6.0, IQR, 4.0-10.0 months). Sixteen (25.4%) patients developed LRR. The interval to occurrence of LRR after mastectomy ranged from 4-36 months (median, 9 months, IQR, 6.0-20.0). Eighteen (28.6%) patients developed distant metastasis 9-60 months after surgery (median 19, IQR 12.0-37.0 months) and 50% of those with LRR were among. Metastasis mostly affected the lungs and pleura in 55.6%. Mean tumour size ≥ 10 cm ($p < 0.000$), mean lump duration > 11 months, advanced disease T3/4 ($p = 0.01$) and higher number of positive lymph nodes ($p = 0.011$) were significantly associated with LRR. Both tumour size ($p = 0.01$) and positive lymph nodes ($p = 0.015$) are predictors of LRR. **Conclusion:** LRR and metastasis are common occurrences after mastectomy. Early presentation and availability of more adjuvant therapies can reduce the rate.

Keywords: Breast cancer- mastectomy- recurrence- metastasis- survival

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Introduction

Breast cancer is the most common malignancy in Nigerian women [1] and a large number of patients usually present with a huge tumour requiring mastectomy as an integral component of standard multimodal treatments. Mastectomy is aimed at the locoregional control and alleviates the physical burden of the disease. In the developed countries where there are robust screening programs, the majority of the breast cancer patients are diagnosed early and breast conserving surgery is

often feasible. Most breast cancer patients in Nigeria and Africa often require more radical treatments with a combination of neoadjuvant chemotherapy, mastectomy and radiotherapy for locoregional control because of late presentation with more advanced local and regional disease. Nigeria breast cancer patients present with one of the highest incidences of large locoregional tumour burden globally with potential for early and high incidence of treatment failure [2-5].

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Two very disturbing outcomes of treatment failure are locoregional recurrence (LRR) and metastatic progression (MP). Women who have completed initial treatments for breast cancer are not spared of local recurrence and/or metastasis [6]. Cheng et al. [7] in their study reported that the 4-year LRR rate was 16.1% after modified radical mastectomy. Some contributing factors to the increased risk of LRR include young age at diagnosis, huge tumour size, positive lymph node status, high tumour grade, triple negative or human epidermal growth factor receptor 2 (HER2/neu)-positive subtype, lack of endocrine therapy, omitting indicated adjuvant radiotherapy and treatment strategies [8-10]. Studies have shown that LRR correlates with increased risk of poor survival outcomes [7, 11].

Understanding the pattern of LRR and metastatic recurrence will help in identifying future interventions to improve the quality and effectiveness of palliative care for Nigerian and other African countries. Thus, the objective of this study was to describe the outcomes in terms of locoregional recurrence and metastasis after modified radical mastectomy for breast cancer in a teaching hospital in Ekiti, Nigeria.

Materials and Methods

Design, Setting and Participants

This was a descriptive retrospective study of patients with histologically confirmed breast cancer who underwent mastectomy at Ekiti State University Teaching Hospital (EKSUTH), Ado-Ekiti over a five-year period between October 2012 and September 2017. The study was approved by the Ethics and Research Committee of EKSUTH (EKSUTH/A67/2018/07/008).

The medical records of patients listed for mastectomy treatment of locoregional disease, corresponding to stage 0-3 disease, in the operating theatre register were obtained by the surgery residents. Patients diagnosed with metastatic disease before mastectomy and those with tumour-positive resection margin were excluded.

Data on patient demographics, time to presentation, clinicopathologic tumour findings including size, nodal status, stage and Scarff-Bloom-Richardson (SBR) grade, treatment received and follow up were collected with the aid of a well-designed proforma. Event of Locoregional recurrence and metastatic progression were primary outcomes. LRR was defined as the appearance of tumour in the chest wall, skin, or regional lymph nodes (ipsilateral axillary, supraclavicular, infraclavicular or internal mammary lymph nodes) at least six weeks after mastectomy while metastasis is the appearance of tumour in other organs/structures. Patients with concurrent LRR and distant metastasis were categorized as distant metastasis as first recurrence event.

During the period under review, provisional diagnosis of primary tumour was by clinicoradiologic review with pathologic confirmation by fine needle aspiration or histology. Staging and scouting for metastasis was limited to breast, axillary and supraclavicular ultrasound scanning, chest Xray, and abdominal ultrasound scanning, adopting the AJCC version 7,2010. Computerized tomography

(CT), magnetic resonance imaging (MRI) and bone scan were not routine.

Locoregional recurrence was confirmed by repeat biopsy. Our protocol for salvage treatment for LRR comprises of local therapy, in form of wide local excision and axillary node dissection, and systemic treatment using chemotherapy and hormonal agents. Post excision radiotherapy was routinely recommended. Patients were followed up at the surgical outpatient clinic.

Statistical analysis

The data generated were analysed for frequencies and simple percentages using SPSS version 23 (SPSS Inc., Chicago, IL, USA). The results were presented using descriptive statistics: mean±SD, median and IQR. Associations between clinicopathological parameters and recurrence were assessed using the Chi-square and logistic regression analysis done to determine the predictor of locoregional recurrence. Life-table type analysis was used to describe the distribution of yearly event in the first 3 years. Statistical significance was set at $p < 0.05$.

Results

Seventy-one patients had mastectomy over the study period, 63 (88.7%) with detailed information were eligible. Their ages ranged from 24 to 80 years with a mean age of 51.9 ± 12.7 years. The patients' sociodemographic variables are shown in Table 1.

The lump size ranged from 2-18 cm (mean, 7.8 ± 3.5 cm, median 7.0, IQR 6-10 cm) and the lump duration was 1-48 months (median 6.0 months, IQR 4-10). Other tumour characteristics are shown in Table 2.

All the patients had modified radical mastectomy. Sixteen (25.4%) patients developed recurrence. Median time to first recurrence was 9 months (range: 4-36 months). Chest wall was the most common site of LRR in 9 (56.3%) of the patients while 5 (31.3%) and 2 (12.5%) developed LRR on the skin and axillary lymph nodes respectively. The yearly risk of LRR in the first 3 years was 29% during the first year and 4% each in the second and third years

Eighteen (28.6%) patients developed distant metastasis. The median time to metastasis after surgery was 19 months (range: 9-60 months). The sites of metastasis were: lungs 6 (33.3%), pleural 4 (22.2%), bone 3 (16.7%), liver 2 (11.1%), brain 2 (11.1%) and one patient (5.6%) had multiple metastases. Among the patients with metastasis, only 8 (44.4%) had LRR. The time to LRR and distant metastasis after surgery are shown in Table 3. Risk of appearance of metastasis was 8.5% during the first-year post mastectomy, 10% during the second year and 3.5% during the third year.

The factors associated with locoregional recurrence are shown in Table 4. Advanced stage ($p=0.01$) and number of positive lymph nodes ($p=0.011$) in the resected specimen were significantly associated with cancer recurrence and these two factors also predicted the development of LRR (Table 5).

Although half of the patients with LRR developed

Table 1. Socio-demographic Characteristics of the Patients (N=63)

Socio-demographic	Frequency	Percentage (%)
Age group (year)		
21-30	2	3.2
31-40	9	14.3
41-50	22	34.9
51-60	15	23.8
61-70	9	14.3
>70	6	9.5
Gender		
Female	61	96.2
Male	2	3.8
Education		
Low	13	20.6
High	50	79.4
Marital status		
Single	2	3.2
Married	52	82.5
Divorced/separated	1	1.6
Widow (er)	8	12.7
Menopausal status		
Premenopausal	32	50.8
Postmenopausal	29	46
Not applicable	2	3.2
Occupation		
Employed	47	74.6
Unemployed	16	25.4

metastasis, the T stage, SBR grade and lymph nodes involvement were not significantly associated with metastasis ($P=0.852$, 0.085 and 0.425 respectively).

Twelve (75%, $n=16$) of the patients with LRR had wide local excision while four (25%) were unresectable. Four (25%) had radiotherapy to the chest wall after excision and there was no further recurrence. All patients who developed metastasis commenced chemotherapy using Cyclophosphamide, Adriamycin/Epirubicin and 5-Fluorouracil (CAF/CEF) or Paclitaxel in combination with other agents.

At five years, 37 (58.7%) of the patients who had mastectomy were alive. Eighteen (28.6%) patients with metastasis died: 4 (22.2%) in the first year, 12 (66.7%) second year and 2 (11.1%) third year. Eight (12.7%) patients were lost to follow up. Survival after development of metastasis ranged from 6 to 30 months (median 16.5 months, IQR 12.75-20.0). Periodic mortality was 18% during the first year, 86% during the second year and 100% during the third year.

The overall incidence of an event within 5 years, either LRR or metastasis, was 26 (41.3%) and 88.5% of events occurred within the first 24 months, with about 52% in between 6 and 12 months.

Discussion

The most feasible option of treatment for resectable breast cancer in Africa and most parts of the world is modified radical mastectomy [12]. However, LRR and distant metastasis are common treatment failures attending mastectomy and this could be so devastating to the patients and distressing to the surgeon [13].

The LRR rate was 25% at a median follow-up period of 5 years in this study. Other authors from another center, also in Southwest Nigeria, reported a lower rate of 16% over 5 years [2]. The difference in this rate could be due to the availability of more adjuvant treatments (radiotherapy and immunotherapy) in the latter. Considering the advanced stage at which most of our patients presented, radiotherapy would have been a necessary adjuvant therapy to drive low the recurrence rate. Some studies have also reported LRR rate as high as 30% [7,14]. In early breast cancer (Stage T1 or T2) reported by Garg et al. [15], the 5-year risk for LRR was 5% and the routine inclusion of postmastectomy radiotherapy was adjudged unwarranted.

Advanced clinical stage (T3 & 4) and higher positive lymph nodes were associated with recurrence in our study and this was in consonance with other previous studies [2,10,16]. High tumour grade is a risk factor for recurrence. Despite the fact that only one patient out of 12 with well differentiated tumour developed LRR while a larger number of patients with moderate- and poorly differentiated tumour developed LRR, this was not statistically significant. The result is not unexpected as the small number of patients could have underpowered our analysis in this study.

All the locoregional recurrences occurred within three years with about two-thirds occurring within a year. This is most likely due to large tumour bulk at presentation making surgery to be more challenging. This finding was similar to those of Wangchinda and Ithimakin [17] in which larger and node-positive tumours were associated with greater chances of early recurrence. Our study also showed that more positive lymph nodes and large tumour size were predictors of recurrence. In the study by Mansell et al. [18], large tumour size, high grade tumour, more than 3 positive axillary nodes in addition to the presence of lymphovascular invasion were significant independent predictors of recurrence within 2.5 years. Other factors implicated in the early breast cancer recurrence include younger age of patients, positive resection margin, lack of postoperative irradiation, low estrogen receptor (ER) positivity and overexpression of human epidermal growth factor receptor 2 (HER2 Neu) and triple negative biologic status [17,19,20]. Vascular endothelial growth factor (VEGF) expression has been found to be correlated with tumour grade, tumour size and biological aggressiveness of the tumour which could affect recurrence and tumour metastasis.

The majority (87.5%) of our patients developed a local recurrence mainly involving the skin and the chest wall. With about three-quarters (76.2%) of patients presenting in stages T3 and T4 making adequate local

Table 2. Clinico-pathology Characteristics of the Sixty-three Postmastectomy Patients at Ekiti State University Teaching Hospital

Tumour characteristics	Frequency	Percentage (%)
Laterality		
Right	27	42.9
Left	31	49.2
Bilateral	5	7.9
Tumour stage		
1	1	1.6
2	14	22.2
3	36	57.1
4	12	19.1
Clinical stage		
I	1	1.6
II	9	14.3
III	53	84.1
Positive lymph nodes		
<5 lymph nodes	33	52.4
≥5 lymph nodes	30	47.6
Histology		
Invasive ductal carcinoma	61	98.4
Others (tubular, papillary)	2	1.6
Scarff–Bloom–Richardson grade		
Well differentiated	12	19.1
Moderately differentiated	28	44.4
Poorly differentiated	23	36.5

control more challenging, it is thus not surprising to have a local recurrence in these “high risk” patients [21]. Adjuvant radiotherapy was indicated in most patients but for unavailability, high cost and difficulty in accessing at other distant centers. The lower axillary lymph nodes recurrence might be due to the adequacy of the axillary dissection and adjuvant chemotherapy.

Half of the patients with LRR developed distant metastasis and two-thirds (66.6%) of the distant metastases also occurred within two years. The median time to first recurrence was 9 months and this was similar to 8.0 months reported by Ali-Gombe et al. [22] in a center where majority received radiotherapy. Locoregional recurrences are typically associated with an increased risk of concurrent or subsequent distant metastatic disease [23-25]. Ordinarily, it would be expected that the clinical T stage and positive lymph nodes associated with LRR in this study would also affect metastasis. This was not established in our study as the factors were not statistically significant. The fact that the remaining patients with distant metastasis did not have prior LRR explains why different factors might be responsible for these two outcomes. This is buttressed by the theory that breast cancer might actually be a systemic disease from the outset [26]. More than half (55.5%) of our patients had lungs/pleural metastasis. Other sites of metastasis include bone, liver and brain. This is consistent with other studies from different centers [27-29]. However, the frequency

and distribution of visceral and bone metastases also vary in these centers.

The overall frequency of post mastectomy events in this study was high, and particularly disturbing was finding more than half occurring within the first year. This might have implications for post mastectomy surveillance. Although there are no universal protocols for post mastectomy surveillance, with majority of events occurring from 6 months to 24 months we might suggest closer monitoring in the period from 6-24 months, starting slightly earlier than the 12 -24 months suggested for the COVID-19 era in the study by Agodirin and colleagues [30].

The management of LRR of breast cancer remains a challenge, and as such multidisciplinary care are usually required from different experts including surgeons,

Table 3. Durations of Development of Locoregional Recurrence (n=16) and Metastasis (n=18) after Mastectomy

Duration (year)	Locoregional recurrence (N/%)	Distant metastasis (N/%)
1	11 (68.8)	6 (33.3)
2	3 (18.8)	6 (33.3)
3	2 (12.5)	2 (11.1)
4	0 (0.0)	2 (11.1)
5	0 (0.0)	2 (11.1)

Table 4. Factors Associated with Tumour Recurrence

Variables	No recurrence	Recurrence	p-value
Tumour stage			
Early (T1, 2)	15	0	
Advanced (T3, 4)	32	16	0.01
Scarff-Bloom-Richardson grade			
Well differentiated	11	1	
Moderately/poorly differentiated	36	15	0.131
Positive lymph nodes			
<5	29	4	
≥5	18	12	0.011

T1: ≤2cm, T2: 2.1-5cm, T3: >5cm, T4: Any size with direct extension to chest wall/skin

Table 5. Logistic Regression Showing the Predictor of Locoregional Recurrence of Tumour

Variables	B	P value	Odd Ratio	95% C.I.	
				Lower	Upper
Tumour size	-0.362	.010*	0.696	0.529	0.917
Duration of lump	-0.037	0.579	0.963	0.845	1.099
Number of Lymph Node (> 5 lymph nodes)	-2.097	.015*	0.123	0.023	0.661
Gender (female)	2.488	0.174	12.035	0.333	435.606
Scarff-Bloom-Richardson (well differentiated)	1.525	0.241	4.596	0.358	58.935
Stage of Tumor (early stage)	-0.607	0.647	0.545	0.041	7.333

B- Beta value, P- p-value, reference group in parenthesis. CI: confidence interval; *- statistically significant (P<0.05).

radiation oncologist, and medical oncologist. Surgery still plays a major role in achieving a good local control in resectable LRRs. A large portion (75%) of our patients had wide local excision followed by systemic chemotherapy. Although the effectiveness of additional systemic therapy for patients with LRR remains controversial, it would be worthwhile where other treatment options are not consistent as a result of limited facilities. Additional therapies such as radiotherapy, endocrine therapy, molecular target therapies or a combination of these can improve the treatment outcome of patients with locoregional recurrence.

The five-year survival rate of postmastectomy patients in our center was 58.7%. This rate is slightly lower than 65.3% reported by Ayandipo et al. [2, 31]. The observed difference could have been due to the availability of more adjuvant treatments in the latter study. In contrast, high-income countries still have higher rates of survival compared with low-and middle-income countries [32]. Advanced stage at presentation, unfavorable tumour grade, financial constraints with treatment inconsistencies and limited infrastructures account for the disparities [12, 13, 31, 33].

This study is limited by its retrospective nature which has the demerit of poor record keeping. We also did not have facilities for IHC and radiation therapy. These two would have impacted the quality of care, drive low the occurrence of LRR and metastatic disease, and make our study more robust. Furthermore, healthcare financing is by way of fees for service and out-of-pocket expenditures. This makes the cost of care out of reach, and the use of targeted/biologic therapy not feasible.

In conclusion, LRR and metastasis frequently occur

following mastectomy and post-mastectomy patients may still remain at risk despite undergoing chemotherapy. Advanced tumour stage and lymph nodes positivity are risk factors identified for LRR. Early presentation, availability of diagnostic and treatment facilities with more robust adjuvant therapies can reduce the rates.

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Conflict of interest

The authors declare no conflict of interest.

References

- Jedy-Agba E, Curado MP, Ogunbiyi O, Oga E, Fabowale T, Igbino F, Osabor G, et al. Cancer incidence in Nigeria: a report from population-based cancer registries. *Cancer Epidemiology*. 2012 Oct;36(5):e271-278. <https://doi.org/10.1016/j.canep.2012.04.007>
- Ayandipo O, Adepoju O, Ogun G, Afuwape O, Soneye O, Ulasi I. Axillary nodal metastasis and resection margins as predictors of Loco Regional Recurrence in Breast Cancer Patients. *African Health Sciences*. 2022 03;22(1):115-124. <https://doi.org/10.4314/ahs.v22i1.15>
- Edge J, Buccimazza I, Cubasch H, Panieri E. The challenges of managing breast cancer in the developing world - a perspective from sub-Saharan Africa. *South African Medical*

- Journal = Suid-Afrikaanse Tydskrif Vir Geneeskunde. 2014 05;104(5):377-379. <https://doi.org/10.7196/samj.8249>
4. Zouladeny H, Dille I, Wehbi NK, Kim J, Soliman AS. Epidemiologic and Clinical Profiles of Breast Diseases in Niger. *International journal of cancer and oncology*. 2015;2(2):10.15436/2377-0902.15.015.
 5. Agodirin O, Aremu I, Rahman GA, Samuel O, Akande H, Olaogun J, Anyan R. Demographic Pattern, Tumor Size and Stage of Breast Cancer in Africa: A Meta-analysis. *Asian Pacific Journal of Cancer Care*. 2021 Nov 03;6:477-492. <https://doi.org/10.31557/apjcc.2021.6.4.477-492>
 6. Jemal A, Murray T, Ward E, Samuels A, Tiwari RC, Ghafoor A, Feuer EJ, Thun MJ. *Cancer statistics, 2005*. CA: a cancer journal for clinicians. 2005;55(1):10-30. <https://doi.org/10.3322/canjclin.55.1.10>
 7. Cheng JC, Chen CM, Liu MC, Tsou MH, Yang PS, Jian JJ, Cheng SH, Tsai SY, Leu SY, Huang AT. Locoregional failure of postmastectomy patients with 1-3 positive axillary lymph nodes without adjuvant radiotherapy. *International Journal of Radiation Oncology, Biology, Physics*. 2002 03 15;52(4):980-988. [https://doi.org/10.1016/s0360-3016\(01\)02724-9](https://doi.org/10.1016/s0360-3016(01)02724-9)
 8. Wallgren A, Bonetti M, Gelber RD, Goldhirsch A, Castiglione-Gertsch M, Holmberg SB, Lindtner J, et al. Risk factors for locoregional recurrence among breast cancer patients: results from International Breast Cancer Study Group Trials I through VII. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*. 2003 04 01;21(7):1205-1213. <https://doi.org/10.1200/JCO.2003.03.130>
 9. Holleczeck B, Stegmaier C, Radosa JC, Solomayer E, Brenner H. Risk of loco-regional recurrence and distant metastases of patients with invasive breast cancer up to ten years after diagnosis - results from a registry-based study from Germany. *BMC cancer*. 2019 05 30;19(1):520. <https://doi.org/10.1186/s12885-019-5710-5>
 10. Huang J, Tong Y, Chen X, Shen K. Prognostic Factors and Surgery for Breast Cancer Patients With Locoregional Recurrence: An Analysis of 5,202 Consecutive Patients. *Frontiers in Oncology*. 2021 Oct 13;11:763119. <https://doi.org/10.3389/fonc.2021.763119>
 11. Anderson SJ, Wapnir I, Dignam JJ, Fisher B, Mamounas EP, Jeong J, Geyer CE, et al. Prognosis after ipsilateral breast tumor recurrence and locoregional recurrences in patients treated by breast-conserving therapy in five National Surgical Adjuvant Breast and Bowel Project protocols of node-negative breast cancer. *Journal of Clinical Oncology: Official Journal of the American Society of Clinical Oncology*. 2009 05 20;27(15):2466-2473. <https://doi.org/10.1200/JCO.2008.19.8424>
 12. Ogundiran TO, Ayandipo OO, Ademola AF, Adebamowo CA. Mastectomy for management of breast cancer in Ibadan, Nigeria. *BMC surgery*. 2013 Dec 19;13:59. <https://doi.org/10.1186/1471-2482-13-59>
 13. Olaogun J, Agodirin O, Etonyeaku A, Omonisi A, Joseph O. Management of Locally Advanced Breast Cancer: Challenges and Treatment Outcomes in an Emerging Tertiary Hospital in South-Western Nigeria. *Journal Of Clinical And Diagnostic Research*. 2021 02 01;15. <https://doi.org/10.7860/JCDR/2021/46159.14484>
 14. Truong PT, Olivetto IA, Kader HA, Panades M, Speers CH, Berthelet E. Selecting breast cancer patients with T1-T2 tumors and one to three positive axillary nodes at high postmastectomy locoregional recurrence risk for adjuvant radiotherapy. *International Journal of Radiation Oncology, Biology, Physics*. 2005 04 01;61(5):1337-1347. <https://doi.org/10.1016/j.ijrobp.2004.08.009>
 15. Garg AK, Strom EA, McNeese MD, Buzdar AU, Hortobagyi GN, Kuerer HM, Perkins GH, et al. T3 disease at presentation or pathologic involvement of four or more lymph nodes predict for locoregional recurrence in stage II breast cancer treated with neoadjuvant chemotherapy and mastectomy without radiotherapy. *International Journal of Radiation Oncology, Biology, Physics*. 2004 05 01;59(1):138-145. <https://doi.org/10.1016/j.ijrobp.2003.10.037>
 16. Huang EH, Tucker SL, Strom EA, McNeese MD, Kuerer HM, Hortobagyi GN, Buzdar AU, et al. Predictors of locoregional recurrence in patients with locally advanced breast cancer treated with neoadjuvant chemotherapy, mastectomy, and radiotherapy. *International Journal of Radiation Oncology, Biology, Physics*. 2005 06 01;62(2):351-357. <https://doi.org/10.1016/j.ijrobp.2004.09.056>
 17. Wangchinda P, Ithimakin S. Factors that predict recurrence later than 5 years after initial treatment in operable breast cancer. *World Journal of Surgical Oncology*. 2016 08 24;14(1):223. <https://doi.org/10.1186/s12957-016-0988-0>
 18. Mansell J, Monypenny IJ, Skene AI, Abram P, Carpenter R, Gattuso JM, Wilson CR, Angerson WJ, Doughty JC. Patterns and predictors of early recurrence in postmenopausal women with estrogen receptor-positive early breast cancer. *Breast Cancer Research and Treatment*. 2009 09;117(1):91-98. <https://doi.org/10.1007/s10549-008-0291-z>
 19. Komoike Y, Akiyama F, Iino Y, Ikeda T, Akashi-Tanaka S, Ohsumi S, Kusama M, et al. Ipsilateral breast tumor recurrence (IBTR) after breast-conserving treatment for early breast cancer: risk factors and impact on distant metastases. *Cancer*. 2006 01 01;106(1):35-41. <https://doi.org/10.1002/encr.21551>
 20. Kennecke H, McArthur H, Olivetto IA, Speers C, Bajdik C, Chia SK, Ellard S, Norris B, Hayes M, Barnett J, Gelmon KA. Risk of early recurrence among postmenopausal women with estrogen receptor-positive early breast cancer treated with adjuvant tamoxifen. *Cancer*. 2008 04 01;112(7):1437-1444. <https://doi.org/10.1002/encr.23320>
 21. Bijker N, Rutgers EJ, Peterse JL, Dongen JA, Hart AA, Borger JH, Kroon BB. Low risk of locoregional recurrence of primary breast carcinoma after treatment with a modification of the Halsted radical mastectomy and selective use of radiotherapy. *Cancer*. 1999 04 15;85(8):1773-1781.
 22. Ali-Gombe M, Mustapha MI, Folasire A, Ntekim A, Campbell OB. Pattern of survival of breast cancer patients in a tertiary hospital in South West Nigeria. *Ecancermedicalscience*. 2021;15:1192. <https://doi.org/10.3332/ecancer.2021.1192>
 23. Newman LA, Hunt KK, Buchholz T, Kuerer HM, Vlastos G, Mirza N, Ames FC, Ross MI, Singletary SE. Presentation, management and outcome of axillary recurrence from breast cancer. *American Journal of Surgery*. 2000 Oct;180(4):252-256. [https://doi.org/10.1016/s0002-9610\(00\)00456-6](https://doi.org/10.1016/s0002-9610(00)00456-6)
 24. Bedwinek J. Natural History and Management of Isolated Local-Regional Recurrence Following Mastectomy. *Seminars in Radiation Oncology*. 1994 Oct;4(4):260-269. <https://doi.org/10.1053/SRAO00400260>
 25. Tienhoven G, Voogd AC, Peterse JL, Nielsen M, Andersen KW, Mignolet F, Sylvester R, et al. Prognosis after treatment for loco-regional recurrence after mastectomy or breast conserving therapy in two randomised trials (EORTC 10801 and DBCG-82TM). *EORTC Breast Cancer Cooperative Group and the Danish Breast Cancer Cooperative Group. European Journal of Cancer (Oxford, England: 1990)*. 1999 01;35(1):32-38. [https://doi.org/10.1016/s0959-8049\(98\)00301-3](https://doi.org/10.1016/s0959-8049(98)00301-3)
 26. Fisher B, Gebhardt MC. The evolution of breast cancer

- surgery: past, present, and future. *Seminars in Oncology*. 1978 Dec;5(4):385-394.
27. Abdus-salam A. Pattern of breast cancer metastasis at the Radiotherapy Clinic, Ibadan-A ten year review. *J Am Sci*. 2011;7:906-12.
 28. Anyanwu SN. Survival following treatment of primary breast cancer in eastern Nigeria. *East African Medical Journal*. 2000 Oct;77(10):539-543.
 29. Wichendu P, Dodiya-Manuel S. Advanced Breast Cancer in Nigeria: A Single Centre Experience. *African Journal of Biology and Medical Research*. 2021 05 17;4:51-56. <https://doi.org/10.52589/AJBMR-T1CPAENI>
 30. Agodirin O, Rahman GA, Olatoke S, Aremu I, Shittu A, Yusuf A, Oyewale S, et al. A Survey of the Impact Lockdown Due to COVID-19 Pandemic on the Volume of Patients Accessing Breast Cancer Care in Nigeria. *Pan African Journal of Life Sciences*. 2020 08 16;4:77-85. [https://doi.org/10.36108/pajols/0202/40\(0260\)](https://doi.org/10.36108/pajols/0202/40(0260))
 31. Ayandipo OO, Ogun GO, Adepoju OJ, Fatunla EO, Afolabi AO, Osuala PC, Ogundiran TO. Impact of axillary node-positivity and surgical resection margins on survival of women treated for breast cancer in Ibadan, Nigeria. *Ecancermedicalscience*. 2020;14:1084. <https://doi.org/10.3332/ecancer.2020.1084>
 32. Sankaranarayanan R, Swaminathan R, Brenner H, Chen K, Chia KS, Chen JG, Law SCK, et al. Cancer survival in Africa, Asia, and Central America: a population-based study. *The Lancet. Oncology*. 2010 02;11(2):165-173. [https://doi.org/10.1016/S1470-2045\(09\)70335-3](https://doi.org/10.1016/S1470-2045(09)70335-3)
 33. Adesunkanmi ARK, Lawal OO, Adelusola KA, Durosimi MA. The severity, outcome and challenges of breast cancer in Nigeria. *Breast (Edinburgh, Scotland)*. 2006 06;15(3):399-409. <https://doi.org/10.1016/j.breast.2005.06.008>



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