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# Two to Nine Year Review of Breast Conservation Therapy (BCT) for Breast Carcinoma: Clinico-Pathological Features and Outcomes in a Single Centre in East Africa

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## Abstract

**Introduction:** Breast conservation therapy compares to mastectomy in terms of overall survival and disease free survival. However it's utilization in most parts of the sub-Sahara Africa is minimal with various factors cited: patient preference, provider preference and limited access to radiation therapy. The aim of this study was to determine the clinico-pathological profile and outcomes of breast cancer patients treated with breast conservation therapy or mastectomy at a single referral centre.

**Methods:** We retrospectively analysed the details of breast cancer patients who underwent breast conservation therapy from the year 2008 to 2015 and compared this with patients who had undergone mastectomy during the same period at the Aga Khan University hospital.

**Results:** Ninety one patients who had breast conservation therapy and 187 patients who underwent mastectomy were included in this study. The majority of patients, 38.1% (n=106) had stage II breast cancer. Although there was no stage to stage comparison between the breast conservation group and the mastectomy group, patients who had breast conservation were likely to be younger, with tumour grade I or III and luminal A molecular subtype. There was no significant correlation with being nulliparous, grade II tumours, having received neoadjuvant chemotherapy or re-excision rates. Patients who had mastectomy were likely to be older with grade II breast cancer and had adjuvant chemotherapy.

**Conclusion:** The present study concluded that with proper pre-operative patient selection, breast conservation therapy has comparable clinico-pathological characteristics and outcomes to mastectomy.

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## Abbreviations

AJCC: American Joint Committee on Cancer; AKU: The Aga Khan University; AKUHN: The Aga Khan University Hospital, Nairobi; BCS: Breast Conservation Surgery; BCT: Breast Conservation Therapy; CITI: Collaborative Institutional Training Initiative; DFS: Disease Free Survival; EORTC: European Organization for Research and Treatment of Cancer; GLOBOCAN: Global Burden of Cancer study; LRFS: Local Recurrence Free Survival; MRM: Modified Radical Mastectomy; NCI: National Cancer Institute; NSABP: National Surgical Adjuvant Breast and Bowel Project; OS: Overall Survival; TNBC: Triple Negative Breast Cancer; TNM: Tumour Node Metastasis; USA: United States of America; WHO: World Health Organization

## Introduction

Breast cancer is the most commonly diagnosed cancer and the leading cause of cancer death in women world over. In Africa, it accounts for one in four diagnosed cancers and up to 20% of cancer deaths in women [1-3]. Age-adjusted incidence in non-Hispanic white women in the United States from breast cancer is 127.3 per 100,000 compared to the African-American women's 118.4. However age-adjusted mortality is higher in the African-American women at 30.8 per 100,000 women when compared to the non-Hispanic white women, which is at 22.7 per 100,000 women [4].

It is postulated that breast cancer in third world countries occurs less frequently when compared to the resource-rich countries. However, the mortality-to-incidence ratios, is higher in third world countries. For example case fatality is approximately four times greater in East African women compared to North American women [5].

Most countries in Sub-Saharan Africa do not maintain cancer registries hence limited data. Details of death registration vary from ne 100% in the World Health Organization (WHO) European Region to less than 10% in the African Region. Cancer-specific mortality statistics are available for only three countries, Mauritius, Reunion & South Africa. More than half of African women diagnosed with breast cancer die of the disease [6].

Breast cancer being a heterogeneous disease also manifests racial differences in the age, grade, receptor status, stage and even mortality. It has been postulated that higher mortality and lower survival rates among African-American women are because of factors associated with lower socioeconomic status and late stage at diagnosis [7-11]. Poverty, illiteracy, and a lack of health insurance are also associated with lower survival rates [12,13]. These racial differences in survival persisted even after adjusting for stage at diagnosis, access to health care, treatment, comorbid illness, marital status, and other pathologic and socio-demographic variables [14-17]. Aggressive tumour characteristics associated with poorer prognosis appear to be more common in African American women and may also contribute to lower survival rates [18,19]. By 2010, breast cancer death rates were 41% higher in African American than white women [4]. These Afro-American statistics may reflect the African female breast cancer patients probably due to their shared ancestry [20-23].

## Background of breast cancer treatment

The history of breast cancer treatment is rich. Leonides championed for a wide margin of excision and excision of localized tumours, foreshadowing the oncological principles of contemporary cancer surgical practice [24,25]. Galen, attributing breast cancer to the accumulation of black bile in the blood, suggested that it was a systemic disease [25].

During most of the 20th century William S. Halstead of Johns Hopkins hospital in the United States of America (USA) promoted radical mastectomy (first reported in 1894) and emphasised on removing tissues in one piece to prevent spread [26]. This was the treatment of choice for breast cancer of any stage, regardless of the patient's age, for about 80 years.

Patey and Handley from London advocated for modified radical mastectomy which preserved the pectoralis major muscle [27]. A randomized clinical trial to compare radical mastectomy with breast conservation surgery was then approved by the WHO in 1969. The recruitment of patients began at the Milan Cancer Institute in 1973, after the new procedure was standardized, and preliminary data showed that survival rates were equal after radical and breast conserving surgery were published in 1977 and 1981 [28,29].

The above studies provided necessary information that allowed dramatic reductions in the extent of surgery required for local control of breast cancer with decreases in treatment related morbidity that then popularized BCT (Table 1) [30-36].

## Surgical treatment of early breast cancer

Non-metastatic breast cancer includes early stage defined as patients with clinical stage II or below [37]. Generally, patients with resectable breast cancer can undergo BCT or mastectomy with or without reconstruction. BCT refers to excision of the breast tumour with concentric margin of surrounding healthy tissue and overlying Skin Island that has the biopsy site included and done in a cosmetically acceptable manner [38]. Its goals are to provide the survival equivalent of mastectomy, a cosmetically acceptable

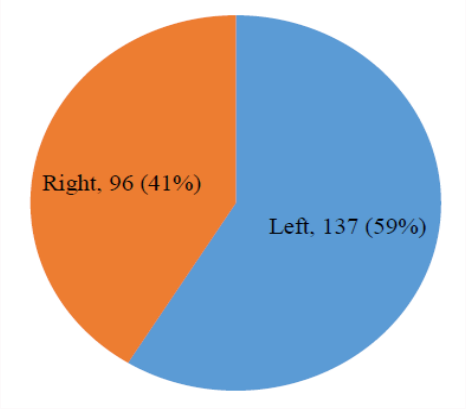


**Figure 1:** Patients presenting with breast lumps.

breast, and a low rate of recurrence in the treated breast. BCT allows patients with breast cancer to preserve their breast without sacrificing oncologic outcome.

There are few absolute contraindications to BCT [39]:

- First or second trimester pregnancy.
- Multicentric breast cancer.
- Previous irradiation of the breast.
- Persistent positive tissue margins after surgery.
- Connective tissue disorders like scleroderma.
- Large tumour size to breast ratio is a relative contraindication to BCT. For such patients an alternative approach is the use of neoadjuvant chemotherapy to downstage the tumour.

The surgical technique for BCT entails a curvilinear incision along the natural skin crease line (lines of Langer) or an elliptical incision and including the skin ellipse with the specimen. A clear macroscopic margin of about 3 mm of grossly normal breast tissue around the mass is also observed. The specimen is then labeled and sent to the laboratory for frozen section analysis, the results of which are communicated to the surgeon by phone call. This is reported as either positive or negative. Positive margins are defined as ink on tumour, while negative margins as no ink on tumour. Should the margin status are positive, the surgeon performs re-excision at the same sitting. Sentinel lymph node biopsy is performed on patients with non-palpable nodes or less than 3 sentinel lymph nodes. Patients with palpable axillary lymphadenopathy or 3 or more sentinel nodes, undergo axillary lymph node dissection. Histopathology confirms the definite margin status. Patients with positive margins on histology undergo re-excision or mastectomy at a later date. After the surgery, post-operative radiotherapy is then administered.

Conversely, mastectomy is indicated for patients who are not candidates for BCT and those who prefer mastectomy. For this an elliptical incision is made to include a previous surgical biopsy site if present. The incision is usually placed horizontally to include the nipple-areolar complex and extended through the dermis into the subcutaneous adipose tissue to expose the superficial investing fascia of the breast. Superior and inferior flaps are then elevated and dissection continued circumferentially following the superficial fascia to its fusion with the muscular fascia around the anatomic borders of the breast. For Modified Radical Mastectomy (MRM), axillary

**Table 1:** Clinical trials comparing Survival after BCT with mastectomy.

| S.no | Trial | End point | Overall Survival | | Disease-free survival | |
|---|---|---|---|---|---|---|
| | | | BCT | Mastectomy | BCT | Mastectomy |
| 1 | Milan I trial | 20 years | 58.30% | 58.80% | 91.20% | 97.70% |
| 2 | Institut Gustav Roussy | 15 years | 73% | 65% | 69% | 71% |
| 3 | NSABP B-06 | 20 years | 63% | 59% | 49% | 50% |
| 4 | NCI USA trial | 10 years | 77% | 75% | 72% | 69% |
| 5 | EORTC trial | 20 years | 39.10% | 44.40% | 54% | 58% |
| 6 | Danish Breast Cancer Group | 6 years | 79% | 82% | 70% | 66% |

**Table 2:** Clinical demographic characteristics.

| Variables | Type of Surgery | | |
|---|---|---|---|
| | Frequency (N=278) | BCT (n=91) | Mastectomy (n=187) |
| Age at time of diagnosis | | | |
| <35 | 27 (9.7) | 10 (37.0) | 17 (63.0) |
| 36-50 | 103 (37.1) | 37 (35.9) | 66 (64.1) |
| >51 | 148 (53.2) | 44 (29.7) | 104 (70.3) |
| Race | | | |
| African | 242 (87.1) | 85 (35.9) | 157 (64.9) |
| Asian | 23 (8.3) | 3 (13.0) | 20 (87.0) |
| Other | 13 (4.7) | 3 (23.1) | 10 (76.9) |
| Parity | | | |
| Nulliparous | 12 (4.3) | 5 (41.7) | 7 (58.3) |
| Para 1 | 20 (7.2) | 3 (15.0) | 17 (85.0) |
| Multiparous (2 or more) | 60 (21.6) | 23 (38.3) | 37 (61.7) |
| Grand multiparous (5 or more) | 19 (6.8) | 6 (31.6) | 13 (68.4) |
| Not specified | 167 (60.1) | 54 (32.3) | 113 (67.7) |
| Laterality | | | |
| Left | 164 (59.0) | 54 (32.9) | 110 (67.1) |
| Right | 114 (41.0) | 37 (32.5) | 77 (67.5) |
| Presenting symptoms | | | |
| Breast lump | 233 (83.8) | 81 (34.8) | 152 (65.2) |
| Breast pain | 15 (5.4) | 4 (26.7) | 11 (73.3) |
| Nipple discharge | 5 (1.8) | 2 (40.0) | 6 (60.0) |
| Combination of any two above | 10 (3.6) | 2 (20.0) | 8 (80.0) |
| Other | 15 (5.4) | 2 (13.3) | 13 (86.7) |

dissection is performed to level II nodes.

Post mastectomy radiotherapy is indicated for patients at high risk for local recurrence, including those with any involved axillary lymph nodes. If the likelihood of post mastectomy radiotherapy is high preoperatively, this may affect the choice of mastectomy type, the choice of the reconstructive approach, and optimal timing of the breast reconstruction (immediate versus delayed). Oncoplastic techniques recently introduced, utilize more cosmetically acceptable incisions like sub-areolar incisions. Established goals of oncoplastic breast conserving surgery are to broaden the indication for breast conservation towards larger tumours, and to improve aesthetic outcomes. There is a growing demand to standardize various aspects of oncoplastic BCS for implementation in clinical research and practice.

## The African perspective

Most patients in Africa typically present approximately 10 years younger than breast cancer patients of western nations and at advanced stages [20,40-43]. African young women suffer a severe form of the disease in terms of higher grade, late stage at diagnosis and a worse prognosis. A higher prevalence of hormone receptor negative and Triple-Negative Breast Cancers (TNBC) has also been previously reported [40-43]. TNBC subtypes account for 12% to 20% of all breast cancer; however, women of African descent tend to have a high incidence of TNBC translating into poorer outcomes [44]. A study by Sayed et al., [45] at the Aga Khan University Hospital, Nairobi (AKUHN), however indicated that the receptor status may be comparable to that in the west, with 72.8% ER positive breast cancer, 64.8% being PR positive, HER2 in 17.6% and TNBC in 20.2%. The majority of women (over 50% to 70%) present with late

**Table 3:** Pathological characteristics of patients.

| Variables | Frequency (N=278) | BCT (n=91) | Mastectomy (n=187) |
|---|---|---|---|
| Tumor size | | | |
| Tx | 9 (3.2) | 0 (0.0) | 9 (100.0) |
| Tis | 11 (4.0) | 3 (27.3) | 8 (72.7) |
| T1 | 39 (14.0) | 12 (30.8) | 27 (69.2) |
| T2 | 129 (46.4) | 46 (35.7) | 83 (64.3) |
| T3 | 39 (14.0) | 11 (28.2) | 28 (71.8) |
| T4 | 4 (1.4) | 1 (25.0) | 3 (75.0) |
| Not specified | 47 (16.9) | 18 (38.3) | 29 (61.7) |
| Nodal status | | | |
| NX | 10 (3.6) | 3 (30.0) | 7 (70.0) |
| N0 | 92 (33.1) | 38 (41.3) | 54 (58.7) |
| N1 | 69 (24.8) | 24 (34.8) | 45 (65.2) |
| N2 | 42 (15.1) | 7 (16.7) | 35 (83.3) |
| N3 | 16 (5.8) | 1 (6.3) | 15 (93.7 |
| Not specified | 49 (17.6) | 18 (36.7) | 31 (63.3) |
| Staging modality | | | |
| Clinical stage | 2 (0.7) | 0 (0.0) | 2 (100.0) |
| Pathological stage | 273 (98.2) | 91 (33.3) | 182 (66.7) |
| Not specified | 3 (1.1) | 0 (0.0) | 3 (100.0) |
| Staging class | | | |
| stage 0 | 25 (9.0) | 3 (12.0) | 22 (88.0) |
| stage 1 | 32 (11.5) | 10 (31.2) | 22 (68.8) |
| stage 2 | 106 (38.1) | 43 (40.6) | 63 (59.4) |
| stage 3 | 73 (26.3) | 17 (23.3) | 56 (76.7) |
| NA | 40 (14.4) | 17 (42.5) | 23 (57.5) |
| Histological subtypes | | | |
| Invasive ductal carcinoma | 201 (72.3) | 74 (36.8) | 127 (63.2) |
| Invasive lobular carcinoma | 12 (4.3) | 3 (25.0) | 9 (75.0) |
| DCIS | 20 (7.2) | 2 (10.0) | 18 (90.0) |
| Other | 41 (14.7) | 12 (29.3) | 29 (70.7) |
| Not specified | 4 (14.8) | 0 (0.0) | 4 (100.0) |
| Histological grade | | | |
| Grade 1 | 43 (15.5) | 13 (30.2) | 30 (69.7) |
| Grade 2 | 134 (48.2) | 40 (29.8) | 94 (70.2) |
| Grade 3 | 86 (30.9) | 36 (41.9) | 50 (58.1) |
| Not specified | 15 (5.4) | 2 (13.3) | 13 (86.7) |
| Receptor status | | | |
| Luminal A | 5 (35.5) | 112 (67.5) | 166 (59.7) |
| Luminal B | 4 (57.4) | 3 (42.9) | 7 (2.5) |
| Triple negative | 1 (25.0) | 3 (75.0) | 4 (1.4) |
| HER2/neu positive | 5 (35.7) | 9 (64.3) | 14 (5.0) |
| Not specified | 27 (31.0) | 60 (69.0) | 87 (31.3) |
| Neo-adjuvant chemotherapy | | | |
| Yes | 82 (29.5) | 34 (41.5) | 48 (58.5) |
| No | 130 (46.8) | 43 (33.1) | 87 (66.9) |
| Not specified | 66 (23.7) | 14 (21.2) | 52 (78.8) |

| | | | |
|---|---|---|---|
| Hormonal therapy | | | |
| Yes | 164 (59.0) | 57 (34.8) | 107 (65.2) |
| No | 66 (23.7) | 18 (27.3) | 48 (72.7) |
| Not specified | 48 (17.3) | 16 (33.3) | 32 (66.7) |
| Adjuvant chemotherapy | | | |
| Yes | 195 (70.1) | 73 (37.4) | 122 (62.6) |
| No | 34 (12.2) | 6 (17.7) | 28 (82.3) |
| Not specified | 49 (17.6) | 12 (24.5) | 37 (75.5) |
| Distance of closest resection margin | | | |
| 6 mm to 10 mm | 7 (2.6) | 2 (28.6) | 5 (71.4) |
| <5 mm | 13 (4.8) | 5 (38.5) | 8 (61.5) |
| >10 mm | 189 (69.2) | 63 (33.3) | 126 (66.7) |
| Not specified | 64 (23.4) | 21 (32.8) | 43 (67.2) |

stage disease that is not amenable to BCT. This makes mastectomy to be the most common surgical procedure performed [43,46].

The limited availability of radiotherapy in Africa is a major factor contributing to the limited access to BCT in many countries. Even where radiotherapy facilities are available in Africa, very few women are considered candidates for breast conservation despite achieving good response rates to neo-adjuvant chemotherapy for various reasons [26]. Maalej et al., [47] reported that even though half of breast cancer patients present with resectable disease in Tunisia, the breast conservation rate was only 17.6% and was dependent on the surgeon's preferences. Egyptian women with early stage disease may be considered poor candidates for breast conservation because of high illiteracy rate and compounding cultural influences. These factors do not allow for regular surveillance of patients following breast conservation required to detect early recurrence in the remaining breast tissue [48].

Other factors cited include: patient preference, surgeon preference, fear of breast cancer recurrence, adverse effects of radiation therapy and lack of other modalities of treatment. Despite universal acceptance of BCT as the treatment alternative for early stage breast cancer patients, the utilization of the same has not been realized in most Sub-Saharan countries [43,46,49,50].

## The Aga Khan University Hospital

The Aga Khan University Hospital, Nairobi (AKUHN), is a tertiary private teaching hospital that has an active breast clinic that is also dedicated to breast cancer screening, diagnosis and management. We have multiple awareness programs including seminars, breast cancer month that have enabled detection of breast cancer at its early stages.

The patient profile comprises urban, literate women with access to information, health insurance and healthcare facilities. The age group most affected by breast cancer is in the 45 to 49 year range with only about 32.5% presenting with early disease. Thirty one percent of the patients fewer than 50 years have early disease. These patient populations under 50 years make up about 66% of the breast cancer female patients [51].

BCT is an available option offered to patients who meet its criteria. This has been made possible with the availability of surgeons with experience in oncoplastic techniques, well equipped laboratory with capability of doing frozen section with prompt reporting of the results and radiotherapy services with radio-oncologists. About 20% of the patients with breast cancer undergo breast conservation. BCT has been practiced at the Aga Khan University Hospital Nairobi (AKUHN) since the year 2008 with over 150 cases up to the year 2015 [52].

**Table 4:** Patients outcomes.

| Variables | Frequency | BCT | Mastectomy |
|---|---|---|---|
| Re-excision before local recurrence | | | |
| Yes | 30 (10.8) | 10 (33.3) | 20 (66.7) |
| No | 223 (80.2) | 75 (33.6) | 148 (66.4) |
| Not specified | 25 (9.0) | 6 (24.0) | 19 (76.0) |
| What was the second operation | | | |
| Mastectomy | 26 (86.7) | 8 (30.8) | 18 (69.2) |
| Repeat wide local excision | 4 (13.3) | 2 (50.0) | 2 (50.0) |
| Time to recurrence/distance metastasis | | | |
| 3+ years | 0 (0.0) | 2 (100.0) | 2 (0.7) |
| <3 years | 6 (60.0) | 4 (40.0) | 10 (3.6) |
| No recurrence | 83 (31.8) | 178 (68.2) | 261 (93.9) |
| Not specified | 0 (0.0) | 3 (100.0) | 3 (1.1) |
| Recurrence | 2 (100.0) | 0 (0.0) | 2 (0.7) |

In terms of adequacy of excision margins, which is a requisite in BCT, Riogi et al., [52] demonstrated that for breast conservation surgeries done in AKUHN up to 85.7% were negative and only 14.3% needed a re-excision or mastectomy. This is comparable to published rates in the western world [53-55].

## Justification

BCT is a novel therapy for breast cancer in East Africa [56,57]. We intend to evaluate the clinico-pathologic features of our breast cancer patients who undergo BCT and how they fare after such treatment in terms of disease free survival and overall survival. We also intend to compare their clinico-pathological features and outcomes with the patients who undergo MRM.

To our knowledge, no studies in the region have been done on BCT clinico-pathological features and outcomes. This is in the background of differences in the molecular subtypes in the African women and the comparatively younger age affected by breast cancer. Compared with data on the incidence and overall burden of the

disease, there is a significant paucity of data on breast cancer outcomes including overall survival and disease free survival comparing breast conservation therapy and mastectomy.

As such most of our practice is based on evidence outside Africa. The evidence for the implementation of BCT as the alternative treatment for early breast cancer to mastectomy is largely from studies done in the western nations. This is in the background that breast cancer in younger women is characterized by a more aggressive disease [58].

**Aims and objectives:** The aim of this study was to describe an institutional experience with BCT in terms of the clinico-pathological features and the outcome after such treatment.

**Primary objective:** To determine the clinico-pathological features, disease free survival and overall survival of breast cancer patients who had undergone BCT between 2008 and 2015 at AKUHN.

**Secondary objectives:** To describe BCT and mastectomy in terms of:

- Overall survival and disease free survival
- Stage and grade of breast cancer
- The molecular subtypes

## Materials and Methods

### Research design

This was a single institution historical cohort study of female patients with breast cancer treated with either breast conservation therapy or modified radical mastectomy. The study employed cross-section retrospective design to collect data from records of women that underwent surgery between the periods: 1st January 2008 to 31st December 2015.

### Data collection and management

Data collection was done via retrieval of records of patients who had breast surgery for breast carcinoma at AKUHN between 2008 and 2015. Data was obtained from the hospital's medical records department. Pathology reports were obtained from the hospital's software system 'care2000'.

Patients' details were assessed for demographics like age, patient's race and parity; clinical manifestation like breast lump, breast pain, nipple discharge; tumour-related characteristics (tumour size, TNM stage and grade, molecular subtypes), treatment-related characteristics and follow-up related characteristics. (See Patient Data Capture Sheet: Breast conservation therapy at the AKUHN 2008-2015 and the appendix below). Data on staging were retrieved from the pathology report biopsy specimen, clinical assessment of the admitting physician as recorded in the file or when absent, they were derived by assessing the staging investigations entered in the file. The American Joint Committee on Cancer (AJCC) 7th edition staging system was used [21].

Outcomes of interest were disease free survival and overall survival. Disease-free survival that is loco-regional recurrence or distance recurrence was measured from the date of surgery until recurrence or the follow-up visit at the 2nd and or 9th year whichever came first. Local or regional recurrences was be defined as recurrences in the ipsilateral supraclavicular, axillary, or internal mammary nodal regions; chest-wall disease; or inoperable recurrence within the breast. Recurrence within the breast that was successfully treated by mastectomy was considered a local or regional recurrence. Overall survival was measured from the date of surgery until death or at the 2nd or the 9th year. The timing of censoring was at least 2 years since the last entered patient record was on the 31st December 2015 and the end of the study period was 31st December 2017. The data collected were entered into a computer using the goggle forms software that is password protected and there-after analysed.

### Sample size

All eligible candidates were recruited. This included all the breast cancer patients underwent breast conservation therapy between 1st January 2008 and 31st December 2015.

### Inclusion criteria

- All records of the patients treated for primary breast cancer with either BCT or MRM between January 1st 2008 and December 31st 2015.
- Stage 0 to IIIA breast cancer.
- Unilateral breast cancer.

### Exclusion criteria

- Records of patients with breast cancer of stage IIIB to Stage IV
- Bilateral breast cancer by the time of index surgery
- Previous history of another cancer.
- Histology not consistent with a solid breast tumour, including sarcoma, Paget's disease of the nipple, lymphoma and hematopoietic tumours.

### Statistical analysis

Profiling of patient-related characteristics was done. This included age, race, parity, presenting symptoms and laterality. Tumour- related characteristics was also profiled to include the size, nodal status, histologic subtype and receptor status. Treatment-related characteristics included neo-adjuvant therapy, adjuvant therapy, resection margins, conversion to mastectomy rates and hormonal therapy. Follow-up related characteristics included time to recurrence, number of follow up visits and duration of follow-up. We did not obtain data on mortality and therefore did not analyse mortality rates.

Data were collected via a data-sheet form designed for the study (see appendix below) and entered into a spreadsheet program. These were then analysed done using stata version 12 and two sample test of proportion to compare the equality of the proportions. The results (percentages, rates and proportions) were presented in tables and graphs.

Data collected were stored in a safe computer with a password only accessible to the principal investigator.

## Results and Discussion

The Aga Khan University Hospital, Nairobi (AKUHN), is a tertiary private teaching hospital that has an active breast clinic that is also dedicated to breast cancer screening, diagnosis and management. We have multiple awareness programs including seminars, breast cancer month that have enabled detection of breast cancer at its early stages. BCT is an available option offered to patients who meet its

criteria and has been practiced at the Aga Khan University Hospital Nairobi (AKUHN) since the year 2008 with over 150 cases up to the year 2015 [52]. In this study, breast conservation therapy was offered to 32.7% of the breast cancer patients who were eligible for it. Although this is higher than early work done by Riogi and Wasike in which only 21.9% had BCT, it is still lower than what other series report of about 48% [52,59-62]. This relatively higher utility of BCT can be attributed to the longer study duration and the higher sensitization of BCT (Tables 2-4 and Figure 1).

In terms of age, 53.2% of the patients were over the age of 51 years, which is similar to what Maalej reported in Tunisia and from the global perspective [47,63,64]. Previous study at AKUHN had indicated an average age of 45 years [51,52]. Young-aged breast cancer (less than 35 years) was 9.7% in our series similar to Korea but higher than in the US and European countries [65,66]. When BCT was compared to mastectomy, we found that BCT was popular among the younger patients; mastectomy was commoner as the age increased.

The sample population was largely African (87.1%), likely due to their predominance in this locality. However this could also be due to the limited number of patients in this study. BCT was offered in up to 36% of the African which would reflect the relatively higher socioeconomic status of this patient population. This is however anecdotal as we were not able to gather such data due to inadequate record keeping. The Asian race, though relatively common in the hospital's catchment area only contributed to 8.3%.

A surprising finding was the relatively lower proportion of breast cancer in the nulliparous women (4.3%). This was surprising since traditionally this has been a risk factor to breast cancer [20,67-69]. Makanga et al., [51] in his study also found a relatively lower incidence of 16% of the breast cancer patients to be nulliparous. This however could be attributed to the lower number of patients and the inadequacy of documentation in a retrospective study. In contrast, multiparous women with 2 to 4 children had the highest frequency of 21.6%. In all categories, more women had mastectomy as compared to BCT.

In terms of presentation, painless breast lump was the commonest symptom and predominantly on the left breast. Most of the tumours (46.4%) had estimated sizes of between 20 mm to 50 mm. This is similar to what Riogi et al., [52] found at an average size of 23.5 mm as well as in Maalej et al., [47] study in which the range was between 35.8 mm and 50.7 mm. BCT was offered more to this category of patients' tumour size, while mastectomy was offered more to T3 and T4 tumours. Though absolute size alone is not a criterion to BCS, it likely suggests the suitability of BCS given other factors. Gakinya and colleagues however found the average tumour size to be 5.9 cm [70].

For the infiltrants cancers, grade II was the most prevalent (48.2%), while 30.9% had grade III disease. Only 15.5% had grade I breast cancer. Other findings in Africa reflect similar higher grade breast cancer, with Maalej et al., [47] reporting 53.6% having grade II breast cancer. Two thirds of the patients had nodal metastasis. Both the BCT and mastectomy arms had majority of the patients having N1 disease and above. The tumour grade and nodal involvement did not influence the type of surgery as demonstrated by other studies [38].

The commonest molecular subtype in this study was luminal A (59.7%). This is in keeping with other studies done on molecular subtypes in the west [18,71]. Gakinya et al. however found that the incidence of luminal A breast cancer in an earlier study was 42%, lower than what our study found but still the commonest molecular subtype [70]. HER2/neu breast cancer was the second commonest with five percent, while luminal B disease was 2.5% and triple negative breast cancer at 1.4%. The latter was surprisingly lower than what other studies have quoted in earlier studies of about 23% [18,70,72]. Luminal A breast cancer was also the commonest molecular subtype across all the age groups and all the stages of breast cancer evaluated in this study.

The staging modality was predominantly pathological. Early stage disease was noted in this with 58.6% of the patients presenting with stage 0, I or II disease. Twenty six percent presented with stage III disease. This is contrary to what Makanga et al., [51] had earlier found of only 32.5% of breast cancer patients having early stage disease. Our findings in this study could be attributed to the earlier diagnosis in this population of patients but also the exclusion of stage IV breast cancer patients and the limited number of patients cannot be underplayed. Calleb et al., [73] demonstrated late stage of presentation at the coast provincial general hospital. Similar findings were obtained by Vorobiof et al., [74] in South Africa and Fregene et al., [20]. The proportion of breast cancer patients in which BCS was appropriate was not stage dependent; 4.1% (n=3) in carcinoma in situ, 14.9% (n=11) in stage I, 58.1% (n=43) in stage II and 22.9% (n=17) in stage III. This is in contradistinction to what Tyldesley et al., [62] found, though for the suitable BCS patient, higher stage is not a contraindication to the operation. When stage was compared to the age groups, it was found that postmenopausal women (over the age of 50 years), were the majority across all the stages of disease. However, there was no statistical significance noted when stage was compared across the different age groups.

The commonest histologic diagnosis was invasive ductal carcinoma (72.3%) which is similar to contemporary population-based series [52,75]. More than two thirds of the patients in all the categories underwent mastectomy. However, for DCIS in which 90% of the patients underwent mastectomy with only 10% undergoing BCT.

For neo-adjuvant chemotherapy, only 29.5% of the patients received this. Of these, 41.5% underwent BCT.

Hormonal therapy was administered to 59% of the patients. The ones who underwent BCT constituted were 34.8%. (Compare hormonal therapy with receptor status). Adjuvant chemotherapy was administered to seventy percent of the patients. Of these, 37.4% had undergone BCT. The distance of closest resection margin was more than 10 mm in both types of surgeries.

In this study positive margins that necessitated re-excision were only 10.8%. This is a slight improvement from the earlier documented positive margin of 15.3% [52]. Other centres have published excision rates ranging from 13% to 72% [53-55]. This could be attributed to our wider margin levels of more than 10 mm in two thirds of our patients undergoing BCT. Other centres have used margins of even 2 mm [76]. The majority of our patients who had positive margins (86.7%) were treated with mastectomy. Eighty three percent of the patients had no recurrence during the study duration.

## Limitations

This being a retrospective study, the investigator had to retrieve pre-existing data that was not necessarily acquired in a predetermined

way and hence inherently susceptible to poor record keeping, lack of standardization and methods of recording. We particularly faced challenges from the private patients where the recording was highly abbreviated and poor follow up was noted.

We were not able to estimate disease free survival rates and overall survival rates largely as a result of lack of data on mortality. This could have been due to loss of follow up of our patients or lack of documentation of such.

The lack of significant difference to the characteristics analysed may be because of the small sample size used in this study.

## Conclusion and Recommendations

Standardization of patients records especially for cancer diagnosis. This will facilitate future population or hospital based studies with better precision and accuracy.

Follow up of the patients was noted to be erratic and led largely to inadequate record keeping. This can be reduced by perhaps calling patients whose appointments is due and finding out their reason for not coming for review or for choosing another facility for continued care.

A larger study with prolonged follow up patients will be more generalizable to the population. This is therefore also recommended.

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