**QUALITY OF BREAST CANCER CARE IN A TEACHING HOSPITAL IN ADDIS ABABA, ETHIOPIA**

**Endale Anberber Alemu1**

**1** **Addis Ababa University, College of Health Sciences, School of Medicine, Department of Surgery**

**Email:** [**endale.anberber@gmail.com**](mailto:endale.anberber@gmail.com)

[**endale.anberber@aau.edu.et**](mailto:endale.anberber@aau.edu.et)

**Mobile: +251911424659**

**ABSTRACT**

**Background**

Breast cancer is one of the commonest cancers in female both in developed and developing countries. Quality measurement isimportant in breast cancer treatment to evaluate the different diagnostic modalities, to see effectiveness and safety of treatment according to recommended guidelines and to improve cancer care. Quality care assessment should include both process and outcome. The objective of the study was to assess the quality of patient evaluation, investigation, surgical management and early complications.

**Method**

Retrospective crossectional study was done on 65 patients operated for breast cancer from January 15, 2018 to July 24, 2019 fulfilling the inclusion criteria. List of patients was collected from the operation theatre registration book, patient’s chart retrieved and information collected. Analysis was done using SPSS version 25.

**Result**

The mean and median age of patients was 43.7 and 41.0 years respectively. Males make 4.6% of all patients. The median duration of symptoms before presentation was 5.0 months. Nearly 50% (49.2%) were in stage III. Clinical evaluation was incomplete for significant percentage of patients. For 18.5% diagnosis was confirmed by surgical biopsy. Only 12.9% have undergone mammographic examination. 16.9% and 1.5% patients developed wound infection and flap necrosis respectively. Axillary dissection was adequate only for 46.7% of patients. There is no sentinel lymph node biopsy, breast conserving surgery and multidisciplinary teams (MDT) approach for breast cancer.

**Conclusion**

Most of the quality indicators of breast cancer show poor performance.

**Key Words**: Breast Cancer, Quality of care, MRM, ALND, mammography, FNA, Core needle biopsy

**BACKGROUND**

Breast cancer is one of the commonest cancers in female both in developed and developing countries **(1, 2)**. Despite high prevalence, mortality from breast cancer has been decreasing in developed countries due to early detection and advancement in breast cancer treatment.

Quality care in breast cancer is the means of achieving the maximum possible outcome with the available resources and current medical knowledge. Quality measurement isimportant in cancer treatment to evaluate the different diagnostic modalities, to see effectiveness and safety of treatment according to recommended guidelines and to improve cancer care **(1)**. It also identifies areas for intervention and improvement **(3)**. Even patients in developed countries like USA have 1-in-seven chance of missing some of the care they should be receiving **(4)**. The quality of life of breast cancer patients during and after treatment shows the level of the quality of care **(5)**. Many countries do not have standard to compare their performance with and to assure patients get access to best surgical practice **(5)**.

Quality measurement can measure process or outcome of care (survival, quality of care) **(6)**. But outcome is affected by conditions other than quality of care. So assessment of quality care should include both process and outcome **(6)**. The quality measurement may involve the diagnostic process, treatment, follow up and data documentation **(1)**. It also addresses time delivery of a particular treatment and available expertise of health professionals.

Countries/Institutions with same level of resources may achieve different levels of quality of life showing the different level of care **(5,** 4**)**. Different countries and different countries have their own quality care indicators. They differ in number and type of indicators. The Selection of indicator depends on the quality of data recording and availability of the different diagnostic and therapeutic modalities. One of the commonly used measures of quality of care is survival (5 years, 10 years, and 15 years). This needs good recording and follow up of patients for long time which makes it difficult in institutions where follow up not strict.

U/S examination and mammography are highly recommended before surgery **(7)**. Mammography is important to evaluate mass, nipple discharge and other symptoms of breast disease **(8)**. It can detect second cancer in the ipsilateral breast or contra lateral one. Preoperative breast U/S helps in characterization of primary in the breast **(8)** (especially in young patients with dense breast) and to detect axillary metastasis in patients with negative physical examination. Patients should always have U/S guided axillary staging **(9)**. It also guides fine needle aspiration (FNA) sample collection (7, 9). The Belgian Health Care Knowledge Centre**,** Quality indicators in breast cancer has shown 14% of patients have no record of preoperative breast ultrasound (U/S) or mammography **(8)**.

In comparison with FNA, core needle biopsy has a higher sensitivity and specificity **(7)**. It avoids excisional/incisional biopsy which may have occurred with inconclusive diagnosis of fine needle aspiration cytology (8). It differentiates in situ carcinoma from invasive carcinoma and is used for determination of hormone receptor status **(7)**.

The percentage of women having non-operative diagnosis of breast cancer is a measure of the quality of pathological service. According to European guidelines for quality assurance in breast cancer screening and diagnosis, >90% of patients are expected to have non operative diagnosis **(7)**. Significant numbers of patients in developed countries are either screen detected or early presenting.

The proportion of non-operative diagnosis (i.e. FNA/Core needle based diagnosis) out of the total diagnosed breast cancer cases diagnosed is an indicator of diagnostic quality of breast cancer **(7)**.

To my knowledge, the quality of breast cancer care in the area of patient evaluation, investigation and surgery is not studied in Ethiopia. This study will evaluate the current quality of care and will be base line to assess improvement in the quality of care in future studies.

**METHODOLOGY**

*Setting*: The study was done in Yekatit 12 Hospital Medical College, Department of Surgery. The department gives training for undergraduate medical students and general surgery surgical residents. The hospital gives surgical service for breast cancer patients but no radiotherapy and chemotherapy service. The hospital has pathology department, FNA being the standard for the diagnosis of breast cancer.

*Study Type*: Retrospective crossectional

*Study population*: All patients with breast cancer who had first time breast surgery, MRM (Modified Radical Mastectomy). Patients with a diagnosis of phyloides tumor, breast sarcoma and recurrent sarcoma were excluded.

*Data collection*: The list of patients fulfilling the inclusion criteria was collected from the registration book of the operation theatre. Patients’ chart was collected and data filled on prepared questioner. Data collected included clinical, radiological pathological and surgical information. Analysis was done on SPSS version 25.

Ethical clearance was obtained from the research and publication committee of Yekatit 12 Hospital.

**RESULT**

From a period of January 15, 2018 to July 24, 2019, there were a total of 102 breast operations. Based on the exclusion criteria, 24 were excluded and 78 were selected for the study. 13 charts were lost and 65 patients were taken for the analysis (chart retrieval rate of 83.3%). Out of the 65 patients, there were 3 male (4.6%). The age range was 23 to 75 years with a mean and median of 43.7 and 41.0 years respectively. 50 patients (76.9%) are at the age of 50 years and below.

On assessing the clinical evaluation, the status of ipsilateral axillary lymph nodes, ipsilateral supra/infraclavicular lymph nodes and contralateral breast was recorded in 58(89.2%), 24(36.9%) and 15(23.1%) patients respectively.

Diagnosis was confirmed by FNA, core biopsy and incisional/excisional biopsy in 47(72.3%), 1(1.5%), 12(18.5%) of patients respectively. For five patients (7.7%), the means of diagnosis couldn’t be known from patients’ record. When the five patients are excluded, the rate of surgical biopsy (incisional/excisional) is 20%.

Mammography is done for 8(12.9%) and breast ultrasound for 20(32.3%) of the female patients.

As metastatic work up, chest x-ray was done in 51(78.5%) and abdominal ultrasound in 55 (84.6%)

As a complication, one patient (1.5%) had flap necrosis and 11 patients (16.9%) developed wound infection.

The mean and median duration of symptoms before presentation were 9.9 months and 5.0 months. When one patient who was symptomatic for 16 years (?) is excluded, the mean is 7.1 months. The shortest duration of symptoms was two weeks and the two longest durations 6 and 16 years.

The waiting time from diagnosis (decision of surgery) to surgical intervention was unknown for eight cases. For the remaining 57 patient, it ranges from 5 days to 240 days. The mean and median are 46.7 and 33.0 days. 10 (17.5%) were operated < 15 days and 47 (82.5%) were operated more than 15 days after diagnosis of breast cancer or after referral following neoadjuvant chemotherapy.

33 (49.2) patients were in stage III and only 3 (4.6%) were in stage I. There were no stage IV patients as these are treated medically and surgery has limited role. For seven patients, staging was not written nor could be determined from the physical examination finding due to incomplete recording.

|  |  |  |  |
| --- | --- | --- | --- |
| Stage | No | Percentage |  |
| IA | 3 | 4.6 | 4.6 |
| IB | 0 | 0 |
| IIA | 8 | 12.3 | 35.4 |
| IIB | 15 | 23.1 |
| IIIA | 21 | 32.3 | 49.2 |
| IIIB | 11 | 16.9 |
| Can't be determined | 7 | 10.8 | 10.8 |
| Total | 65 | 100.0 | 100.0 |

Table 1. Percentage of patients in different stages of breast cancer

Out of those patients for whom staging was possible, 19 had a tumor < 5cm with clinically negative or mobile axillary lymph nodes which makes them candidates for breast conserving surgery. But due to lack of radiotherapy service, all were subjected for mastectomy. This has big impact on the postoperative quality of life.

Eleven of patients staged had T4 primary tumor and/or N2 axillary lymph nodes (locally advanced disease) and primarily treated with surgery.

The post mastectomy biopsy result was available only for 15 patients. The mean and median number of LNs harvested was 10.9 and 9.0 lymph nodes. The range is 1 to 36. Only seven (46.7%) patients have 10 or more lymph nodes harvested.

Out of the 15 patients, 3 had a positive surgical margin and 11 negative surgical margins. For one patient margin status was not reported.

**DISCUSSION**

Clinical evaluation of breast cancer patient should include physical examination of the affected breast with ipsilateral axillary and supra/infraclavicular lymph nodes. Contralateral examination should always be done. In this study, the status of ipsilateral axillary lymph nodes, ipsilateral supra/infraclavicular lymph nodes and contralateral breast was recorded in 58(89.2%), 24(36.9%) and 15(23.1%) patients respectively. These areas may not have been examined or examined and not recorded. The status of regional lymph nodes and contralateral breast has an impact on subsequent investigation and management of patients.

The European Society of breast cancer specialists has set a target of 90% for all breast cancer patients to have physical examination, mammography and breast U/S **(10)**.

|  |  |  |
| --- | --- | --- |
| Breast Imaging | Number | Percentage |
| Mammography | 8 | 12.9 |
| Breast U/S | 20 | 32.3 |
| Both Mammography **&** U/S | 4 | 6.5 |
| Either mammography or U/S | 24 | 38.7 |
| No breast imaging | 34 | 54.8 |

**Table 2**: Breast imaging in 62 female breast cancer patients

In this study 54.8% of all patients do not have any breast imaging studies from their records. 86% of Belgian stage I – III patients in the year 2001 to 2006 underwent two-view mammography or breast sonography (30).

40% of patients were in early stage (stage I & II) and 49.2% in stage III (locally advanced). For 10.8% of patients, stage can’t be determined from the information available on patients’ chart. As, there is no chemotherapy service in the hospital, stage IV patients are not referred to this hospital. So the staging pattern above may not reflect the actual staging in the whole patients in the society when they present.

Gemta EA et al in his multicenter study of 197 patients “Patterns of Breast Cancer Among Ethiopian Patients:

Presentations and Histopathological Features” found that 69.6% were having either locally advanced or metastatic disease (stage III & IV) (**11**).

Abdulrahman et al. in his study of “Epidemiology of Breast Cancer in Europe and Africa” **(12)** has found that more than 70% of patients in East Africa have stage III and IV disease and Libyan and Nigerian studies showed more than 50% patients in stage III & IV. A relatively higher percentage of patients in advanced stage in our study may be explained by a longer delay before presentation. Unlike other studies, Endale Hadgu et al (13) has found a relatively high percentage (20.0%) of stage I breast cancer among 114 patients where as stage III and IV patients were 41.0%.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Country | Stage I | Stage II | Stage III | Stage IV | | Unknown |
| This study | **Ethiopia** | **4.6%** | **35.4%** | **49.2%** | **0** | | **10.8%** |
| Temitope O. et al (14) | Nigeria | 3.2% | 14.5% | 39.7% | 42.6% | |  |
| Tessema E.(15) | Ethiopia | 0 | 39.8% | 50.0% | 10.2% | |  |
| Gemta EA et al. (11) | Ethiopia | 3.0% | 27.4% | 57.4% | 12.2% | |  |
| Endale Hadgu et al (13) | Ethiopia | 20.0% | 39.0% | 37.0% | 4.0% | |  |
| Joffe M et al (16) | South Africa | 48.7% | | 51.3% | | |  |
| Alwan, Nada A. S. et al (17) | UK | 60.8% | 36.2% | 2.3% | | 0.7% |  |
| Iraq | 12.0% | 47.5% | 31.9% | | 8.6% |  |

Table 3: stages of breast cancer at presentation

Optimal pathology service is one basic requirement for the delivery of quality breast healthcare affecting patient outcome (**18**). Wendy Bruening et al. has also demonstrated thatStereotactic- and ultrasonography-guided core-needle biopsy procedures seem to be almost as accurate as open surgical biopsy, with lower complication rates **(19)**. Because of psychological distress and financial expenses (**20**), surgical biopsies should be done only when FNA and core biopsies are not diagnostic or when there is clinical and cytological discrepancy. Open surgical biopsy has a higher complication rate than core needle biopsy (**21**) being less than 1% for the latter.

In this study, 72.5% and 1.5% patients have their diagnosis confirmed by FNA and core biopsy respectively. For 18.5%, the diagnosis was by surgical biopsy (incisional / excisional). For 7.7%, the means of diagnosis was not known. When only patients with the known means of diagnosis are known, 20% are by surgical biopsies. This is higher than surgical biopsies from other centers **(20**, **22).** The nonoperative diagnosis rate for breast cancers in the United Kingdom increased from 63% to a95% between 1996 and 2009 ( **22**). V van Breest Smallenburg et al. in his study of “*Trends in breast biopsies for abnormalities**detected at screening mammography*” has found a surgical biopsy 1.4% in the years 2009–2010. He also showed decreasing trend in the percentage of surgical biopsies. This low surgical biopsy is for patient groups where significant numbers are screen detected (**20**). With the same pathology service, even a lower percentage of surgical biopsies would be expected when almost all patients are clinically manifested as in our case.

Sentinel lymph node biopsy (SLNB) is the standard of care for early breast cancer with clinically negative axilla. Axillary lymph node dissection (ALND) is reserved for positive SLND, clinically positive axillary lymph nodes and locally advances breast cancer after neoadjuvant treatment. Our current practice in the management of axillary LNs is routine axillary LN dissection for all invasive breast cancer cases.ALND helps to determine prognosis (based on pathological staging), controls local disease and reduce recurrence, helps in deciding on the need of chemotherapy in low grade small tumors and may have an effect on overall survival. It is the most important means of assessing the disease burden in the axilla in patients with early breast cancer **(23)**. ALND is defined efficient when at least 10 LNs are retrieved **(24)**. M. Rosselli Del Turco has set a target of 98% and minimum standard of 95% of patients to have at least 10 lymph nodes harvested and examined during axillary lymph node dissection (**10**). The higher number of lymph nodes reported are indicators of adequate surgery and pathologic examination (**10**). The post mastectomy biopsy result was available only for 15 patients. The mean and median numbers of LNs harvested were 10.9 and 9 lymph nodes respectively with range of 1 to 36. Only seven (46.7%) patients have 10 or more lymph nodes harvested. The percentage positivity ranged from zero in two cases to 100% in seven of the 15 cases. More than 50% of patients have inadequate axillary dissection necessitating repeat axillary surgery or radiotherapy with risk of local complications.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| S. No | Study | Country | Number | Mean | Median | Range | % > 10 LMs |
| 1 | Boughey JC et al **(20)** | USA | 698 | 20.4 | 19 | 4 - 67 | 93.0 |
| 2 | Abass MO et al **(24)** | Sudan | 96 | 15.0 | 14 | 2 - 31 | 81.3 |
| 3 | [Anees B Chagpar](https://pubmed.ncbi.nlm.nih.gov/?term=Chagpar+AB&cauthor_id=17461896) et al **(25)** | USA | 4131 |  | 11 | 2 - 45 | 77.8 |
| 4 | Florian Ebner et al **(26)** | Germany | 2992 |  |  |  | 87.9 |
| 5 | Petrik et al **(27)** | Canada | 938 | 9.8 |  | 1 -31 | 49.0 |
| 6 | Somner, J E A et al **(28)** | Scotland | 609 | 17.9 | 17 | 2 - 47 | >92.0 |
| 7 | Gichere et al **(29)** | Kenya | 73 | 12.12 | 11 |  | 84.9 |
| 8 | **This study** | **Ethiopia** | **65 (15)** | **10.9** | **9** | **1 - 36** | **46.7** |

Table 4: LNs in axillary dissection

Abass MO et al has shown 81.3% adequate axillary dissection rate in a total of 96 patients. The mean and median in this study were 15 and 14, higher than the finding in our study (24). [Anees B Chagpar](https://pubmed.ncbi.nlm.nih.gov/?term=Chagpar+AB&cauthor_id=17461896) et al showed 77.8 percent adequate lymph node dissection rate in a total of 4131 patients. He also demonstrated the positive effect of academic affiliation and experience of breast surgery on the number of LNs harvested (25). But Gichere et al from Kenya didn’t demonstrate difference in the number of nodes harvested between consultant surgeons and residents. Mayo clinic on analysis of patients who have undergone ALND over four years period has found the mean and median number of LNs recovered to be 20.4 and 19 respectively with range 4 to 65. In 93% of patients ten and more lymph nodes were recovered (20). The same study has shown a higher lymph node recovery by surgical oncologists than non oncologic trained surgeons showing the importance of training specifically on oncologic principles of axillary dissection. Compared with the experience of the Mayo clinic our study has shown a much lower LN recovery rate. Our patients are less likely to get all the benefits of axillary dissection.

In the absence of contraindication, breast conserving surgery (BCS) is the standard of care for early breast cancer (**30**). Women who undergo BCS have the same survival as patients with mastectomy but with low incidence of insomnia, depression, anxiety, improved body image and higher satisfaction (**30** - **32**).

Out of those patients for whom staging was possible, 19 had a tumor < 5cm with clinically negative or mobile axillary lymph nodes which makes them candidates for breast conserving surgery. But due to lack of radiotherapy service, all were subjected for mastectomy. This has big impact on the postoperative quality of life.

As a quality performance indicator, Australia and Newzland have set breast conserving rate of > 70% for tumors < 2cm. Moyer A. on his study of *Psychosocial Outcomes of Breast-Conserving Surgery Versus Mastectomy,* has shown that patients with breast conserving surgery have better psychological, marital-sexual, and social adjustment. (**33**)

Out of the 15 patients, 3 had a positive surgical margin and 11 negative surgical margin. For one patients margin status was not reported. This makes that 21.4% of patients with a known margin status have positive margin. This high percentage may be due to the inclusion of locally advanced breast cancer for mastectomy before neoadjuvant chemotherapy. Previous study done in Ethiopia (**34**) has shown a positive margin status of 30.1%. Another study in USA (**35**) on 240 patients with simple and modified radical mastectomy has shown a positive margin status of 10%. A positive margin gives patient second possibly avoidable surgery (re excision) or exposure for radiotherapy. Study has shown that a positive margin after mastectomy or wide local excision increases risk of chest wall recurrence (**36**, **37**). This is true also for patients with ductal carcinoma in situ who undergo mastectomy (**38**).

Skin flap necrosis in mastectomy has incidence of 5 to 30% (**39**). In this study, only one of the 65 patients (1.5%) developed flap necrosis. The low incidence may be due to the small size of the sample.

Flap necrosis increases risk of infection, delays subsequent chemo and radiotherapy. It also causes delayed hospital stay, financial expense, esthetic compromise and psychological morbidity (**39**).

Surgery is one of the treatment modality for breast cancer with possible wound site infection as one complication. In this study, 11 of the 65 patients (16.9%) had postoperative wound infection. It is our practice to give prophylactic antibiotics for all breast cancer patients undergoing modified radical mastectomy. The diagnosis was made both during in patient stay and after discharge from the hospital. The result is higher than the report from Kenya and USA (40, 41). Chandrakar from India in his study of 41 patients, he found infection rate of 24.4% (42).

Patients with postoperative surgical site infections have prolonged hospital stay, usage of antibiotics, higher treatment costs, delay in initiation of chemotherapy affecting local control and overall survival (**43**, **44**, **45, 46**).

Generally the prevalence of post mastectomy wound infection is higher in this study when compared with studies done elsewhere. The risk of infection is dependent on a number of factors (**45**). Looking in to the details of individual risk factors helps to find the reason for high incidence of infection in this study.

The hospital does not have multidisciplinary team working on breast cancer. Except the 10 patients referred from another center after neoadjuvant chemotherapy managed with mastectomy, the management for the 55 patients was based on individual physician’s single decision. This may be the reason why 11 patients with locally advanced tumors (candidates for neoadjuvant chemotherapy) have undergone mastectomy first. The current standard of breast cancer management includes MDT approach (**47**). Cancer patients (including breast cancer) managed on MDT approach are found to have better survival (**48**, **49**).

Sentinel lymph node biopsy (SLNB) is the standard of care in patients with early breast cancer (clinical T1-2, N0 breast cancer) (**49, 50**). Compared with axillary dissection, SLNB has many advantages and with fewer complications (**49**). It has comparable accuracy of diagnosis of metastasis status as axillary dissection with reduced morbidity (numbness, lymphoedema, shoulder dysfunction) (**50, 51**). In this study, there were 11 patients who had T1 or T2 tumor with negative axilla. These patients were potentially candidates for sentinile lymph node biopsy with possibility of avoiding axillary dissection related morbidities in some of them. But all these patients were treated by axillary dissection. Lack of MDT service and lack of surgeons’ experience may be the reason for not doing SLNB when indicated.

Eleven of patients staged had T4 primary tumor and/or N2 axillary lymph nodes (locally advanced disease) and primarily treated with surgery. The current recommendation of locally advanced tumors is to treat first with neoadjuvant treatment followed by surgery and other treatments (**52**). Neoadjuvant treatment has the advantage of down staging making mastectomy easier & enabling breast conserving surgery and also seeing the response for treatment (**53**, **54)** It also enables early treatment of micro metastatic disease (**53, 55, 56**

CONCLUSION AND RECOMMENDATION

The quality of breast cancer care in Yekatit 12 Hospital is poor as most of the indicators show poor performance. There is poor documentation of physical findings. Preoperative mammography or ultrasound was not done for majority of patients. Although it is routine practice to have chest x-ray and abdominal ultrasound, no information was found in 54.8% of patients about breast imaging. The surgical biopsy rate was high. Axillary lymph node dissection was adequate in only 46.7% of case (high inadequate dissection rate). Margin positivity and post mastectomy infection rate was high. The hospital doesn’t deliver sentinel lymph node biopsy, breast conserving surgery and does not have MDT for breast cancer. Patients with locally advanced breast were not provided neoadjuvant treatment). In the absence of chemotherapy service, patients with locally advanced breast cancer should be referred to centers where the service can be delivered so that patients can get the above mentioned benefits The hospital should develop guideline and give training on evaluation, work up and surgery (SLNB, ALND, Mastectomy) on breast cancer. Long term plan should include recruiting oncologist, establish, MDT and radiotherapy service.

**Abbreviations**

MDT: multidisciplinary teams; FNA: fine needle aspiration; U/S: ultrasound; MRM: modified radical mastectomy; SLNB: sentinel lymph node biopsy; ALND: Axillary lymph node dissection

**Funding**

NA

**Ethics approval and consent to participate**

Ethical clearance was obtained from the institutional board of Yekatit 12 Hospital Medical College

**Consent for publication**

Individual person’s data are not included in this study and so consent is not applicable.

**Competing interests**

No competing interests

**Acknowledgements**

NA

**Author details**

1Addis Ababa University, College of Health Sciences, School of Medicine, Department of Surgery, Endocrine and Breast Surgery Unit, Addis Ababa, Ethiopia.

**REFERENCES**

1. Schachter HM, Mamaladze V, Lewin G, et al. Many quality measurements, but few quality measures assessing the quality of breast cancer care in women: a systematic review. *BMC Cancer*. 2006;6:291. Published 2006 Dec 18.
2. Top 10 Female Cancer in Addis Ababa [online]. Available: [http://afcrn.org/ Membership/membership-list/100-addisababa] [Accessed 21 Aug 2020]
3. Canin B, Freund KM, Ganz PA, Hershman DL, Paskett ED. Disparities in breast cancer care and research: report from a Breast Cancer Research Foundation sponsored workshop, 9-10 October 2014. *NPJ Breast Cancer*. 2015;1:15013. Published 2015 Oct 14.
4. [Transforming Breast Cancer Together: European elections manifesto 2019 seizing the opportunities for breast cancer patients.](https://www.ncbi.nlm.nih.gov/pubmed/31525579) Cardoso F, Bușoi CS, Cattaneo I, Decise D, Cardone A, Filicevas A, Gentile E, Wierinck L, Knox S, Sebastiani S, Terrasanta C, Ujupan S, Ventura R, Wilson B, Rubio IT
5. Jonsson B, Normad C and Widdershoven G. A review of breast cancer care and outcomes in 18 countries in Europe, Asia and Latin America.
6. Malin JL, Schneider EC, Epstein AM, Adams J, Emanuel EJ, Kahn KL. Results of the National Initiative for Cancer Care Quality: how can we improve the quality of cancer care in the United States? J Clin Oncol. 2006 Feb 1;24(4):626-34. Epub 2006 Jan 9. Erratum in: J Clin Oncol. 2006 Apr 20;24(12):1966. PubMed PMID: 16401682.
7. Perry N, Broeders M, de Wolf C, Törnberg S, Holland R, von Karsa L. European guidelines for quality assurance in breast cancer screening and diagnosis. Fourth edition--summary document. Ann Oncol. 2008 Apr;19(4):614-22. doi: 10.1093/annonc/mdm481. Epub 2007 Nov 17. PMID: 18024988.
8. Belgian Health Care Knowledge Center:Quality Indicators in Oncology: 2010: Breast Cancer: 2010
9. Quality Indicators in breast cancer:An update from EUSOMA working group. Eur J cancer. 2017 Nov;86:59-81
10. M. Rosselli Del Turco, A. Ponti, U. Bick, L. Biganzoli, G. Cserni, B. Cutuli, T. Decker, M. Dietel, O. Gentilini, T. Kuehn, M.P. Mano, P. Mantellini, L. Marotti P. Poortmans, F. Rank m, H. Roe n, E. Scaffidi h, J.A. van der Hage o, G. Viale, C. Wells, M. Welnicka-Jaskiewicz, Y. Wengsto¨m, L. Cataliotti; Quality indicators in breast cancer care; EUROPEAN JOURNAL OF CANCER 4 6 ( 2 0 1 0 ) 2 3 4 4 –2 3 5 6
11. Gemta EA, Bekele A, Mekonen W, Seifu D, Bekurtsion Y, et al. (2019) Patterns of Breast Cancer Among Ethiopian Patients: Presentations and Histopathological Features. J Cancer Sci Ther 11: 038-042.
12. Abdulrahman GO Jr, Rahman GA. Epidemiology of breast cancer in europe and Africa. *J Cancer Epidemiol*. 2012;2012:915610.
13. Hadgu E, Seifu D, Tigneh W, Bokretsion Y, Bekele A, Abebe M, et al. Breast cancer in Ethiopia: evidence for geographic difference in the distribution of molecular subtypes in Africa. BMC Womens Health. 2018;18(1):40-. pmid:29444670
14. Olatunji T, Sowunmi AC, Ketiku KK, Campbell OB. Sociodemographic correlates and management of breast cancer in Radiotherapy Department, Lagos University Teaching Hospital: A 10-year review. J Clin Sci 2019;16:111-9.
15. Tessema Ersumo. Breast Cancer in an Ethiopian Population, Addis Ababa. East and Central African Journal of Surgery. [Vol 11 No 1 (2006)](https://www.ajol.info/index.php/ecajs/issue/view/13997)
16. Joffe M, Ayeni O, Norris SA, McCormack VA, Ruff P, Das I, et al. (2018) Barriers to early presentation of breast cancer among women in Soweto, South Africa. PLoS ONE 13(2): e0192071.
17. Alwan, Nada A. S. et al. “Comparative Study on the Clinicopathological Profiles of Breast Cancer Among Iraqi and British Patients.” (2018).
18. Masood S, Vass L, Ibarra JA Jr, et al. Breast pathology guideline implementation in low‐ and middle‐income countries. *Cancer* 2008; **113**(8 Suppl): 2297– 304.
19. Bruening W,  Fontarosa J,  Tipton K,  Treadwell JR,  Jaunders J,  Schoelles K.  Systematic review: comparative effectiveness of core-needle and open surgical biopsy to diagnose breast lesions, *Ann Intern Med* [published online ahead of print December 15, 2009]
20. van Breest Smallenburg, V et al. “Trends in breast biopsies for abnormalities detected at screening mammography: a population-based study in the Netherlands.” *British journal of cancer* vol. 109,1 (2013): 242-8.
21. Dahabreh IJ, Wieland LS, Adam GP, Halladay C, Lau J, Trikalinos TA. *Core Needle and Open Surgical Biopsy for Diagnosis of Breast Lesions: An Update to the 2009 Report. Comparative Effectiveness Review No. 139. (Prepared by the Brown Evidence‐Based Practice Center under Contract 290‐2012‐00012‐I.) Agency for Healthcare Research and Quality Pub. No. 14‐EHC040‐EF*. Rockville, MD: Agency for Healthcare Research and Quality; 2014.
22. Kristine E. Calhoun and Benjamin O. Anderson. [Needle Biopsy for Breast Cancer Diagnosis: A Quality Metric for Breast Surgical Practice](https://ascopubs.org/doi/abs/10.1200/JCO.2014.55.6324). Journal of Clinical Oncology 2014 32:21, 2191-2192
23. Bidoli, E., Virdone, S., Hamdi-Cherif, M. *et al.* Worldwide Age at Onset of Female Breast Cancer: A 25-Year Population-Based Cancer Registry Study. *Sci Rep* **9,**14111 (2019).
24. Arndt, V et al. “Patient delay and stage of diagnosis among breast cancer patients in Germany -- a population based study.” *British journal of cancer* vol. 86,7 (2002): 1034-40.
25. Chagpar AB, Scoggins CR, Martin RC 2nd, et al. Factors determining adequacy of axillary node dissection in breast cancer patients. *Breast J*. 2007;13(3):233–237. doi:10.1111/j.1524-4741.2007.00415.x
26. Ebner, F., Wöckel, A., Schwentner, L. *et al.* Does the number of removed axillary lymphnodes in high risk breast cancer patients influence the survival?. *BMC Cancer* **19,**90 (2019). https://doi.org/10.1186/s12885-019-5292-2
27. Petrik, David W. et al. “Association between extent of axillary lymph node dissection and patient, tumor, surgeon, and hospital factors in patients with early breast cancer.” Journal of surgical oncology 82 2 (2003): 84-90 .
28. Somner, J E A et al. “Node retrieval in axillary lymph node dissections: recommendations for minimum numbers to be confident about node negative status.” Journal of clinical pathology 57 8 (2004): 845-8.
29. Gichere, Raphael N. “Adequacy of axillary lymph node dissection in the management of breast cancer at Kenyatta National Hospital.” (2014).
30. Apantaku LM. Breast conserving surgery for breast cancer. Am. Fam. Phy. 2002; 66:2271.
31. Salindera S, Ogilvy M, Spillane A, What are the appropriate thresholds for High Quality Performance Indicators for Breast Surgery in Australia and New Zealand?, *The Breast*,
32. Riedel F, Hennigs A, Hug S, Schaefgen B, Sohn C, Schuetz F, Golatta M, Heil J: Is Mastectomy Oncologically Safer than Breast-Conserving Treatment in Early Breast Cancer. Breast Care 2017;12:385-390.
33. Moyer A. Psychosocial outcomes of breast-conserving surgery versus mastectomy: a meta-analytic review [published correction appears in Health Psychol 1997 Sep;16(5):442]. *Health Psychol*. 1997;16(3):284–298.
34. E.J. Kantelhardt, P. Zerche1, A. Mathewos, P. Trocchi, A. Addissie4, A. Aynalem, T. Wondemagegnehu, T. Ersumo, A. Reeler, B. Yonas, M. Tinsae7, T. Gemechu7, A. Jemal8, C. Thomssen1, A. Stang and S. Bogale: Breast cancer survival in Ethiopia: A cohort study of 1,070 women: Int. J. Cancer: 135, 702–709 (2014) VC 2013 UICC.
35. Yu, J., Al Mushawah, F., Taylor, M.E., Cyr, A.E., Gillanders, W.E., Aft, R.L., et al. (2012) Compromised Margins Following Mastectomy for Stage I - III Invasive Breast Cancer. Journal of Surgical Research, 177, 102-108.
36. Freedman GM, Fowble BL, Hanlon AL, et al. A close or positive margin after mastectomy is not an indication for chest wall irradiation except in women aged fifty or younger. *Int J Radiat Oncol Biol Phys*. 1998;41(3):599-605.
37. Douglas-Jones AG, Logan J, Morgan JM*, et al.* Effect of margins of excision on recurrence after local excision of ductal carcinoma in situ of the breast. *Journal of Clinical Pathology*2002;**55:**581-586
38. Rashtian A, Iganej S, Liu IA, Natarajan S. Close or positive margins after mastectomy for DCIS: pattern of relapse and potential indications for radiotherapy. *Int J Radiat Oncol Biol*
39. Robertson SA, Jeevaratnam JA, Agrawal A, Cutress RI. Mastectomy skin flap necrosis: challenges and solutions. *Breast Cancer (Dove Med Press)*. 2017;9:141-152
40. *Nyaoncha A, Wasike R, Ahmed M, Njihia B. Surgical Site Infection Rates in Breast Cancer Surgery at a University Hospital in Nairobi, Kenya. Clin Oncol. 2016; 1: 1069.*
41. Olsen, Margaret A et al. “Incidence of Surgical Site Infection Following Mastectomy With and Without Immediate Reconstruction Using Private Insurer Claims Data.” *Infection control and hospital epidemiology* vol. 36,8 (2015): 907-14.
42. Chandrakar, Naman & Shinde, Raju. (2018). Study the early complications of modified radical mastectomy performed. International Surgery Journal. 6. 239. 10.18203/2349-2902.isj20185480
43. D'Amico DF, Parimbelli P, Ruffolo C. Antibiotic prophylaxis in clean surgery: breast surgery and hernia repair. *J Chemother*. 2001;13 Spec No 1(1):108–111.
44. Olsen MA, Chu-Ongsakul S, Brandt KE, Dietz JR, Mayfield J, Fraser VJ. Hospital-Associated Costs Due to Surgical Site Infection After Breast Surgery. Arch Surg. 2008;143(1):53–60.
45. Olsen, Margaret A et al. “Risk factors for surgical site infection after major breast operation.” *Journal of the American College of Surgeons* vol. 207,3 (2008): 326-35.
46. Subramanian, A et al. “Necrotising soft tissue infection following mastectomy.” *Journal of surgical case reports* vol. 2010,1 4. 1 Mar. 2010, doi:10.1093/jscr/2010.1.4
47. Rajan, S., Foreman, J., Wallis, M. G., Caldas, C., & Britton, P. (2013). Multidisciplinary decisions in breast cancer: does the patient receive what the team has recommended?. *British journal of cancer*, *108*(12), 2442–2447.
48. Taylor C, Shewbridge A, Harris J, Green JS. Benefits of multidisciplinary teamwork in the management of breast cancer. *Breast Cancer (Dove Med Press)*. 2013;5:79-85. Published 2013 Aug 30.
49. Moghimi M, Ghoddosi I, Rahimabadi AE, Sheikhvatan M. Accuracy of sentinel node biopsy in breast cancer patients with a high prevalence of axillary metastases. *Scand J Surg*. 2009;98(1):30-33.
50. Ferrucci M, Franceschini G, Douek M. New techniques for sentinel node biopsy in breast cancer. Transl Cancer Res 2018;7(Suppl 3):S405-S417.
51. Papathemelis T, Jablonski E, Scharl A, et al. Sentinel lymph node biopsy in breast cancer patients by means of Indocyanine green using the Karl Storz VITOM® fluorescence camera. *Biomed Res Int*. 2018; **26**: 1‐ 8
52. Wang, M., Hou, L., Chen, M. *et al.* Neoadjuvant Chemotherapy Creates Surgery Opportunities For Inoperable Locally Advanced Breast Cancer. *Sci Rep* **7,**44673 (2017).
53. Pernaut C, Lopez F, Ciruelos E: Standard Neoadjuvant Treatment in Early/Locally Advanced Breast Cancer. Breast Care 2018;13:244-249. doi: 10.1159/000491759
54. Klein, J., Tran, W., Watkins, E. *et al.* Locally advanced breast cancer treated with neoadjuvant chemotherapy and adjuvant radiotherapy: a retrospective cohort analysis. *BMC Cancer* **19,**306 (2019).
55. Daniel F. Hayes, Anne F. Schott, Neoadjuvant Chemotherapy: What Are the Benefits for the Patient and for the Investigator?, JNCI Monographs, Volume 2015, Issue 51, May 2015, Pages 36–39
56. Suthinee Ithimakin and Suebwong Chuthapisith (May 22nd 2013). Neoadjuvant Chemotherapy for Breast Cancer, Neoadjuvant Chemotherapy - Increasing Relevance in Cancer Management, Maurie M. Markman, IntechOpen, DOI: 10.5772/53124. Available from: