**Original Article**

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# Favorable Long-Term Outcome in Male Breast Cancer

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**ABSTRACT**

**Objective:** Male breast cancer (MBC) is a rare type of cancer in the breast cancer series and in the male population. Data is usually extrapolated from female breast cancer (FBC) studies. We aim to study the clinicopathological characteristics and outcome of MBC patients at our institution and we aim to emphasize the differences compared with FBC.

**Materials and Methods:** Between January 1993 and April 2016, 56 male patients who were diagnosed as breast cancer and underwent surgical operation were retrospectively analyzed. Patients were evaluated for demographical characteristics, surgery type, clinicopathological characteristics, adjuvant and neoadjuvant treatments, follow-up time, overall survival (OS), disease free survival (DFS), and disease specific survival (DSS).

**Results:** The ratio of MBC among all breast cancers at our institution is 1%. The median age was 64 (34-85). Surgical procedures were modified radical mastectomy (MRM) in 41 patients (77%), simple mastectomy in 11 patients (21%), and lumpectomy in 1 patient (2%). Two patients were Stage 0 (4%), 7 were Stage 1 (13%), 12 were Stage 2 (22.6%), and 32 were Stage 3 (60.4%). Molecular subtypes of the invasive tumors were luminal A in 40 (80%), luminal B in 6 (12%), HER-2 type in 1 (2%), and basal-like in 3 (6%). Median follow-up time was 77 (3-287) months. 5-year and 10-year OS, DFS, and DSS rates were 80.7%, 96%, 95.6% and 71.6%, 81.9%, 91.7% respectively.

**Conclusion:** MBC presents different clinicopathological and prognostic factors when compared to FBC. Our survival rates are higher than the average presented in available literature. Because of the high rate of hormone receptor positivity, hormonal therapy is the mainstay for the treatment of estrogen receptor (ER)+ male breast cancer.

**Keywords:** Breast neoplasm, disease-free survival, male, survival rate

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## Introduction

Because of the very low incidence of male breast cancer (MBC) cases, limited information is available about the epidemiology, treatment strategies, prognosis and other data about MBC. Data is usually extrapolated from female breast cancer (FBC) studies. There are no randomized trials that have specifically addressed treatment of MBC. Thus, evidence concerning optimal treatment strategies is limited. The best evidence for effectiveness of treatment of MBC comes from population-based statistics. Anderson et al. reported on MBC from the Surveillance, Epidemiology, and End Results (SEER) database during the period of 1973 to 2005 and found an annual increase in incidence of 1.19%, with a peak in 2000 of 1.24 cases per 100,000 men (1). The prevalence varies between countries and regions. It is lower in Japan, Colombia, Singapore, Finland and Hungary, whereas the incidence is higher in North America and England and very high in some African countries (2). Main risk factors for MBC are genetic factors (Klinefelter's syndrome), family history of breast cancer, BRCA1-2 mutations, endocrine factors (liver disease, exogenous estrogens, and androgen deficiency), testicular disorders (undescended testes, orchitis), occupational and environmental exposures (occupational exposure to heat, exhaust emissions, electromagnetic field radiation), obesity, alcohol, and diet (3).

Because a normal male breast does not contain any lobular elements, clinically the most frequent cancer type detected in men is invasive ductal carcinoma (85-90%) (4) (Figure 1). MBC shows higher estrogen receptor (ER) (75-94%) and progesterone receptor (PR) (67-96%) positivity than FBC (3). In the National Cancer Institute's SEER database between 1973 and 2005, 92% of the MBCs (n=5494) as opposed to 78% of the FBCs (n=838,805) were ER-positive (1).

The management for MBC has been extrapolated from the treatment of FBC. Almost for all patients, radiological assessment should be done (Figure 2). The primary approach is surgery. Latter treatment options in early-Stage MBC are adjuvant endocrine therapy, che-



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motherapy or radiotherapy according to prognostic factors (3). Disease specific survival (DSS) and overall survival (OS) rates in MBC among 1,986 male patients in the SEER database were 90% and 70% respectively at 5 years (5). MBC causes a higher mortality than the female counterpart (6). Patients have a worse survival rate compared to women, because of a more advanced disease and older age at diagnosis (7). When matched by Stage and age, men appear to have a similar or better prognosis compared to women (8, 9).

The aim of our study was to determine the clinicopathological characteristics and outcome of MBC patients at our institution according to the new molecular subtype classifications including luminal and nonluminal types.

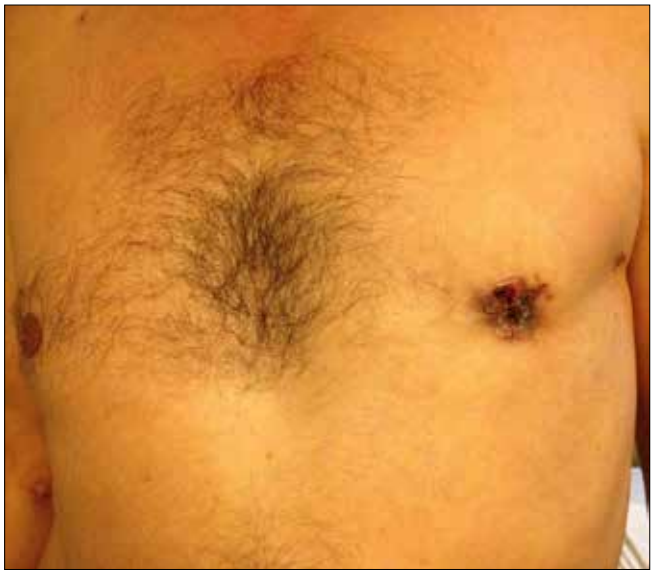

**Figure 1.** Physical examination finding of a 45 year-old male showing ulceration around his nipple

## Materials and Methods

Between January 1993 and April 2016, 5762 breast cancer patients were reviewed from breast cancer registry system in the Department of General Surgery, Breast Unit. Of the 5762 registered patients, 57 male patients (1%) that diagnosed as breast cancer and underwent surgical operation were evaluated. There was no Stage 4 patient in our series. Excluding one patient with malignant fibrous histiocytoma, 53 patients with routine follow-up were included into the study. Patients' medical records were collected from breast cancer registry forms and computer database. Patients were evaluated for demographical characteristics, surgery type, clinicopathological characteristics (stage, cancer type, hormone receptor status, HER2/neu status, etc.), adjuvant and neoadjuvant treatments (chemotherapy, radiotherapy, and hormonal therapy), follow-up time, OS, disease free survival (DFS), and DSS. Patients were followed-up closely, and physical examination findings were recorded at each visit. Dates of death and causes of death were recorded according to information received from hospital records and patients' relatives.

The hormone receptor (ER, PR), HER2/neu and Ki-67 positivity were assessed using immunohistochemistry (IHC). Patients that do not have any of these four pathological variables were assessed retrospectively from patient blocks to maintain homogenous pathological data. Of the 53 patients, 50 patients' blocks were able to provide full information about ER, PR, HER2/neu, and Ki-67 status. The histologic classification was based on WHO criteria and histologic grade in the Nottingham system. ER and PR were considered positive if ≥1% cells showed nuclear staining. Cases were considered HER2/neu- positive when they are IHC-3+ or SISH (Silver in situ hybridization)-ampli-

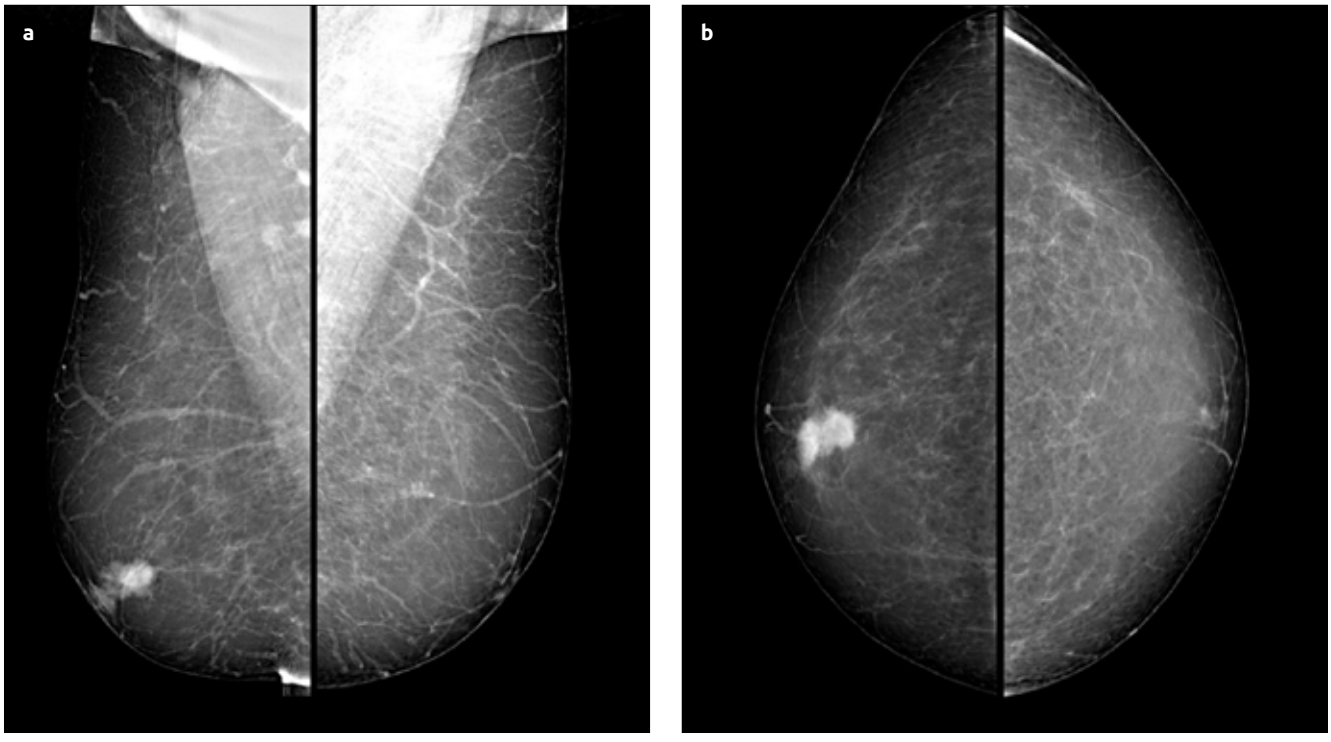


**Figure 2. a, b.** Mammography imaging of a 65 year-old male patient with a malignant mass on his right breast. MLO mammography (a), CC mammography (b)

fied. The staging was made according to the American Joint Committee on Cancer (7th edition) (10).

Survival analysis was conducted for breast cancer patients and OS was defined as the time between diagnosis and death from any cause. Disease-free survival was defined as the time between diagnosis and the occurrence of relapse either locally or systematically. Disease-specific survival rate was defined as the percentage of patients who have died from breast cancer but not from other causes.

Table 1. Patient characteristics and surgical procedure

| | n | % |
|---|---|---|
| Median age (min-max) | 64 (34-85) | |
| Median follow-up (range, months) | 77 (3-287) | |
| Age | | |
| <60 | 22 | 41.5 |
| ≥60 | 31 | 58.5 |
| Concomitant History of Cancer | | |
| Yes (prostate cancer) | 2 | 4 |
| No | 51 | 96 |
| Family History of Breast Cancer | | |
| Yes | 6 | 11.3 |
| No | 47 | 88.7 |
| Primary Complaint of Admission | | |
| Lump | 43 | 81.1 |
| Nipple Discharge | 7 | 13.2 |
| Ulceration | 3 | 5.7 |
| | n | % |
| Surgery Type | | |
| Breast Conserving Surgery | 1 | 2 |
| Mastectomy | 11 | 21 |
| Modified Radical Mastectomy | 41 | 77 |
| SLNB | | |
| Yes | 20 | 37.7 |
| No | 33 | 62.3 |
| ALND | | |
| Yes | 42 | 79.2 |
| No | 11 | 20.8 |
| Systemic treatment | | |
| PSCT | 7 | 13.2 |
| Chemotherapy | 25 | 47.2 |
| No treatment | 21 | 39.6 |
| | n | % |
| Radiotherapy | | |
| Yes | 32 | 60.4 |
| No | 21 | 39.6 |
| Hormonal therapy (n=50) | | |
| Yes | 45 | 90 |
| No | 5 | 10 |

SLNB: Sentinel Lymph Node Biopsy; ALND: Axillary Lymph Node Dissection; PSCT: Preoperative systemic chemotherapy
Missing data excluded

**Statistical Analysis**

Overall survival was the primary endpoint chosen to assess prognosis. Statistical analyses were performed using Statistical Packages for the Social Sciences (SPSS) version 17.0 for Windows software (SPSS Inc., Chicago, IL, USA). Descriptive statistical analyses (median, number and percentage) were used for continuous variables. Patient and tumor characteristics were individually analyzed using log-rank test to determine the effect of each variable on OS. The OS, DSS, and DFS rates were calculated using the Kaplan-Meier method. All pvalues were two-sided, and $p<0.05$ was used to indicate a statistically significant difference.

This research was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" (amended in October 2013), and written informed consent was obtained from the patient whose image we use in figure 1.

## Results

The ratio of MBC among the whole breast cancers in our institution is 1%. Median age was 64 (34-85). The majority of the patients were ≥60 (58.5%). Twenty-two (41.5%) patients under 60 and only two patients under 40 years. Family history of breast cancer was detected in 6 (11.3%) patients. BRCA mutations analyzed in five patients in our series and BRCA1 mutation was detected only in one patient.

The most common primary complaint at admission was palpable stiff lump in the breast (Figure 1). Nipple ulceration was detected in only 5.7% of patients and nipple discharge was seen in 13.2% of our patients. Surgical procedures were modified radical mastectomy (MRM) in 41 patients (77%), simple mastectomy in 11 patients (21%), and lumpectomy in 1 patient (2%). Sentinel lymph node biopsy (SLNB) was performed in 21 (40%) patients. Forty-two patients (79.2%) underwent axillary lymph node dissection (ALND) due to clinical node positivity (n=33) or SLNB positivity (n=9). Of those 42 patients, 32 patients (60.4%) revealed pathologically axillary involvement. Twenty-two (41.5%) patients had T4 tumors. The majority of 32 patients (n=21, 65.6%) had N1 disease with <4 lymph node-positivity. Seven patients received neoadjuvant chemotherapy, 25 patients received adjuvant chemotherapy, 32 patients received radiotherapy, and 45 received adjuvant hormonal therapy as tamoxifen 20 mg per day for 5 years. Patient characteristics and surgical procedures are summarized in table 1.

At the final pathology assessment, the majority of patients (n=49) were found to have invasive ductal carcinoma (92%), the remaining 2 had ductal carcinoma in-situ (4%), whereas 1 had neuroendocrine tumor (2%), 1 had invasive papillary carcinoma (2%). Two patients were Stage 0 (4%), 7 were Stage 1 (13%), 12 were Stage 2 (22.6%), and 32 were Stage 3 (60.4%). Of the 50 patients whose receptor status were achieved, 92% were ER positive (n=46), 86% were PR positive (n=43), and 10% were HER2/neu positive (n=5). Molecular subtypes of the invasive tumors were luminal A in 40 (80%), luminal B in 6 (12%), HER-2 type in 1 (2%), and basal-like in 3 (6%). Tumor characteristics and clinicopathological features of patients are summarized in table 2.

Table 2. Tumor characteristics and clinicopathological features of patients

| | n | % |
|---|---|---|
| Tumor Type | | |
| IDC | 49 | 92 |
| DCIS | 2 | 4 |
| Other | 2 | 4 |
| Median invasive tumor diameter (min-max) (n=51) | 25 mm (2-50) | |
| Tumor stage | | |
| Tis | 2 | 4 |
| T1 | 14 | 26.3 |
| T2 | 15 | 28.2 |
| T4 | 22 | 41.5 |
| Nodal Stage | | |
| N0 | 21 | 39.6 |
| N1 | 21 | 39.6 |
| N2 | 5 | 9.5 |
| N3 | 6 | 11.3 |
| | **n** | **%** |
| LVI (n=45) | | |
| + | 25 | 55.5 |
| - | 20 | 44.5 |
| Grade (n=50) | | |
| 1 | 5 | 10 |
| 2 | 24 | 48 |
| 3 | 21 | 42 |
| Stage | | |
| 0 | 2 | 4 |
| 1 | 7 | 13 |
| 2 | 12 | 22.6 |
| 3 | 32 | 60.4 |
| Tumor focus | | |
| Unifocal | 50 | 94.3 |
| Multifocal/multicenter | 3 | 5.7 |
| | **n** | **%** |
| ER and/or PR (n=50) | | |
| + | 46 | 92 |
| - | 4 | 8 |
| HER2/neu (n=50) | | |
| + | 5 | 10 |
| - | 45 | 90 |
| Luminal type (n=50) | | |
| Luminal A | 40 | 80 |
| Luminal B | 6 | 12 |
| HER-2 type | 1 | 2 |
| Triple negative | 3 | 6 |

IDC: Invasive ductal carcinoma; DCIS: Ductal carcinoma in-situ; LVI: Lymphovascular invasion; ER: Estrogen receptor; PR: Progesterone receptor Missing data excluded

Table 3. 5-year and 10-year overall survival, disease-free survival and disease-specific survival of patients

| Survival | 5-year (%) | 10-year (%) |
|---|---|---|
| OS | 80.7 | 71.6 |
| DFS | 96 | 87.9 |
| DSS | 95.6 | 91.7 |

OS: Overall survival; DFS: Disease-free survival; DSS: Disease-specific survival

The median follow-up time was 77 (3-287) months. One patient had chest wall recurrence in 168$^{th}$ month, 1 patient had axillary recurrence in 93$^{th}$ month, and 4 patients had systemic metastases (bone [n=2], lung [n=1], and liver [n=1]). The 5-year OS, DFS, and DSS rates were 80.7%, 96%, and 95.6%, whereas the 10-year OS, DFS, and DSS rates were 71.6%, 81.9%, and 91.7%, respectively. The 5-year and 10-year survival of the patients are summarized in table 3. The influence of patient's age, tumor stage, lymph node status, hormone receptor status, molecular subtype, hormone therapy, and chemotherapy on OS were examined by univariate analysis. Luminal A subtype and Stage I disease compared to Stage II-III showed decrease in OS. In multivariate analysis, there was only significant difference in OS between Stage I compared to Stage II-III patients ($p<0.001$).

## Discussion and Conclusion

Male breast cancer is a rare type of cancer in breast cancer series and in male population. In our series, it also constitutes 1% of all breast cancer cases similar to previous reports (1). The median age of the patients in our series was 64 and majority of the patients were ≥60 years old in concordance with other reports (11). The mean age of diagnosis of MBC is 68, which is 5 to 10 years older than for FBC patients in the United States, but in other parts of the world such as the Middle East and South Asia, the age gap is smaller (11).

The main complaint of admission to a health institution is a hard and painless mass, located centrally under the nipple. Nipple ulceration is commonly observed, but nipple discharge is rare (3). Moreover, MBC may usually present with locally advanced disease because its superficial location and central areola involvement due to little breast tissue in men (2) (Figure 1). In our series, T4 tumors were detected in 22 patients (41.5%) higher than reported before (12, 13). Nipple ulceration was detected in only 5.7% of patients among our patients which seems to be lower than other series (14). Nipple discharge was seen in 13.2% of our patients and it is higher than mentioned in recent literature (3). As in FBC, nipple discharge is usually associated with ductal involvement like carcinoma in-situ.

Almost 5 to 10% of all MBC cases are related to a genetic predisposition (15). Generally, BRCA2 mutation is likely to exist in MBC cases with a family history of breast cancer (11). Six patients have family history of breast cancer in our series. BRCA mutations analyzed in 5 patients in our series and BRCA1 mutation was detected only in 1 patient. This is one of the limitations about our series. It is probably due to high costs of genetic testing and patients' reluctance to have a genetic analysis. Other factors related with MBC are endocrine, environmental, occupational, and lifestyle factors as mentioned before (3).

Nearly over 90% of MBCs are invasive ductal carcinomas (13). Due to lack of lobular tissue in male breast, lobular carcinoma is rare, accounting approximately 1.5% of cases (13). In the SEER data, ductal or unclassified type encounters 93.7% of MBCs and the lobular type 1.5% (5). MBC cases represent high rates of ER and PR expression. Average rate of ER and PR expression is 90% and 81%, respectively (16). Cardoso et al. reported early results of 1483 cases from International Male Breast Cancer Program (17). Of these patients, 92% were ER+, 35% PR+, and 5% were HER2/neu+. In a multicenter study, 251 MBC and 263 FBC were matched by patient age, nodal status, and tumor grade. In both MBC and FBC cases, the most common subtype was Luminal A. Triple negative was rare and no Luminal B or HER2 were seen in MBC group (18). Kornegoor reported in their series that 75% of all cases were luminal A, 21% were luminal B and the rest were basal type (n=4) or triple negative (n=1) (19). More recently, Aydogan et al. presented the SEER data about tumor subtype and race in MBC (20). They indicated that unlike FBC, MBC subtype does not vary by race/ethnicity. In our series, 92% of our cases were invasive ductal carcinoma and 4% were ductal carcinoma in-situ. There was no lobular carcinoma. Pathological assessment revealed 92% of ER positivity, 86% of PR positivity, and 10% of HER2/neu positivity among 50 patients. According to the molecular subtype analysis by IHC, majority of the cancers (80%) were luminal A, whereas 6 patients (12%) had Luminal B, 1 patient had nonluminal HER2 type (2%) and 3 patients (6%) had triple negative tumors in our series.

The main choice of treatment is surgery in MBC and mastectomy is the most common procedure (11). This is probably because of the small amount of breast tissue, skin involvement by the tumor at admission, and lack of aesthetic concern by both patient and physician points of view, as many of the patients are over 60 years old. In the Zaenger study, it is mentioned that 56% of MBC patients had T1 tumor, but only 4% had undergone breast conserving surgery (BCS) (21). In the SEER data, although 76.3% of patients were ≤T2, surgical procedure rates are 86.8% for mastectomy, 13.2% BCS (12). BCS rates are rising in recent years (from 10.6% to 15.1%) (21). It is also previously reported that there was no significant survival difference between patients undergoing mastectomy or BCS (22). Besides, BCS associated with radiation therapy in selected patients is advocated by some authors as an alternative to simple mastectomy or MRM (23). We should keep in mind that men of our era also have aesthetic concerns about nipple-areola complex and masculine breast contour.

Regarding the axillary approach, sentinel lymph node biopsy was performed in 21 patients (40%) by blue dye method. The mapping by blue dye was successful in 95% of patients that is similar to previously reported (24). Due to the high axillary involvement in our series, the majority of the patients (79.2%) underwent ALND.

The efficacy of chemotherapy, radiotherapy, and hormonal therapy is not well studied because of the rarity of MBC. However, as most of the cases are hormone receptor positive, hormonal therapy is the first-line choice of adjuvant treatment. In a German study, OS was better with tamoxifen compared with aromatase inhibitor treatment in MBC patients (25). The long-term use of tamoxifen is suggested because it does not cause severe bone marrow toxicity or drug-induced death. However, tamoxifen may not be tolerated well in male patients. Men often experience bothersome symptoms from endocrine therapy, and approximately one in four discontinue treatment early because of hot flashes or sexual dysfunction (26). Anelli and colleagues. Reported a rate of 63% side effects like mood changes, loss of libido, weight gain and hot flushes resulting 21% of dropout rate (27). All patients with hormone-receptor positivity in our series received tamoxifen as hormonal therapy for 5 years.

Again, as in other treatment modalities, the use of chemotherapy is extrapolated from FBC data. Preoperative systemic chemotherapy may be useful for cases with a critical tumor load. Only 7 patients (13.2%) received preoperative systemic chemotherapy in our series despite a high incidence of T4 disease (41.5%). This might be due to the comorbidities of patients with older age to receive chemotherapy and/or a high incidence of luminal A type tumors among our patients.

Furthermore, in our series, 60.4% of patients received chest wall irradiation due to the axillary involvement and/or T4 disease. There are no prospective randomized studies evaluating the clinical effects of postoperative adjuvant radiotherapy in MBC. A case series of 75 men treated with curative intent in Ontario found significantly improved local recurrence-free survival in the 46 patients who received postmastectomy radiation, but their OS was not different (28). Ragaz (29) showed that radiotherapy reduced the first 2-year local relapse (from 60 to 20%) for the patients with positive nodes. However, a decrease in local relapse does not reflect OS. No survival difference was found between patients who received radiotherapy and who did not. However, radiotherapy has been considered based on similar criteria as for FBC patients and the indications are related to local findings in MBC.

As in FBC, the most important prognostic factor in MBC is positive axillary lymph nodes (3). In an international population-based study including 459,846 women and 2665 men diagnosed with breast cancer over the last 40 years, male patients had a poorer 5-year relative survival ratio than women. However, after adjustments are made for age and the year of diagnosis, stage, and treatment, male patients had a significantly better relative survival from breast cancer than female patients (8). In a Korean study on the OS rate of a group of MBC matched with FBC, they found no significant differences between two groups (13). Furthermore, the hazard ratios of survival in men, older than 60 years old at diagnosis or who had tumors >2 cm were significantly greater in multivariate analysis. SEER data revealed older age, grade III/IV tumors, Stage IV disease, no surgery, no radiotherapy, ER- tumors, and unmarried patients had significantly shorter OS in multivariate analysis (12). Five-year OS rates were 88%, 75.7%, 61%, and 17.7% for Stage I, II, III, and IV, respectively. As we do not have Stage IV patients in our study, the 5-year OS rates for Stage I, II and III were 100%, 84.6% and 73.8 respectively. Ethnic differences might also affect the prognosis of MBC (30). In a Turkish cohort of 86 male patients treated over 37 years, Selcukbiricik and colleagues reported a 65.8% 5-year OS rate, and they stated that tumor Stage and nodal Stage were significant prognostic factors (22). We reported an OS, DFS, and DSS rate of 80.7%, 96%, and 95.6 for 5-year, and 71.6%, 81.9%, and 91.7% for a 10-year period respectively. We only found significant difference in OS of Stage I patients among Stage II-III patients in multivariate analysis ($p<0.001$). The excellent prognosis of patients might also be due the higher incidence of patients with luminal A type tumors (80%). There was no difference in OS when analyzed according to the age, luminal type, tumor size, and lymph node status. This is probably due to the small number of cases in our series.

Although the number of cases in our series is low, MBC is a rare entity and there are no prospective randomized trials in this field. In this situation, additional data is important from every different institution. Our OS and DSS rates are strikingly higher than the average of available literature. This might be due to lack of Stage IV cases and good tumor biology of patients since they mostly presented with luminal tumors in our series (92% of the patients). Therefore, hormonal therapy is the mainstay for the treatment of ER+ male breast cancer.

**Ethics Committee Approval:** Ethics committee approval was received for this study from the ethics committee of Istanbul University Istanbul School of Medicine.

**Informed Consent:** Informed consent was not taken due to retrospective design of the study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.Ö.; Design - E.Ö.; Supervision - A.İ., V.Ö., A.S.D.; Resources - E.Ö.; Materials - E.Ö., R.Y.; Data Collection and/or Processing - E.Ö., M.T.; Analysis and/or Interpretation - E.Ö., N.C.; Literature Search - E.Ö., R.Y.; Writing Manuscript - E.Ö.; Critical Review - A.İ., M.M., N.C., V.Ö.

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## References

1. Anderson WF, Jatoi I, Tse J, Rosenberg PS. Male breast cancer: A population-based comparison with female breast cancer. J Clin Oncol 2010; 28: 232-239. (PMID: 19996029). [CrossRef]
2. Gradishar WJ: Male breast cancer. Harris JR, Lippman ME, Morrow M, Osborn CK, editors. Disease of the Breast. Philedelphia: Lippincott Williams and Wilkins; 2000.p661-667.
3. Abdullah İğci, Mustafa Tükenmez, Enver Özkurt. Male Breast Cancer. Adnan Aydıner, Abdullah İğci, Atilla Soran, editors. Breast Disease Volume II: Management and Therapies. Switzerland: Springer; 2016.p389-405. [CrossRef]
4. Tahmasebi S, Akrami M, Omidvari S, Salehi A, Talei A. Male breast cancer; analysis of 58 cases in Shiraz, South of Iran. Breast Dis 2010; 31: 29-32. (PMID: 20644250). [CrossRef]
5. Giordano SH, Buzdar AU, Hortobagyi GN. Breast cancer in men. Ann Intern Med 2002; 137: 678-687. (PMID: 12379069). [CrossRef]
6. Patten DK, Sharifi LK, Fazel M. New approaches in the management of male breast cancer. Clin Breast Cancer 2013; 13. 309-314. (PMID: 23845572) [CrossRef]
7. Fentiman IS, Fourquet A, Hortobagyi GN. Male breast cancer. Lancet 2006; 367: 595-604. (PMID: 16488803) [CrossRef]
8. Miao H, Verkooijen HM, Chia KS, Bouchardy C, Pukkala E, Larønningen S, Mellemkjær L, Czene K, Hartman M. Incidence and outcome of male breast cancer: an international population-based study. J Clin Oncol 2011; 29:4381-4386. (PMID: 21969512) [CrossRef]
9. Foerster R, Foerster FG, Wulff V, Schubotz B, Baaske D, Wolfgarten M, Kuhn WC, Rudlowski C. Matched-pair analysis of patients with female and male breast cancer: a comparative analysis. BMC Cancer 2011; 11:335. (PMID: 21816051) [CrossRef]
10. American Joint Committee on Cancer. AJCC cancer staging handbook, 7th edn. New York: Springer; 2010.
11. Johansen Taber KA, Morisy LR, Osbahr AJ 3rd, Dickinson BD. Male breast cancer: risk factors, diagnosis, and management (Review). Oncol Rep 2010; 24: 1115-1120. (PMID: 20878100). [CrossRef]
12. Leone JP, Zwenger AO, Iturbe J, Leone J, Leone BA, Vallejo CT, Bhargava R. Prognostic factors in male breast cancer-a population-based study. Breast Cancer Res Treat 2016; 156: 539-548. (PMID: 27039306). [CrossRef]
13. Choi MY, Lee SK, Lee JE, Park HS, Lim ST, Jung Y, Ko BK, Nam SJ; Korean Breast Cancer Society. Characterization of Korean Male Breast Cancer Using an Online Nationwide Breast-Cancer Database: Matched-Pair Analysis of Patients with Female Breast Cancer. Medicine (Baltimore) 2016; 95: e3299. (PMID: 27100414). [CrossRef]
14. Olu-Eddo AN, Momoh MI. Clinicopathological study of male breast cancer in Nigerians and a review of the literature. Nig Q J Hosp Med 2010; 20: 121-124. (PMID: 21033319).
15. Thorlacius S, Struewing JP, Hartge P, Olafsdottir GH, Sigvaldason H, Tryggvadottir L, Wacholder S, Tulinius H, Eyfjörd JE. Population-based study of risk of breast cancer in carriers of BRCA-2 mutation. Lancet 1998 Oct; 352: 1337-1339. (PMID: 9802270). [CrossRef]
16. Giordano SH, Cohen DS, Buzdar AU, Perkins G, Hortobagyi GN. Breast carcinoma in men: a population-based study. Cancer 2004; 101: 51-57. (PMID: 15221988). [CrossRef]
17. Cardoso F, Bartlett JMS, Slaets L, van Deurzen CHM, van Leeuwen-Stok E, Porter P, Linderholm B, Hedenfalk I, Schröder C, Martens J, Bayani J, van Asperen C, Murray M, Hudis C, Middleton L, Vermeij J, Punie K, Fraser J, Nowaczyk M, Rubio IT, Aebi S, Kelly C, Ruddy KJ, Winer E, Nilsson C, Dal Lago L, Korde L, Benstead K, Bogler O, Goulioti T, Peric A, Litière S, Aalders KC, Poncet C, Tryfonidis K, Giordano S. Characterization of male breast cancer: results of the EORTC 10085/TBCRC/BIG/NABCG International Male Breast Cancer Program. Ann Oncol 2018; 29: 405-417. (PMID: 29092024).
18. Shaaban AM, Ball GR, Brannan RA, Cserni G, Di Benedetto A, Dent J, Fulford L, Honarpisheh H, Jordan L, Jones JL, Kanthan R, Maraqa L, Litwiniuk M, Mottolese M, Pollock S, Provenzano E, Quinlan PR, Reall G, Shousha S, Stephens M, Verghese ET, Walker RA, Hanby AM, Speirs V. A comparative biomarker study of 514 matched cases of male and female breast cancer reveals gender-specific biological differences. Breast Cancer Res Treat 2012; 133: 949-958. (PMID: 22094935). [CrossRef]
19. Kornegoor R, Verschuur-Maes AH, Buerger H, Hogenes MC, de Bruin PC, Oudejans JJ, van der Groep P, Hinrichs B, van Diest PJ. Molecular subtyping of male breast cancer by immunohistochemistry. Mod Pathol 2012; 25: 398-404. (PMID: 22056953). [CrossRef]
20. Aydogan F, Sagara Y, Mallory MA, Tukenmez M, Golshan M. Tumor subtype and race in male breast cancer: A population-based cohort study. J Clin Oncol 2015; 33(28 suppl): 149. [CrossRef]
21. Zaenger D, Rabatic BM, Dasher B, Mourad WF. Is Breast conserving therapy a safe modality for early-Stage male breast cancer? Clin Breast Cancer 2016; 16: 101-104. (PMID: 26718092). [CrossRef]
22. Selcukbiricik F, Tural D, Aydogan F, Beşe N, Büyükünal E, Serdengeçti S. Male breast cancer: 37-year data study at a single experience center in Turkey. J Breast Cancer 2013; 16: 60-65. (PMID: 23593083). [CrossRef]
23. Golshan M, Rusby J, Dominguez F, Smith BL. Breast conservation for male breast carcinoma. Breast 2007; 16: 653-656. (PMID: 17606375). [CrossRef]
24. Flynn LW, Park J, Patil SM, Cody HS 3rd, Port ER. Sentinel lymph node biopsy is successful and accurate in male breast carcinoma. J Am Coll Surg 2008; 206: 616-621. (PMID: 18387465). [CrossRef]
25. Eggemann H, Ignatov A, Smith BJ, Altmann U, von Minckwitz G, Röhl FW, Jahn M, Costa SD. Adjuvant therapy with tamoxifen compared to aromatase inhibitors for 257 male breast cancer patients. Breast Cancer Res Treat 2013; 137: 465-470. (PMID: 23224235). [CrossRef]
26. Pemmaraju N, Munsell MF, Hortobagyi GN, Giordano SH. Retrospective review of male breast cancer patients: analysis of tamoxifen-related side-effects. Ann Oncol 2012; 23: 1471-1474. (PMID: 22085764). [CrossRef]
27. Anelli TFM, Anelli A, Tran KA, Lebwohl DE, Borgen PI. Tamoxifen administration is associated with a high rate of treatment-limiting symptoms in male breast cancer patients. Cancer 1994; 74: 74-77. (PMID: 8004585). [CrossRef]
28. Yu E, Suzuki H, Younus J, Elfiki T, Stitt L, Yau G, Vujovic O, Perera F, Lock M, Tai P. The impact of post-mastectomy radiation therapy on male breast cancer patients—a case series. Int J Radiat Oncol Biol Phys 2012; 82: 696-700. (PMID: 21398053). [CrossRef]
29. Ragaz J, Jackson SM, Le N, Plenderleith IH, Spinelli JJ, Basco VE, Wilson KS, Knowling MA, Coppin CM, Paradis M, Coldman AJ, Olivotto IA. Adjuvant radiotherapy and chemotherapy in nodepositive premenopausal women with breast cancer. N Engl J Med 1997 Oct 2; 337: 956-962. (PMID: 9309100). [CrossRef]
30. O'Malley CD, Prehn AW, Shema SJ, Glaser SL. Racial/ethnic differences in survival rates in a population-based series of men with breast carcinoma. Cancer 2002; 94: 2836-2843. (PMID: 12115370). [CrossRef]