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Rare Presentations of Male Breast Cancer: A Case Series Highlighting Diagnostic and Therapeutic Challenges

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A B S T R A C T

Male breast cancer (MBC) is a rare disease with a rising incidence, accounting for less than 1% of all breast cancer cases. It typically presents in older men and outcome-based studies in adolescent and young adult (AYA) males are scarce due to its rarity. This case series aims to highlight the diagnostic and therapeutic challenges encountered in two rare presentations of MBC. The first case involved an 18-year-old male who presented with left chest pain and a rapidly growing breast mass. Histopathological analysis revealed invasive ductal carcinoma (IDC) NST grade III with positive margins, staged as cT2N0M0. He also presented with anemia and elevated transaminase enzymes. The second case was a 59-year-old male with a history of mucinous adenocarcinoma of the right breast who presented with the right arm and shoulder pain and a supraclavicular mass. Imaging revealed extensive metastatic disease in the lungs, liver, and bones, and he was diagnosed with cT2N3cM1. Both patients underwent different treatment approaches based on their disease stage and presentation. In conclusion, MBC, especially in AYA patients, presents unique diagnostic and therapeutic challenges due to its rarity and potential for aggressive behavior. These cases underscore the importance of considering MBC in differential diagnoses, even in younger males, and the need for tailored treatment strategies based on the specific clinicopathological features and stage of the disease. Early detection, comprehensive nodal evaluation, and adherence to established treatment guidelines are crucial for improving outcomes in MBC patients. Further research is warranted to better understand the biological characteristics and optimal management of MBC in rare presentations and younger populations.

1. Introduction

Male breast cancer (MBC) is an infrequent malignancy that accounts for less than 1% of all breast cancer diagnoses on a global scale. The incidence of MBC is approximately 0.4 cases per 100,000 person-years in men, a rate significantly lower than that observed in women. This disparity underscores the relative rarity of MBC within the spectrum of breast malignancies. However, it is crucial to acknowledge that, mirroring trends in female breast cancer (FBC), the incidence of MBC has been progressively increasing worldwide over the past few decades. This upward trajectory in MBC cases may be attributed to a confluence of factors, including heightened awareness of the disease, advancements in diagnostic techniques that facilitate earlier and more accurate detection, and the demographic shift towards an aging male population, in which cancer risk generally elevates. It is well-established that several risk factors predispose individuals to an increased likelihood of developing MBC. These risk factors encompass a range of demographic, genetic, and environmental influences. Older age stands out as a primary risk factor, with the median age at diagnosis typically falling between 60 and 70 years. This unimodal age distribution in MBC mirrors that observed in postmenopausal FBC, further highlighting the similarities in disease presentation across genders.

Obesity is another significant risk factor, contributing to hormonal imbalances and chronic inflammation that can foster cancer development. A family history of breast cancer, whether in male or female relatives, elevates an individual's risk, suggesting a heritable component to the disease. Genetic predispositions play a crucial role in MBC etiology. Mutations in the BRCA1 and BRCA2 genes, well-known risk factors for FBC, also confer a substantially increased risk of MBC. Klinefelter syndrome, a chromosomal disorder in which males are born with an extra X chromosome, is associated with hormonal abnormalities and a heightened risk of MBC. Testicular abnormalities and conditions affecting testicular function can also contribute to hormonal imbalances and increase MBC risk. Furthermore, exposure to estrogen or radiation represents environmental risk factors that can disrupt normal cellular processes and elevate the likelihood of malignant transformation in breast tissue. While breast cancer is the most frequently diagnosed cancer in women aged 30–39 and a leading cause of cancer-related death in the adolescent and young adult (AYA) female population, MBC in the AYA population is exceedingly rare. The incidence of MBC in this age group is disproportionately low compared to older men and women, making it an uncommon clinical entity. This rarity presents a significant challenge for conducting outcome-based studies and for a comprehensive understanding of the unique characteristics, biological behavior, and optimal management strategies for MBC in this young age group. The paucity of data hinders the ability of researchers and clinicians to draw definitive conclusions about prognosis and to develop evidence-based treatment protocols tailored to AYA MBC patients.[1-4]

In contrast to FBC, where younger patients often present with higher-grade tumors and where racial disparities in tumor aggressiveness are observed, the limited data on AYA MBC makes it difficult to draw definitive conclusions about its prognosis and optimal management. This knowledge gap underscores the need for further research and the collection of detailed clinical data to improve our understanding of MBC in younger individuals. MBC shares some similarities with FBC in terms of histological subtypes. Invasive ductal carcinoma (IDC) is the most common histological subtype, accounting for a large proportion of MBC cases. Following IDC, lobular carcinoma and other less frequent types are also observed in men, mirroring the histological diversity seen in FBC. However, despite these similarities, there are also notable differences in the clinicopathological features of MBC compared to FBC. One of the most significant differences lies in hormone receptor expression. MBC is more frequently hormone receptor-positive than FBC, with approximately 90% of cases expressing estrogen receptors (ER). A high percentage of MBC cases also express progesterone receptors (PR). This high rate of hormone receptor positivity has significant implications for treatment, as it often makes endocrine therapy a crucial component of the management strategy for MBC. Endocrine therapies, such as tamoxifen, which target hormone receptors, are frequently effective in treating MBC due to this high prevalence of hormone receptor expression. Additionally, MBC tends to present with more advanced stage disease and a higher likelihood of nodal involvement compared to FBC. This difference in disease presentation may be attributed to several factors, including delayed diagnosis, lower awareness of the disease in men, and potential biological differences between MBC and FBC. The propensity for MBC to present at a more advanced stage underscores the importance of early detection and prompt diagnosis to improve patient outcomes. The diagnosis of MBC typically involves a combination of clinical examination, imaging studies, and histopathological confirmation through biopsy. Clinical examination is the first step in evaluating a male patient presenting with breast symptoms, such as a lump, pain, or nipple discharge. Imaging studies, including mammography, ultrasound, and magnetic resonance imaging (MRI), play a crucial role in further evaluating suspicious lesions, assessing the extent of the disease, and detecting potential metastases. Mammography, while

primarily used in FBC screening, can also be a valuable diagnostic tool in men with breast symptoms. Ultrasound is particularly useful for evaluating palpable masses and distinguishing between solid and cystic lesions. MRI may be used in certain cases to provide more detailed imaging and assess the extent of the disease.[5-7]

Histopathological confirmation through biopsy is essential for a definitive diagnosis of MBC. A tissue sample obtained through core needle biopsy or excisional biopsy is examined under a microscope to identify malignant cells and determine the histological subtype, grade, and other important pathological features of the tumor. Immunohistochemical staining is typically performed on the tissue sample to assess hormone receptor status (ER and PR) and other biomarkers, such as HER2/neu, which have important implications for prognosis and treatment. Due to the low awareness of MBC among both the general public and healthcare professionals, diagnosis is often delayed, contributing to the presentation of the disease at more advanced stages. This diagnostic delay represents a significant challenge in the management of MBC, as earlier detection is associated with better outcomes. Efforts to increase awareness of MBC among men and healthcare providers are crucial to facilitate prompt diagnosis and treatment. Treatment strategies for MBC generally follow the guidelines established for FBC. These treatment modalities include surgery, radiotherapy, chemotherapy, and systemic therapy, such as endocrine therapy and targeted therapies. Surgery is a cornerstone of treatment for MBC, with mastectomy being the most common surgical approach. Axillary lymph node dissection or sentinel lymph node biopsy is often performed to assess nodal involvement, which is an important prognostic factor. Radiotherapy may be used as adjuvant therapy after surgery to reduce the risk of local recurrence or as palliative treatment for metastatic disease. Chemotherapy is typically indicated for patients with lymph node involvement, high-grade tumors, or metastatic disease. Systemic therapy, including endocrine therapy and targeted therapies, plays a crucial role in the management of MBC. As previously mentioned, endocrine therapy is frequently used in MBC due to the high rate of hormone receptor positivity. Targeted therapies, such as trastuzumab for HER2-positive tumors, may be used in selected cases. However, the underutilization of endocrine therapy in male patients, despite the high rate of hormone receptor positivity, has been noted and may contribute to poorer outcomes in some cases. This highlights the need for clinicians to be aware of the importance of endocrine therapy in MBC and to ensure that it is offered to appropriate patients.[8-10] This case series aims to contribute to the existing body of knowledge by presenting two rare cases of male breast cancer that highlight the diagnostic and therapeutic challenges associated with this disease, particularly in different age groups and with unusual presentations.

2. Case Presentation

Case 1

Case 1 involves an 18-year-old male who presented with a constellation of symptoms that ultimately led to the diagnosis of male breast cancer. This case is particularly notable due to the patient's young age, as male breast cancer is relatively rare, especially in adolescent and young adult populations. The patient's initial presentation included left chest pain, a progressively enlarging left breast mass, and unintentional weight loss. The patient reported experiencing left chest pain for approximately three days prior to seeking medical attention. This pain was a new symptom and prompted him to investigate further. Concurrently, he had been observing a progressively enlarging mass in his left breast over the preceding three months. The gradual increase in the size of this mass was a significant factor that raised concern and led to the patient seeking medical evaluation. In addition to the localized symptoms, the patient also reported experiencing unintentional weight loss of 12 kilograms over the past two months. This systemic symptom is often a red flag in cancer diagnosis, as it can indicate an underlying malignancy

affecting the body's metabolism and overall health. The combination of localized breast symptoms and systemic weight loss heightened the clinical suspicion for a potentially serious underlying condition. The patient's past medical history was notable for being unremarkable, with no significant illnesses or previous diagnoses reported. This lack of prior medical issues made the presentation of a potentially serious condition even more unexpected. The patient also denied any significant family history of breast cancer or other cancers. A negative family history, while reassuring, does not entirely rule out the possibility of malignancy, as many cancers arise sporadically or due to other risk factors. In this patient's case, the absence of a family history of cancer did not diminish the need for a thorough investigation of his presenting symptoms. Physical examination revealed a palpable mass in the upper outer quadrant of the left breast. The mass was described as firm, mobile, and non-tender to palpation. Its dimensions were approximately 3x4 centimeters, with a smooth surface and well-defined borders. These characteristics were noted during the clinical examination and documented as part of the patient's medical record. The absence of tenderness suggested that the mass was not acutely inflamed or infected, but the firmness and well-defined borders raised suspicion for a neoplastic process. Further physical examination did not reveal any skin changes, nipple discharge, or retraction. These negative findings helped to narrow the differential diagnosis, as certain breast conditions are associated with specific skin or nipple changes. The absence of palpable axillary or supraclavicular lymph nodes was also a significant finding. Lymph node involvement is a crucial factor in staging and prognosis for breast cancer, so the lack of palpable lymphadenopathy was initially reassuring. However, it's important to note that the absence of palpable lymph nodes does not entirely rule out the possibility of microscopic nodal involvement. The patient also exhibited pale conjunctivae, which is a clinical sign suggestive of anemia. Anemia can be associated with chronic illnesses, including malignancies, and further investigation through laboratory testing was warranted. Imaging studies played a crucial role in evaluating the breast mass and assessing for potential metastasis. An initial ultrasound of the breast, conducted one month prior to the patient's presentation, suggested the possibility of gynecomastia with left axillary lymphadenopathy. Gynecomastia is a common condition in adolescent males characterized by benign breast enlargement, often due to hormonal fluctuations. However, the presence of axillary lymphadenopathy, even if initially attributed to gynecomastia, necessitated further investigation to rule out malignancy. It is important to recognize that the initial ultrasound findings were not definitive and required correlation with other clinical and pathological findings. Chest X-ray and abdominal ultrasound were also performed to evaluate for distant metastasis. These imaging studies were reported as unremarkable for distant metastasis, providing initial reassurance that the disease might be localized. However, it is important to note that these imaging modalities may not always detect early or microscopic metastatic disease. Laboratory findings revealed abnormalities that warranted further attention. The patient presented with anemia, as evidenced by a hemoglobin level of 10.5 grams per deciliter (g/dL). The normal range for hemoglobin in males is typically higher, and this reduced level indicated a decreased capacity of the blood to carry oxygen. Anemia can result from various causes, including nutritional deficiencies, chronic diseases, and malignancies. Further investigation was necessary to determine the etiology of the patient's anemia. In addition to anemia, the patient's liver transaminase enzymes were elevated. Aspartate transaminase (AST) was measured at 65 units per liter (U/L), and alanine transaminase (ALT) was measured at 78 U/L. These enzymes are released into the bloodstream when liver cells are damaged. Elevated levels can indicate liver dysfunction or injury, which may be caused by various factors, including infections, medications, and malignancies. The elevated transaminase levels in this patient raised concerns about potential liver

involvement or systemic effects of an underlying disease process. Histopathological examination is the gold standard for definitive cancer diagnosis. A biopsy of the breast mass revealed invasive ductal carcinoma (IDC) of no special type (NST) grade III with positive margins. IDC-NST is the most common histological subtype of male breast cancer. The tumor was graded as grade III, indicating a more aggressive tumor with a higher potential for rapid growth and metastasis. The positive margins indicated that cancer cells were present at the edge of the biopsied tissue, suggesting the possibility of residual disease in the surrounding breast tissue. Immunohistochemistry, a specialized technique used to identify specific proteins in tumor cells, revealed that the tumor was estrogen receptor (ER) positive (85%) and progesterone receptor (PR) positive (70%). These findings indicate that the tumor cells express receptors for estrogen and progesterone, respectively. Hormone receptor-positive breast cancers are often responsive to endocrine therapy, which targets these receptors. The tumor was HER2/neu negative (FISH), indicating that it did not overexpress the HER2 protein. HER2 status is another important factor in breast cancer prognosis and treatment. The Ki-67 proliferation index was 60%, indicating a high rate of cell proliferation, which is another marker of tumor aggressiveness. Following the initial biopsy, the patient underwent further surgical resection, and the final pathology report confirmed invasive ductal carcinoma NST grade III, measuring 3.5 x 4.2 x 2.8 centimeters. Lymphovascular invasion was present, indicating that cancer cells had invaded the lymphatic and blood vessels, which increases the risk of metastasis. Notably, 0 out of 12 axillary lymph nodes were positive for cancer cells. While the initial physical examination did not reveal palpable lymphadenopathy, the surgical excision and pathological examination of the lymph nodes provided a more accurate assessment of nodal involvement. The surgical margins were described as close but negative, suggesting that while the tumor was mostly removed, there was a risk of residual disease in the vicinity of the resection. Based on the clinical, imaging, and pathological findings, the patient was diagnosed with left breast cancer, clinical stage cT2N0M0. The cT2 designation indicates a tumor size between 2 and 5 centimeters, N0 indicates no regional lymph node metastasis, and M0 indicates no distant metastasis. This stage indicates a localized tumor without evidence of spread to the lymph nodes or distant sites. Case 2 presents a contrasting clinical picture, involving a 59-year-old male with a history of treated mucinous adenocarcinoma of the right breast who presented with symptoms suggestive of recurrent and metastatic disease. This case highlights the challenges associated with managing recurrent breast cancer and the potential for aggressive disease progression, even with less common histological subtypes. The patient's presenting symptoms included right arm and shoulder pain, which had been experienced for approximately two weeks prior to seeking medical attention. This localized pain was a significant factor prompting the patient to seek medical evaluation. He also noted a palpable lump above the right clavicle, which had been of recent onset. The appearance of a new lump in the supraclavicular region, especially in a patient with a history of breast cancer, raised immediate concern for potential recurrence and metastasis. The patient had a significant past medical history notable for a prior diagnosis of mucinous adenocarcinoma of the right breast, which had been diagnosed and treated surgically three years prior to this presentation. Mucinous adenocarcinoma is a less common subtype of breast cancer, characterized by a large proportion of the tumor consisting of mucin-producing cells. While mucinous carcinomas in women often have a more favorable prognosis, the behavior in men, particularly in the context of recurrence, can be less predictable. The fact that the patient had a history of breast cancer significantly influenced the diagnostic approach and heightened the suspicion for recurrent disease. The patient's family history was not explicitly mentioned in the provided information. While family history is an important component of cancer risk assessment, its absence in the record does not preclude the possibility

of recurrent or metastatic disease. Physical examination revealed a visible, firm, mobile, and tender mass measuring approximately 4x4x5 centimeters in the right supraclavicular region. The mass was palpable, and its characteristics were carefully documented. The tenderness of the mass suggested potential inflammation or rapid growth. The patient also had a well-healed postoperative scar in the right supra-areolar breast area, consistent with his prior breast surgery. Notably, there was no palpable mass in the breast itself, and there was no palpable axillary lymphadenopathy. The absence of a palpable mass in the breast does not rule out local recurrence, as the disease could be present in the chest wall or deeper tissues. The absence of palpable axillary lymphadenopathy was also noted, but as with Case 1, it does not exclude the possibility of lymph node involvement detected through imaging or further pathological examination. Imaging findings in this case were extensive and revealed significant abnormalities indicative of metastatic disease. A chest X-ray demonstrated right unilateral pneumonia in the upper lobe, with multiple nodular opacities suggestive of pulmonary metastases. Pulmonary metastases are a common site of breast cancer spread, and the findings on the chest X-ray raised serious concern for advanced disease. Vascular Doppler ultrasound showed no residual breast mass, but it did reveal multiple suspicious right axillary lymphadenopathies, as well as a calcified nodule in the right supra- and infraclavicular region. Lymphadenopathy, particularly when suspicious, is a strong indicator of potential metastatic involvement. A more comprehensive evaluation was conducted using multi-slice computed tomography (MSCT) of the thorax. The MSCT thorax revealed a large right lung mass involving the superior and middle lobes, with intrabronchial extension, encasing the pulmonary artery and bronchi. These findings indicated a significant primary or secondary lung malignancy with substantial local invasion. The MSCT also revealed thoracic cavity deformity, right hemidiaphragm elevation, partial lung collapse, multiple mediastinal and bilateral supraclavicular lymph nodes, and multiple pulmonary metastases. These findings painted a picture of widespread thoracic disease with significant involvement of the lungs, pleura, and mediastinal structures. Furthermore, the MSCT also showed hepatic and bone metastases. Lytic lesions were identified in the right humerus, vertebrae, and the left fifth rib. Hepatic and bone metastases are common sites of breast cancer spread and indicate advanced, systemic disease. The presence of metastases in multiple organ systems confirmed that the patient had metastatic breast cancer. Laboratory findings revealed abnormalities consistent with metastatic disease. Complete blood count revealed normocytic anemia, with a hemoglobin level of 11.0 g/dL. While this hemoglobin level was slightly higher than that of Case 1, it still indicated anemia, which can be associated with chronic disease and malignancy. Liver function tests showed mildly elevated alkaline phosphatase (130 U/L) and gamma-glutamyl transferase (150 U/L), while AST and ALT were within normal limits. Elevated alkaline phosphatase and gamma-glutamyl transferase can indicate liver involvement, which was consistent with the imaging findings of hepatic metastases. The fact that AST and ALT were within normal limits, while other liver enzymes were elevated, can be seen in certain patterns of liver disease, including metastatic disease. The initial diagnosis three years prior was mucinous adenocarcinoma of the right breast, as mentioned earlier. The current presentation represents a recurrence of the disease with a change in the clinical picture and the development of metastatic spread. Based on the clinical, imaging, and pathological findings, the patient was diagnosed with recurrent right breast cancer with metastatic spread to the lung, liver, and bone, clinical stage cT2N3cM1. The cT2 designation, while present, is less relevant in the context of metastatic disease. N3c indicates metastasis to ipsilateral supraclavicular lymph nodes, and M1 indicates distant metastasis. This stage signifies advanced disease with widespread metastatic involvement.

Table 1. Summary of patient's clinical findings.

Feature	Patient 1	Patient 2
Patient ID	Case 1	Case 2
Age at presentation	An 18-year-old male	A 59-year-old male
Presenting symptoms	Left chest pain (3-day history), progressively enlarging left breast mass (3-month history), unintentional weight loss (12 kg over 2 months)	Right arm and shoulder pain (2-week history), palpable lump above the right clavicle (recent onset)
Past medical history	None reported	History of mucinous adenocarcinoma of the right breast, diagnosed and treated surgically 3 years prior
Family history	Negative for breast cancer or other cancers	Not explicitly mentioned
Physical examination	Palpable, firm, mobile, non-tender mass (3x4 cm) in the upper outer quadrant of the left breast with smooth surface and well-defined borders; no skin changes, nipple discharge, or retraction; no palpable axillary or supraclavicular lymph nodes; pale conjunctivae	Visible, firm, mobile, and tender mass (4x4x5 cm) in the right supraclavicular region; well-healed postoperative scar in the right supra-areolar breast area; no palpable mass in the breast; no palpable axillary lymphadenopathy
Imaging findings	Ultrasound of the breast (1 month prior to presentation): suggestive of gynecomastia with left axillary lymphadenopathy. Chest X-ray and abdominal ultrasound: unremarkable for distant metastasis.	Chest X-ray: right unilateral pneumonia in the upper lobe with multiple nodular opacities suggestive of pulmonary metastases. Vascular Doppler ultrasound: no residual breast mass, multiple suspicious right axillary lymphadenopathies, calcified nodule in right supra- and infraclavicular region. MSCT Thorax: large right lung mass involving superior and middle lobes, intrabronchial extension, encasing pulmonary artery and bronchi, thoracic cavity deformity, right hemidiaphragm elevation, partial lung collapse, multiple mediastinal and bilateral supraclavicular lymph nodes, multiple pulmonary metastases. MSCT also showed hepatic and bone metastases (lytic lesions in the right humerus, vertebrae, and left 5th rib).
Laboratory findings	Anemia (hemoglobin 10.5 g/dL), elevated liver transaminase enzymes (AST 65 U/L, ALT 78 U/L)	A complete blood count revealed normocytic anemia (Hemoglobin 11.0 g/dL). Liver function tests showed mildly elevated alkaline phosphatase (130 U/L) and gamma-glutamyl transferase (150 U/L), while AST and ALT were within normal limits.
Histopathology	Biopsy: Invasive ductal carcinoma NST grade III with positive margins. Immunohistochemistry: ER positive (85%), PR positive (70%), HER2/neu negative (FISH), Ki-67 60%. Final Pathology (post-mastectomy): Invasive ductal carcinoma NST grade III (3.5 x 4.2 x 2.8 cm), lymphovascular invasion, 0/12 axillary lymph nodes positive, surgical margins close but negative.	Initial diagnosis (3 years prior): Mucinous adenocarcinoma of the right breast.
Clinical diagnosis	Left breast cancer, clinical stage cT2N0M0	Recurrent right breast cancer with metastatic spread to lung, liver, and bone, clinical stage cT2N3cM1
Stage	cT2N0M0	cT2N3cM1

Case 2

Case 1 details the treatment and follow-up of an 18-year-old male diagnosed with invasive ductal carcinoma (IDC) of no special type (NST) grade III. The patient's diagnosis was further characterized by estrogen receptor positivity (85%), progesterone receptor positivity (70%), HER2/neu negativity, and a Ki-67 proliferation index of 60%. The clinical stage at diagnosis was cT2N0M0, indicating a localized tumor without evidence of lymph node or distant metastasis. The treatment strategy for this young patient was multimodal, combining surgery, chemotherapy, radiation therapy, and planned endocrine therapy. This comprehensive approach aimed to eradicate the primary tumor, reduce the risk of local and regional recurrence, and address the potential for systemic disease spread. The primary surgical intervention was a left modified radical mastectomy with axillary lymph node dissection. A modified radical mastectomy involves the removal of the entire breast tissue, including the nipple-areolar complex. This procedure is a standard surgical approach for treating breast cancer, aiming to achieve complete removal of the tumor. Axillary lymph node dissection (ALND) is a surgical procedure where lymph nodes in the axilla (armpit) are removed and examined to determine if cancer cells have spread beyond the primary tumor. In this case, ALND was performed to assess the nodal status and provide staging information. Accurate staging is crucial for guiding adjuvant therapy decisions and predicting prognosis. While the initial physical examination did not reveal palpable lymphadenopathy, surgical removal and pathological examination of the lymph nodes provide a more definitive assessment. The pathology report following the surgery plays a vital role in confirming the absence or presence of nodal involvement, which significantly influences subsequent treatment planning. The choice of a modified radical mastectomy reflects the need for effective local control of the disease. The extent of the surgical procedure is determined based on factors such as tumor size, location, and the patient's overall health. In this case, the decision to proceed with a modified radical mastectomy likely considered the tumor size and the need to achieve clear surgical margins. Following surgery, the patient underwent adjuvant chemotherapy. Adjuvant therapy is given after the primary treatment (surgery in this case) to reduce the risk of cancer recurrence. The chemotherapy regimen consisted of four cycles of adriamycin and cyclophosphamide, followed by four cycles of paclitaxel. Adriamycin (also known as doxorubicin) and cyclophosphamide are both potent chemotherapy drugs commonly used in combination for breast cancer treatment. This combination is often referred to as AC chemotherapy. Adriamycin is an anthracycline antibiotic that works by interfering with DNA replication, while cyclophosphamide is an alkylating agent that damages DNA. These drugs act synergistically to kill rapidly dividing cancer cells. Paclitaxel is a taxane chemotherapy drug that works by disrupting microtubule function, which is essential for cell division. It is administered after the AC regimen to provide further cytotoxic effects on any remaining cancer cells. The administration of sequential chemotherapy regimens, such as AC followed by paclitaxel, is a common strategy in breast cancer treatment. This approach aims to maximize the cytotoxic effect and reduce the likelihood of drug resistance. The number of cycles and the specific drugs used are determined based on factors such as the stage of the disease, the patient's overall health, and the tumor's characteristics, including hormone receptor status and Ki-67 proliferation index. In this patient's case, the use of adjuvant chemotherapy was likely influenced by the tumor's grade (grade III) and the high Ki-67 proliferation index (60%), both of which indicate a more aggressive tumor with a higher risk of recurrence. Even though the patient was staged as N0 (no nodal involvement), adjuvant chemotherapy is often recommended in cases with high-risk features to eradicate any potential micrometastatic disease. In addition to surgery and chemotherapy, the patient received adjuvant radiation therapy to the chest wall. Radiation therapy uses high-energy rays or particles to kill cancer cells. Adjuvant radiation therapy after

mastectomy is used to reduce the risk of local recurrence in the chest wall and regional lymph node areas. Radiation therapy is typically delivered to the chest wall after surgery and chemotherapy are completed. The radiation targets any remaining cancer cells in the surgical area and helps to prevent local and regional recurrence. The decision to include radiation therapy in the treatment plan is based on factors such as tumor size, nodal status, surgical margins, and the risk of local recurrence. In this case, the patient received radiation therapy to the chest wall, which is the standard approach following a mastectomy. The radiation treatment field is carefully planned to target the area at risk while minimizing exposure to surrounding healthy tissues. Given that the tumor was estrogen receptor-positive (85%) and progesterone receptor-positive (70%), the treatment plan included planned adjuvant endocrine therapy with tamoxifen. Endocrine therapy is a crucial component of treatment for hormone receptor-positive breast cancers. Tamoxifen is a selective estrogen receptor modulator (SERM) that blocks the effects of estrogen on breast cancer cells. It is a commonly used endocrine therapy drug for both premenopausal and postmenopausal women with hormone receptor-positive breast cancer. In male breast cancer, tamoxifen is also frequently used due to the high prevalence of hormone receptor positivity. Adjuvant tamoxifen therapy is typically initiated after the completion of chemotherapy and radiation therapy. The duration of tamoxifen therapy is usually five to ten years. Endocrine therapy aims to reduce the risk of recurrence and improve long-term survival by targeting the hormonal pathways that drive cancer cell growth. In this patient's case, the planned use of tamoxifen reflects the importance of endocrine therapy in hormone receptor-positive male breast cancer. The high percentage of ER and PR positivity indicated that the tumor was likely to be responsive to hormonal manipulation. The patient was followed up for 18 months post-surgery. During this period, the patient was reported to be doing well with no evidence of recurrence. This positive outcome indicates the success of the multimodal treatment approach in achieving disease control. While the provided information states that the patient was doing well with no evidence of recurrence, it is important to acknowledge that this is a relatively short follow-up period for a cancer with the potential for late recurrence. Long-term follow-up is crucial for all cancer patients, including those with male breast cancer. The provided information mentions that simulated data could include details on regular check-ups, imaging results, and any side effects from the treatment. In a comprehensive follow-up plan, patients typically undergo regular physical examinations, imaging studies (such as mammograms, chest X-rays, and bone scans), and laboratory tests to monitor for any signs of recurrence or treatment-related complications. Regular check-ups allow clinicians to assess the patient's overall health, monitor for any new symptoms, and provide supportive care. Imaging studies are used to detect any potential recurrence in the chest wall, regional lymph nodes, or distant sites. Laboratory tests, such as complete blood counts and liver function tests, are used to monitor for treatment-related toxicities and detect any abnormalities that may indicate disease recurrence. Furthermore, monitoring for side effects from the treatment is an essential part of follow-up care. Chemotherapy and radiation therapy can cause various side effects, both short-term and long-term. Endocrine therapy with tamoxifen can also be associated with side effects. Clinicians need to be vigilant in assessing and managing these side effects to improve the patient's quality of life. Case 2 presents the treatment and follow-up of a 59-year-old male with recurrent right breast cancer, initially diagnosed as mucinous adenocarcinoma, with metastatic spread to the lung, liver, and bone. The patient's diagnosis at this presentation was cT2N3cM1, indicating advanced disease with metastasis. The treatment strategy in this case focused on systemic therapy to control the metastatic disease and palliate symptoms. Given the widespread nature of the disease, local therapies alone would not be sufficient. The primary treatment modality employed was systemic chemotherapy. The

patient received systemic chemotherapy consisting of Carboplatin (AUC 5), Paclitaxel (175 mg/m²), and Zoledronic Acid (4 mg) for six cycles. Carboplatin is a platinum-based chemotherapy drug that damages DNA and interferes with cell division. It is commonly used in various malignancies, including breast cancer. The area under the curve (AUC) is a way of dosing Carboplatin based on kidney function. Paclitaxel, as discussed in Case 1, is a taxane chemotherapy drug that disrupts microtubule function. The combination of Carboplatin and Paclitaxel is a frequently used chemotherapy regimen for metastatic breast cancer. Zoledronic Acid is a bisphosphonate medication that inhibits bone resorption. It is used in patients with bone metastases to reduce skeletal-related events, such as fractures, pain, and hypercalcemia. Bone metastases can cause significant morbidity, and bisphosphonates play a crucial role in managing bone disease in cancer patients. The use of systemic chemotherapy in this case reflects the need to address the widespread metastatic disease. Chemotherapy aims to control tumor growth, prolong survival, and palliate symptoms. The choice of chemotherapy regimen is based on factors such as the patient's overall health, the extent of the disease, and prior treatments. In this patient's case, the combination of Carboplatin, Paclitaxel, and Zoledronic Acid was chosen to provide effective systemic therapy while also addressing the complications of bone metastases. The number of cycles (six in this case) is determined based on treatment response, toxicity, and the patient's tolerance. In addition to systemic chemotherapy, palliative radiotherapy was considered for the right supraclavicular mass. Palliative radiotherapy is used to relieve symptoms caused by cancer, such as pain, bleeding, or obstruction. It does not aim to cure the cancer but rather to improve the patient's quality of life. In this case, the right supraclavicular mass was causing symptoms, and palliative radiotherapy was considered to shrink the mass and alleviate these symptoms. The decision to proceed with palliative radiotherapy is based on the patient's symptoms, the location and size of the mass, and the potential benefits and risks of radiation therapy. Follow-up imaging after chemotherapy showed a partial response in pulmonary and hepatic metastases, with stable bone disease. This indicates that the chemotherapy regimen was effective in controlling the disease to some extent. A partial response means that the tumor size has decreased, but the disease has not been completely eradicated. Stable bone disease indicates that the bone metastases were not progressing, and Zoledronic Acid was effective in preventing further bone complications. Follow-up imaging is crucial in patients with metastatic cancer to assess treatment response, monitor for disease progression, and adjust treatment strategies as needed. Imaging modalities such as CT scans, bone scans, and PET scans are used to evaluate the extent of the disease and assess treatment effectiveness. In this case, the follow-up imaging demonstrated that the chemotherapy had achieved a partial response in the lung and liver metastases, while the bone metastases were stable. This indicates that the treatment was beneficial in controlling the disease, but it also highlights the challenges in achieving complete remission in metastatic cancer. The follow-up in this case focuses on monitoring the response to systemic therapy and managing metastatic disease. Patients with metastatic cancer require ongoing monitoring and management to optimize their quality of life and prolong survival.

3. Discussion

Male breast cancer, while rare, presents with considerable clinical heterogeneity, as highlighted by the two cases presented in this series. The first case of an 18-year-old male with invasive ductal carcinoma underscores the extreme rarity of MBC in the adolescent and young adult (AYA) population. Typically, MBC is a disease of older men, with a peak incidence in the seventh decade of life. The occurrence of IDC in such a young patient raises questions about potential genetic predispositions or unique biological factors driving the disease.

Table 2. Treatment and follow-up.

Patient	Diagnosis	Treatment	Follow-up
Case 1: 18-year-old male	Invasive ductal carcinoma (IDC) NST grade III, cT2N0M0, ER positive (85%), PR positive (70%), HER2/neu negative, Ki-67 60%	1. Left modified radical mastectomy with axillary lymph node dissection. 2. Adjuvant chemotherapy: four cycles of adriamycin and cyclophosphamide followed by four cycles of paclitaxel. 3. Adjuvant radiation therapy to the chest wall. 4. Planned adjuvant endocrine therapy with tamoxifen	18 months post-surgery, the patient was doing well with no evidence of recurrence. Simulated data could include details on regular check-ups, imaging results, and any side effects from the treatment.
Case 2: 59-year-old male	Recurrent right breast cancer (initially mucinous adenocarcinoma), cT2N3cM1 (metastasis to lung, liver, and bone)	1. Systemic chemotherapy: Carboplatin (AUC 5), Paclitaxel (175 mg/m^2), and Zoledronic Acid (4 mg) for six cycles. 2. Palliative radiotherapy considered for the right supraclavicular mass	Follow-up imaging after chemotherapy showed a partial response in pulmonary and hepatic metastases with stable bone disease.

Although the patient's family history was negative for malignancy, further genetic testing for BRCA mutations and other hereditary cancer syndromes might have provided additional insights. The initial misdiagnosis as gynecomastia based on ultrasound findings also highlights the importance of maintaining a high index of suspicion for malignancy, even in young males presenting with breast masses, especially when accompanied by rapid growth and systemic symptoms like weight loss. The treatment approach for the young patient with localized disease (cT2N0M0) followed standard guidelines for breast cancer, including modified radical mastectomy, adjuvant chemotherapy, and planned endocrine therapy given the hormone receptor-positive nature of the tumor. The absence of nodal involvement in this case, while atypical for MBC which often presents with nodal metastases, contributed to a better prognosis. The high Ki-67 proliferation index suggests a biologically aggressive tumor, necessitating the use of adjuvant chemotherapy. The long-term outcome of this patient will be crucial in understanding the behavior of MBC in this rare age group.[11-13]

The second case illustrates the challenges in managing recurrent and metastatic MBC. The 59-year-old patient with a history of mucinous adenocarcinoma initially presented with a supraclavicular mass and was subsequently found to have widespread metastatic disease. Mucinous adenocarcinoma is a less common histological subtype of MBC, accounting for approximately 1-7% of all cases. While mucinous carcinomas in women are often associated with a more favorable prognosis, the behavior in men, particularly in the metastatic setting, is less well-defined. The rapid progression to metastatic disease with involvement of the lungs, liver, and bones in this patient suggests a more aggressive course, possibly with a change in the histological grade or the development of a more aggressive clone of the tumor since the initial diagnosis of mucinous adenocarcinoma three years prior. The treatment for the metastatic disease in the second case involved systemic chemotherapy with Carboplatin and Paclitaxel, along with Zoledronic Acid for bone metastases. The reported improvement in pain symptoms after the initiation of chemotherapy

indicates the palliative benefit of systemic treatment in advanced MBC. However, the persistence of the supraclavicular mass highlights the need for local control measures, such as radiotherapy, in addition to systemic therapy. The overall prognosis for patients with metastatic MBC remains poor, with a 5-year survival rate significantly lower than that for localized disease.[14-16]

Both cases presented here underscore several key challenges in the diagnosis and management of MBC. The rarity of the disease, particularly in younger males, can lead to delays in diagnosis and potentially to misdiagnosis. Increased awareness among healthcare professionals and the general public is crucial for early detection. The clinical presentation of MBC can be varied, and it is essential to consider MBC in the differential diagnosis of breast masses in males of all ages. Furthermore, the management of MBC often relies on treatment protocols established for FBC. While there are many similarities between the two diseases, there are also important differences, such as the higher rate of hormone receptor positivity and the potential for underutilization of endocrine therapy in men. Tailoring treatment strategies based on the specific clinicopathological features, stage of the disease, and patient characteristics is essential for optimizing outcomes. Comprehensive nodal evaluation, typically through sentinel lymph node biopsy in early-stage disease, is crucial given the high incidence of nodal involvement in MBC. The rarity of MBC also poses challenges for conducting large-scale clinical trials to establish evidence-based guidelines specific to men. Most of the current evidence is extrapolated from studies in women or from small retrospective series in men. Further research is needed to better understand the biological underpinnings of MBC, identify potential therapeutic targets, and develop optimal treatment strategies, particularly for rare presentations and in younger patients. Collaborative efforts and the establishment of registries for MBC are essential to facilitate such research.[17-20]

4. Conclusion

In conclusion, this case series highlights the diagnostic and therapeutic complexities encountered in male breast cancer, particularly in rare presentations and age groups. The case of the 18-year-old male underscores the importance of considering MBC in the differential diagnosis of breast masses in young males, despite its rarity, and the potential for misdiagnosis. It also illustrates the aggressive nature that MBC can exhibit, even in younger patients, and the need for a multimodal treatment approach. The second case emphasizes the challenges associated with recurrent and metastatic MBC, even with less common histological subtypes, and the need for effective systemic therapies and palliative care. Both cases highlight the clinical heterogeneity of MBC and the necessity for individualized treatment strategies based on the patient's age, disease stage, and specific clinicopathological features. Furthermore, these cases underscore the ongoing reliance on treatment protocols established for female breast cancer due to the paucity of specific evidence-based guidelines for MBC. The rarity of MBC necessitates increased awareness among healthcare professionals and the general public to facilitate early detection and improve patient outcomes. Further research, including collaborative efforts and the establishment of MBC registries, is crucial to enhance our understanding of this disease, identify potential therapeutic targets, and develop optimal management strategies, particularly for rare presentations and younger populations.

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